

# 2022

## ANNUAL MEETING



**ABSTRACT BOOK**

**MAY 11-14**  
**AUSTIN, TEXAS**

[WWW.AUTISM-INSAR.ORG](http://WWW.AUTISM-INSAR.ORG)

## Invited, Keynote Speakers, Awards

### KEYNOTE — INVITED, KEYNOTE SPEAKERS, AWARDS

#### 101 - Keynote Talk - Damien Fair

( *Keynote*) Developmental Cognitive Neuroscience in the Era of Big Data

*D. Fair, Masonic Institute for the Developing Brain, Minneapolis, MN*

Developmental cognitive neuroscience is being pulled in new directions by network science and big data. Brain imaging (e.g. functional MRI, functional connectivity MRI), analytical advances (e.g. graph theory, machine learning), and access to large computing resources have empowered us to collect and process neuro-behavioral data faster and in larger populations than ever before. The translational potential from these advances is unparalleled, as a better understanding of complex human brain function is best grounded in the onset of these functions during human development. However, the maturation of the developmental cognitive neuroscience has seen the emergence of new challenges and pitfalls, which have significantly slowed progress and need to be overcome to maintain momentum. Here I examine the state of developmental cognitive neuroscience in the era of networks and 'big data' and highlight the solid footing we can take forward into the future.

### KEYNOTE — INVITED, KEYNOTE SPEAKERS, AWARDS

#### 103 - Keynote Address - Liz Pellicano

( *Keynote*) The Foundations of Autistic Flourishing

*E. Pellicano, University College London, London, United Kingdom*

At the core of all decent societies is an effort to enable all people to live full and flourishing lives. But what does a flourishing life look like for Autistic people? And how can we all help to build a foundation for such lives? In this talk, Liz Pellicano contends that answering these questions requires us to step away from key assumptions that have structured autism science for decades now. She explains the ways in which both hidden biases and methodological errors too often obscure understanding the nature of Autistic flourishing. She also traces the contours of a new scientific process, one that breaks down the distinction between 'lab' and 'life' and places Autistic people and their families and allies right at the heart of research decision-making itself.

### KEYNOTE — INVITED, KEYNOTE SPEAKERS, AWARDS

#### 104 - Keynote Address - Joseph Buxbaum

( *Keynote*) Precision Medicine in Autism

*J. D. Buxbaum, Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY*

That autism has multiple, distinct biological causes is a concept that has existed since the earliest descriptions of autism. For more than a decade, beginning with the advent of affordable high-throughput sequencing, genome-wide studies of rare coding and non-coding genetic variation in autism have been ongoing, and have completely transformed our knowledge of the biological bases of autism. With hundreds of strong-effect autism genes identified, we are now able to translate these genetic findings into valid model systems for neuroscience. More importantly, these etiological discoveries provide a path towards precision medicine in autism. In this talk, I will summarize progress in gene discovery in autism, and give examples of, and approaches to, precision medicine that can arise from such etiological insights.

### KEYNOTE — INVITED, KEYNOTE SPEAKERS, AWARDS

#### 105 - Keynote Address - Evdokia Anagnostou

( *Keynote*) Exploring Heterogeneity in ASD: From Bench to Clinic to Stakeholder Priorities

*E. Anagnostou, Autism Research Centre, Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

The past decade in ASD research is characterized by a concerted effort to describe and understand its heterogeneity. We will use Canadian multimodal data (structural and functional imaging, phenotypic, and potentially genomic data) from our POND network (<https://pond-network.ca/>) and others, to highlight advances in this area, within ASD and across neurodevelopmental conditions. Stakeholder experience and perspectives will be discussed to illuminate and challenge our common interpretations of such work.

## PANEL — ADULT OUTCOME: MEDICAL, COGNITIVE, BEHAVIORAL

### 210 - Chronic Physical Health Problems in Autistic Adults

**Panel Chair: Sander Begeer, VU University Amsterdam, Amsterdam, Netherlands**

**210.001 (Panel)** Autism and Chronic Ill Health: An Observational Study of Symptoms and Diagnoses of Central Sensitivity Syndromes in Autistic Adults

**S. L. Grant<sup>1</sup>, S. Norton<sup>2</sup>, R. F. Weiland<sup>3</sup>, A. M. Scheeren<sup>1</sup>, S. Begeer<sup>4</sup> and R. A. Hoekstra<sup>1</sup>,** (1)Department of Psychology, King's College London, London, United Kingdom, (2)Department of Health Psychology, King's College London, London, United Kingdom, (3)Vrije Universiteit, Amsterdam, Netherlands, (4)VU University Amsterdam, Amsterdam, Netherlands

**Background:** Autistic adults, particularly women, are more likely to experience chronic ill health than the general population. Central sensitivity syndromes (CSS) are a group of related health conditions, including fibromyalgia, migraine and temporomandibular disorders, that are all thought to include an underlying sensitisation of the central nervous system. Autism and CSS have substantial crossovers in their expression, including physical symptoms such as sensory sensitivity and fatigue, and psychosocial factors including anxiety, stress and trauma. Research indicates that symptomatic joint hypermobility and related conditions appear to be more common in the autistic population, and these are also related to chronic and centralised pain. However, a direct link between autism and central sensitisation has not yet been investigated.

**Objectives:** This study aimed to investigate the occurrence of CSS diagnoses and symptoms in autistic adults, and to explore whether CSS symptoms were related to autistic traits, mental health, sensory sensitivity, or gender.

**Methods:** Participants included 973 autistic adults (410 men, 563 women, mean age = 44.6y) registered at the Netherlands Autism Register, who completed questionnaires assessing autistic traits, sensory sensitivity, CSS symptoms and diagnoses, physical and mental health symptoms. The reliability and validity of using the Central Sensitization Inventory (CSI) in an autistic sample was established with exploratory and confirmatory factor analyses. Chi<sup>2</sup> analyses, independent t-tests, hierarchical regression and path analysis were used to analyse relationships between measures, age and gender.

**Results:** Factor analysis of the CSI indicated that the total CSI score provided a valid and reliable assessment of CSS symptoms in autistic adults, with a bifactor model comprising one general factor and four orthogonal factors generating the best model fit. Multigroup factor analysis indicated that the CSI was capturing the same construct in men and women, although there were some indications of differential item functioning. 21% of participants reported one or more CSS diagnosis, compared to CSS rates varying from 0.2% to 20% in the general population. 60% scored at or above the clinical cut-off for a CSS. Autistic women were more likely to report a CSS diagnosis,  $X^2(2, N = 973) = 33.68, p < .001$ , and experienced more CSS symptoms than autistic men,  $t(971) = -11.774, p < .001$ . Women also reported greater anxiety,  $t(634) = -5.809, p < .001$ , more sensory sensitivity,  $t(391) = 3.539, p < .001$ , poorer physical health,  $t(971) = 4.228, p < .001$  and lower subjective wellbeing,  $t(416) = 3.289, p = .001$ . Exploratory hierarchical regression analysis showed that sensory sensitivity, anxiety, age and gender were significant predictors of CSS symptoms,  $F(5,353) = 75.09, p < .001$ , together accounting for 50.9% of the variance in CSI scores. A path analysis indicated that sensory sensitivity and anxiety mediated the relationship between autistic traits and CSS symptoms (see Fig 1).

**Conclusions:** CSS diagnoses and symptoms appear to be very common in the autistic population. Awareness of an association between autism and central sensitisation should inform clinicians and guide diagnostic practice, particularly for women where CSS are common and autism under-recognised.

**210.002 (Panel)** Chronic Physical Health Disorders in Adults with Autism Spectrum Disorder

**J. H. Ward<sup>1</sup>, E. M. Weir<sup>2</sup>, C. Allison<sup>3</sup> and S. Baron-Cohen<sup>3</sup>,** (1)Department of Gastroenterology, Royal Devon & Exeter NHS Foundation Trust, Exeter, United Kingdom, (2)Autism Research Centre, Department of Psychiatry, Autism Research Centre - University of Cambridge, Cambridge, United Kingdom, (3)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom

**Background:**

Research has shown that autistic adults are at increased risk of chronic physical health conditions (e.g. epilepsy, gastrointestinal disorders, bone and joint disorders, arrhythmias). It is unclear whether this is due to covariance between genes for autism and physical health conditions, demographic factors (e.g., biological sex, ethnicity, age), or environmental factors (e.g., smoking, alcohol, body mass index (BMI)).

**Objectives:**

To investigate the relationship between autism and chronic physical health conditions and the influence of demographic factors, family history, and environmental factors.

## Methods:

We employed a cross-sectional observational study design via an anonymous, online survey of autistic and non-autistic adults (n=2,395, mean age=41.7, 50.8% female, 49.2% autistic). The survey asked participants to self-report information about their demographics, autism status, diet, exercise, sleep, sexual health, substance use, personal medical history, and family medical history (for first-degree, biological relatives). When answering questions about medical history, participants could select common conditions from a provided list or could self-disclose rarer conditions using free text. Results were analysed using binomial logistic regression across four models of increasing complexity (shown in Figure 1). Only conditions that achieved 1% endorsement within the sample (n=24) were included in analysis. We employed multiple comparison correction using the Benjamini-Hochberg Correction. For conditions where perfect separation issues arose that were unavoidable, we have presented only the unadjusted odds ratios.

## Results:

Autistic people are significantly more likely to report having a physical health condition across all of the organ systems tested in this analysis. The most significant finding was for gastrointestinal conditions, where the p value remained at 0 even after controlling for demographics, family history, and lifestyle factors. Disorders of the neurological, dermatological, rheumatological and visual system also remained highly significant after covariates were accounted for.

Compared to non-autistic people, we found highly significant increases in rates of irritable bowel syndrome, hernias of the gastrointestinal tract, gastric reflux, migraine, epilepsy, chronic fatigue syndrome, endometriosis, and premenstrual syndrome among autistic adults. Full results have been provided in Table 1 below. Interestingly, we find that the association between Coeliac's disease and autism becomes non-significant when controlling for family history, suggesting shared variance between family history and autism in this relationship and thus presenting a new avenue for investigation. Further, despite not being an option for selection on the list of medical conditions on the survey, Ehler-Danlos Syndrome was frequently reported by female autistic participants, and when compared with non-autistic females, the odds ratio was estimated at 4.60 (2.29-9.25 95% CI,  $p=5.75 \times 10^{-5}$ ), even when controlling for family history.

## Conclusions:

This study provides evidence of widespread, physical health comorbidity that spans nearly all major organ systems among autistic adults compared to non-autistic adults. Our findings underline the importance of a greater awareness in clinical settings of the potential physical health comorbidities for autistic patients. However, they also point towards potential avenues requiring further exploration, such as the association of autism with disorders with known genetic components such as Ehler-Danlos Syndrome and Coeliac's Disease.

## **210.003 (Panel) Do Insured Adults with Autism Experience Increased Odds of Hospitalizations and Mortality in the U.S. after a COVID-19 Diagnosis?**

**A. M. Davis<sup>1</sup> and H. Belcher<sup>2</sup>, (1)Johns Hopkins Univ, Baltimore, MD, (2)Johns Hopkins University, Baltimore, MD**

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## Background:

The risk of hospitalization and death from the coronavirus disease 2019 (COVID-19) is increased in individuals with comorbid medical conditions, such as obesity, diabetes, chronic obstructive pulmonary disease, chronic renal failure, cardiovascular disease, and pregnancy. Individuals with autism spectrum disorder (ASD) often have comorbid conditions with the potential for increased vulnerability during the coronavirus pandemic. Increased COVID-19-related mortality and morbidity among populations with developmental disabilities has been reported; however, health outcomes attributable to COVID-19 in autistic people are largely unknown. Socioeconomic factors and region-specific health policies may increase the risk for COVID-19-related poor health outcomes and shorter lifespans among individuals with ASD.

## Objectives:

It was hypothesized that individuals with ASD would be at increased odds of COVID-19 mortality adjusted for demographic characteristics and the number of comorbidities.

## Methods:

An analysis was conducted of aggregated, de-identified data representing claims of 752,237 privately insured individuals in the U.S. with a COVID-19 diagnosis, drawn from the FAIR Health, Inc.<sup>[1]</sup> National Private Insurance Claims (FH NPIC<sup>®</sup>) repository database. The data were analyzed using hierarchical multivariate logistic regression models to assess the odds of hospitalization and death among COVID-19 patients with autism.

## Results:

The odds of COVID-19 hospitalizations were 3.04 times higher (95% CI: 2.63-3.51) among individuals with an ASD diagnosis compared to those without, adjusted for demographic characteristics, Health Resources Services Administration (HRSA) region and states with Affordable Care Act (ACA). The odds of COVID-19 hospitalization adjusted for comorbidities demonstrated a dose-response with significant increases for each additional comorbidity, from 2.74 (95% CI: 2.65-2.83) times the odds of mortality for one comorbidity to 23.71 (95% CI: 23.05-24.36) times the



odds of hospitalization for five or more comorbidities. Following adjustment for comorbidities, odds of hospitalization for autistic individuals were not significantly different from individuals without ASD. Odds of COVID-19 death were 3.87 times higher (95% CI: 2.10-7.12) among individuals with an ASD diagnosis than those without, adjusted for demographic characteristics, HRSA region, and states with ACA. The odds of COVID-19 mortality adjusted for comorbidities demonstrated a dose-response with significant increases for each additional comorbidity, from 4.98 (95% CI: 3.74-6.63) times the odds of mortality for one comorbidity to 52.50 (95% CI: 40.91-67.37) times the odds of mortality for five or more comorbidities. Following adjustment for comorbidities, the odds of mortality for autistic individuals decreased to 1.81 (95% CI: 1.00-3.28).

#### Conclusions:

Study results supported the hypothesis of increased odds of hospitalization and mortality for patients with ASD and COVID-19. The more co-occurring disorders a person has, the increased the odds of death. Adjusting for demographics and comorbidities, autistic individuals face a significantly higher mortality risk, but not hospitalization admission. Public health policies should identify those with ASD and COVID-19 as a high-risk population that requires early identification and careful monitoring.

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[1] FAIR Health, Inc. is not responsible for the conduct of the research or any of the opinions expressed in this article.

**210.004** (Panel) Tailored Healthcare Adjustments for Older Autistic People: An Evaluation of an Intervention to Improve Healthcare  
**B. Ingham<sup>1</sup>, P. Rob<sup>2</sup>, T. Brown<sup>3</sup>, I. A. James<sup>4</sup>, D. Mason<sup>5</sup>, C. Scarlett<sup>6</sup>, E. Walton<sup>7</sup>, M. Woodbury-Smith<sup>8</sup> and J. R. Parr<sup>9</sup>**, (1)Cumbria, Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (2)Population Health Sciences Institute, Newcastle University, Newcastle Upon Tyne, United Kingdom, (3)Cumbria, Northumberland Tyne and Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (4)University of Bradford, Bradford, United Kingdom, (5)Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)North Tyneside CCG, Newcastle-upon-Tyne, United Kingdom, (7)Newcastle University, Newcastle upon Tyne, United Kingdom, (8)Newcastle University, Institute of Neuroscience, Newcastle upon Tyne, United Kingdom of Great Britain and Northern Ireland, (9)Population Health Sciences Institute, Newcastle University, Newcastle upon Tyne, United Kingdom

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#### Background:

Improved services that meet the health and wellbeing needs of older autistic people are needed to address autistic people's health conditions (Croen et al., 2015), premature mortality (Hirivkoski et al., 2015) and barriers to effective healthcare (Mason et al., 2019). We consulted with older autistic adults and clinicians to develop the 'Tailored Healthcare Adjustments' (THA) intervention, a structured and personalised approach to using reasonable adjustments to improve healthcare access.

#### Objectives:

To explore outcomes following the 6 week THA intervention for older autistic people: Acceptability (including trial measures and recruitment processes), feasibility (including recruitment and retention) and utility (change in attitudes, improving healthcare access, identifying unmet clinical needs).

#### Methods:

A single arm feasibility study was undertaken with clinically diagnosed autistic people aged  $\geq 50$  years who had at least two health conditions. The THA intervention consists of up to 4 sessions with a participant to explore tailored health adjustments and subsequent sessions with healthcare providers to implement these adjustments. Quantitative data about quality of life, and physical health conditions experienced was collected pre and post intervention. Feasibility was measured through recruitment and retention rates. Acceptability was measured through semi-structured interviews to elicit views on the intervention and trial, including reasons for participation, clarity of the processes, and whether the intervention was helpful (change in attitudes, better access to healthcare, identified unmet clinical needs).

#### Results:

24 older clinically diagnosed autistic adults consented; 21 participants undertook the intervention (16 male, 5 female, aged between 53 and 69 years, mean= 58.8). 17 people completed follow-up measures and interviews. Reasons for attrition were predominantly physical health related (e.g. in palliative care). Thematic analysis on the interviews revealed 3 themes and 8 subthemes on the feasibility and acceptability of the intervention. Themes identified included: (A) reasons for participation (helping themselves and/or other autistic people through developing the evidence base, raising awareness of autism); (B) feasibility and acceptability (ease of completing assessment measures, importance of adapting the assessment environment and the potentially therapeutic benefit of completing assessments); and (C) attitudes and approaches to healthcare (importance of clinician communication and changes in participants' own approach to healthcare).

Participants reported they needed to get used to completing assessments, and they wanted to increase health professional's awareness and knowledge on autism. Importantly, participants reported feeling more confident knowing that their GPs are aware of their adjustments: *"I can explain myself better to him if he's asking the questions, and he's more understanding towards me as well, because he's more aware of what I need"*. Within this,

participants reported that new health conditions and unmet needs were identified through the THA intervention, which were then treated, adjustments introduced or onward referrals made (e.g. referral to falls clinic, investigation of potential hernia).

Conclusions:

The THA intervention was found to be feasible and acceptable for autistic adults to engage with. THA increased access to healthcare for older autistic adults with long-term health conditions. The THA intervention is appropriate for use in a future trial.

## PANEL — ADULT OUTCOME: MEDICAL, COGNITIVE, BEHAVIORAL

### 226 - Interventions to Promote Skill Development As Autistic Youth Transition to Adulthood

**Panel Chair:** Julie Taylor, *Vanderbilt University Medical Center, Nashville, TN*

**Discussant:** Reid Caplan, *Brandeis University, Waltham, MA*

**226.001 (Panel)** Surviving and Thriving in the Real World: A Randomized Clinical Trial of a Daily Living Skills Intervention for Adolescents with Autism Spectrum Disorder

**A. Duncan<sup>1,2</sup>, J. Meinzen-Derr<sup>1,2</sup>, C. Fassler<sup>1</sup> and L. J. Stark<sup>1,2</sup>, (1)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (2)College of Medicine, University of Cincinnati, Cincinnati, OH**

**Background:** Autistic adolescents without an intellectual disability (ID) have daily living skills (DLS) that typically fall 6-8 years below their same-aged peers. DLS include activities in areas such as Personal (self-care, health), Domestic (cleaning, cooking), and Community (money management, transportation), and have been linked to a more positive adult outcome in employment and independent living. However, there are currently no interventions that target DLS. Surviving and Thriving in the Real World (STRW) is a 14-week group intervention for autistic adolescents and their parents that was developed to fill this gap by targeting critical DLS (personal hygiene, laundry, cooking, and money management) using evidence-based strategies (behavior contract, modeling, technology). Initial efficacy studies have shown that STRW participants acquire and maintain DLS and begin to close the gap between age and DLS.

**Objectives:** To test the preliminary effectiveness of STRW in adolescents (14-21 years) with ASD as compared to a control group (PEERS social skills intervention).

**Methods:** Participants included 112 youth with ASD (age M = 16.3, SD = 1.1, 71.4% male, 79.5% White, IQ M = 98.5, SD = 11.0). All participants had DLS deficits as defined as a 15-point difference between their IQ and scores on the DLS domain or subdomains on the Vineland Adaptive Behavior Skills, 3<sup>rd</sup> Edition (VABS-3). Eligible adolescents were randomized to receive either STRW or PEERS, which are similar in duration, frequency, and delivery. Due to COVID-19, approximately 26% of the sample received the interventions in-person and 74% received it via telehealth. Primary outcome measures were the VABS-3 DLS domain and subdomains and goal attainment scaling (GAS), which allows for assessment of individual DLS goals in the 4 areas targeted in STRW.

**Results:** Data collection at post-treatment for all cohorts was just recently completed and only data on the parent/caregiver interview form of the VABS-3 is available for analysis. Prior to the conference, we will have all data collected including all outcome measures for the 6-month follow-up timepoint. Preliminary results indicated that youth in the STRW intervention made significant gains on the VABS-3 DLS domain ( $p = .04$ ) and Domestic subdomain ( $p = .02$ ) as compared to the control group (see Table 1). An examination of change within the STRW group revealed that participants showed significant gains from pre- to post-treatment (all  $p$ 's < .001) on all VABS-3 DLS areas and large effect sizes were obtained. The PEERS group also showed significant gains for pre- to post-treatment (all  $p$ 's < .001).

**Conclusions:** STRW participants demonstrated improved DLS as compared to the control group such that they gained 2-3 years of DLS over the course of a 14-week intervention. The most gains were made in the VABS-3 Domestic subdomain, which is core content in the STRW intervention (e.g., cooking on the stove, laundry). Interestingly, the control group also made DLS gains, though not to the same degree as those in STRW. Future analyses that will be presented include changes in individualized GAS from pre- to post-treatment, and whether DLS gains were maintained at 6-month follow-up.

**226.002 (Panel)** Development, Efficacy, and Community-Based Optimization of a Transition Support Program for Young Adults with Autism  
**A. M. Brewe and S. W. White, Psychology, The University of Alabama, Tuscaloosa, AL**

**Background:** Emerging adulthood is a period of heightened risk for people with autism spectrum disorder (ASD). In fact, people with ASD experience lower rates of employment and postsecondary school enrollment compared to their age- and ability-matched peers. These low rates are partially due to the limited availability of evidence-based services that support transition into adulthood.

**Objectives:** We present results on the feasibility, acceptability, and efficacy of a comprehensive transition support and intervention program (STEPS: Stepped Transition in Education Program for Students with ASD), compared to a transition-as-usual (TAU) control. We also describe a current study to optimize STEPS for use in the community using a qualitative examination of implementation barriers and facilitators.

**Methods:** An iterative approach involving focus groups and surveys with stakeholders was taken to develop and refine STEPS, resulting in two levels (STEP 1 and STEP 2) designed to meet students' specific developmental needs at the secondary and postsecondary levels, respectively. Both levels were developed with the goal of improving self-determination, self-knowledge, and self-regulation. In STEP 1, 24 cognitively able adolescents with ASD ( $M$  age: 17.09, 95.80% male, 100% White) were randomized to receive STEPS ( $n=15$ ) or TAU ( $n=9$ ). In STEP 2, 35 cognitively able young adults with ASD ( $M$  age: 19.71, 71.43% male, 80% White) were randomized to receive STEPS ( $n=17$ ) or TAU ( $n=18$ ). Following the trial, stakeholders (i.e., people with ASD, caregivers, and professionals involved in community-based transition support;  $n=45$ ) were engaged in semi-structured interviews to identify barriers and facilitators of providing STEPS in the community, by community providers. This stakeholder feedback is being used in an ongoing study to optimize STEPS for community implementation.

**Results:** STEPS demonstrated sufficient feasibility, measured by  $<15\%$  attrition and  $>90\%$  average therapist fidelity. Participants and caregivers also reported sufficient acceptability, with  $>75\%$  of participants and caregivers rating STEPS as "somewhat" or "very helpful" and offering "good" or "great" benefit. Two two-level hierarchical linear models, one each for STEP 1 and STEP 2, examined efficacy. STEP 1 participants demonstrated significant improvement in transition readiness to postsecondary school, compared to their TAU peers ( $\chi^2(1)=4.52$ ,  $p=.03$ ; see Figure 1). STEP 2 participants did not demonstrate statistically significant improvement in adjustment to college compared to their TAU peers ( $\chi^2(1)=3.37$ ,  $p=.06$ ; see Figure 2). Treatment effect size estimates indicate that STEPS produces moderate-to-large effects at endpoint (STEP 1  $d=.881$ , STEP 2  $d=.644$ ). Data from qualitative interviews are currently being examined using thematic analysis and will be available before the presentation.

**Conclusions:** Discussion of STEPS development is framed within the ORBIT model of intervention research. Given participation in STEPS was feasible and acceptable by families and led to improvement in transition readiness, additional research on the effectiveness of STEPS with a larger, more diversified sample is warranted. Additionally, preliminary data from an ongoing study to prepare STEPS for community implementation will be discussed.

**226.003 (Panel) Healthy Relationships on the Autism Spectrum (HEARTS): A Feasibility Test of an Online Class Co-Designed and Co-Taught with Autistic People**

**E. F. Rothman<sup>1</sup> and L. Graham Holmes<sup>2</sup>,** (1)Community Health Sciences, Boston University, Sargent College, Boston, MA, (2)Hunter College, CUNY, New York, NY

**Background:** Autistic people, like all people, need and deserve education about how to have healthy relationships. Healthy relationships skills are not the same as social skills. Healthy relationship skills tend to be less task-oriented, amorphous, and generally improve relationship quality for both people. They include, for example, effective interpersonal communication, conflict resolution, obtaining consent, establishing boundaries, rapport building, and expressing intimacy (Wood et al., 2012). In 2020, our team collected formative data from 25 autistic individuals about what they would like to learn from a healthy relationships class, and how such a class would ideally be delivered. Building upon these findings, in 2021, our team—which includes seven autistic self-advocates—collaboratively developed a six-session healthy relationships class to be delivered online by a team of one autistic and one non-autistic teacher. The class, called Healthy Relationships on the Autism Spectrum (HEARTS), was delivered five times during 2021.

**Objectives:** The purpose of this study was to test the feasibility and preliminary efficacy of the HEARTS program.

**Methods:** Fifty-five individuals 20–43 years old participated in a one-arm pre/post-test evaluation study of HEARTS. Individuals were eligible if they were: (1) 18–44 years old; (2) English-speakers; (3) Either diagnosed with autism by a professional or self-diagnosed; (4) Had  $\geq 1$  relationships that they wanted to improve; and (5) Demonstrated ability to communicate (via chat, AAC or verbally) with a researcher. Participants completed an online pre-test survey (40 min duration) the week prior to HEARTS' first session. Four weeks after the final session they completed the post-test. Participants received up to \$200 for participation. Of the 84 screened for eligibility, 90% ( $n=76$ ) were eligible for research. Of the 76 eligible, 95% ( $n=72$ ) consented to participate. Of the 72 who consented to participate, 76% completed both baseline and post-test surveys. Of the 55 participating, 31% were male, 55% female, and 11% non-binary gender. Eighty percent identified as White. Twenty-five percent ( $n=14$ ) were self-diagnosed autistic (Table 1).

**Results:** Participants decreased hostile automatic thoughts ( $p<.05$ ), dating abuse ( $p<.05$ ), fight-or-flight response ( $p<.05$ ), and rejection sensitivity ( $p<.001$ ) (Table 2). Participants experienced improved flourishing ( $p<.001$ ), coping with rejection and jealousy ( $p<.001$ ), motivation to engage with others for socializing ( $p<.05$ ), self compassion ( $p<.05$ ), and positive thinking ( $p<.05$ ) (Table 2). Interpersonal competence did not improve, and loneliness did not decrease significantly. In addition, the percentage of participants who agreed that they knew how to call the national domestic violence hotline increased from 42% to 69% ( $p<.001$ ), the percentage who knew how to call a sexual assault crisis organization increased from 40% to 66% ( $p<.001$ ), and the percentage that totally agreed with the statement "I know the warning signs of abuse in dating relationships" increased from 73% to 91% ( $p<.01$ )(Table 2).

**Conclusions:** It was feasible to deliver HEARTS online. Pairing an autistic and non-autistic person to team teach HEARTS was well-received. Comparison of pre- to post-test survey responses indicated that participants may have benefited from participating in HEARTS.

**226.004 (Panel) Teaching Parents How to Effectively Navigate Adult Services on Behalf of Their Autistic Transition-Aged Youth: A Multi-Site Randomized-Controlled Trial**

**J. L. Taylor<sup>1</sup>, M. M. Burke<sup>2</sup> and L. E. Smith DaWalt<sup>3</sup>,** (1)Vanderbilt University Medical Center, Nashville, TN, (2)University of Illinois Urbana-Champaign, Champaign, IL, (3)University of Wisconsin-Madison Waisman Center, Madison, WI

Background: Accessing needed services and supports is a challenge for many autistic youth as they transition from adolescence to adulthood. Not only is the adult service system underfunded, but it is also difficult to navigate. Increasing the ability of families to navigate adult service systems may be one avenue to improve service access and ultimately transition outcomes. To address this issue, we developed ASSIST (Advocating for Supports to Improve Service Transitions) – a group-based intervention that teaches parents how to advocate for adult services and supports on behalf of their transition-aged youth on the autism spectrum. The present study reports on findings from a randomized-controlled trial of ASSIST in three states in the US.

Objectives: Does participating in ASSIST increase parents’ ability to advocate for adult services and supports, as evidenced by increased: knowledge about the adult service system; confidence navigating adult services; and empowerment?

Methods: 185 caregivers of autistic youth were recruited from study sites in three states in the US (Illinois, Tennessee, Wisconsin). Caregivers were primarily mothers (89.7%) and white, non-Hispanic (84.3%). Youth with ASD ranged from 16 to 26 years of age ( $M = 20.1$ ), 75.1% identified as male, 40% had an intellectual disability, and 60.5% were enrolled in high school.

Participants were randomized to either treatment or control conditions. The treatment group participated in ASSIST, meeting weekly (2 hours/week) for 12 weeks. Topics included services and supports related to employment, education, independent living, community participation, and health insurance. Control group participants received all written materials shared with the treatment group. Outcomes were collected prior to randomization and after the treatment group finished ASSIST. Knowledge of adult service systems was measured using a multiple-choice test developed for this study. Confidence navigating adult services was assessed via a 10-item measure (Taylor et al., 2017). Parental empowerment was measured using the Family Empowerment Scale (Koren et al., 1996). Regression analyses were used to examine whether there was an effect of treatment group on outcomes after controlling for baseline scores and study site.

Results: 174 participants (94%) completed the post-test questionnaire and thus have data on outcomes. Controlling for baseline scores and study site, treatment group participants knew more than the control group about adult services and felt more confident navigating the adult service system after taking ASSIST,  $\beta_s = .28$  and  $.15$ , respectively,  $ps < .05$  (see Figure). There were no significant group differences in parental empowerment. Analyses are ongoing: further analyses will examine aspects of the parent (e.g., stress, education) and youth (e.g., high school or intellectual disability status) that moderate these treatment effects.

Conclusions: Providing comprehensive information about adult services and supports is effective in increasing parents’ knowledge about the adult service system and their confidence advocating for services. The multi-site nature of this study suggests that ASSIST may be useful in many service system contexts. Increasing parents’ advocacy ability is likely to lead to better service access (Lee et al., in press); data to test this hypothesis in the context of ASSIST is currently being collected.

## PANEL — ADULT OUTCOME: MEDICAL, COGNITIVE, BEHAVIORAL

### 227 - Quality of Life

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**Discussant:** Zachary Williams, *Medical Scientist Training Program, Vanderbilt University School of Medicine, Nashville, TN*

**227.001** (Panel) Trajectories of Positive Affect, Well-Being, and Quality of Life during the Transition to Adulthood

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Background: Recent research has highlighted challenges faced by autistic individuals as they transition into adulthood, including difficulties establishing relationships (Sosnowy et al., 2019), employment/post-secondary education (Taylor & Seltzer, 2011), and stagnation in adaptive behavior growth (Clarke et al., 2021). Though trajectories of mental health concerns in this population have been documented (McCauley et al., 2020; Stringer et al., 2020), few reports have examined positive aspects of socioemotional functioning to better understand growth or decline in well-being, quality of life, and positive emotions during this transition.

Objectives: The current study explored longitudinal trajectories of happiness metrics from ages 14 to 26, and whether patterns of change in happiness constructs relate to adult outcomes.

Methods: Participants ( $n = 157$ ) were drawn from a longitudinal cohort ( $n = 253$ ) first assessed for ASD diagnosis at age 2 with frequent follow-up assessments into adulthood. Starting in adolescence, participant caregivers completed assessments on mental health and well-being. Composite scores from the Positive and Negative Affect Scale positive scale (PANAS; Watson, Clark, & Tellegen, 1988), Well-Being Questionnaire (WBQ; Ryff, 1989) and Quality of Life Questionnaire (QLQ; Schalock & Keith, 1993) were each used to model happiness from ages 14 to 26. Adult outcomes for social relationships, autonomy, and engagement were defined specific to ability status.

Results:

Group-based trajectory modeling was used to determine latent classes of change in three metrics of happiness - PANAS, WBQ, and QLQ - using the traj procedure in Stata (Jones & Nagin, 2007).

Results for the PANAS revealed three distinct classes: “1 - Low Declining”, “2 - Mid-Stable” and “3 - High Stable” (Figure 1). Results for the WBQ revealed three distinct classes: “1 - Growing”, “2 - High-Stable” and “3 - Declining” (Figure 2). Results for the QLQ estimated one trajectory class with cubic growth - stable until age 17, then fluctuating upwards into adulthood.

No significant link emerged between PANAS and WBQ classes ( $p=.163$ ). PANAS class membership was significantly associated with social ( $p<.001$ ), work/daily activities ( $p<.001$ ), and autonomy ( $p=.013$ ) outcomes. Participants in the High-Stable PANAS class were significantly more likely to have: one friend/social contact, a job/activities outside the home, and greater autonomy compared to participants in the Low-Declining class; the Mid-Stable and High-Stable PANAS classes did not significantly differ on these outcomes. WBQ trajectory classes and social, work, and living status outcomes were not significantly related ( $p>.05$ ).

Conclusions: Characterizing trajectories of happiness metrics as autistic individuals enter adulthood is an essential pursuit for understanding how to promote positive transitions. Findings revealed different patterns of growth for each happiness measure, which may reflect developmental differences in how the measures function. The longitudinal course of positive affect (e.g., enthusiastic, proud, inspired) was most closely related to living, social, and work experiences of both more and less able autistic adults, while well-being (e.g., positive feelings about purpose/self) was not. This novel finding, to be compared with self-reported measures, highlights that transient emotional experiences (e.g., excitement) are likely intertwined with the broader social and community contexts within which each autistic adult resides.

#### **227.002 (Panel) “Money Is like This Secret Thing That No One Talks about”: Understanding the Determinants of Autistic Adults' Financial Wellbeing**

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Background: Financial wellbeing is an important component of people's overall wellbeing, reflecting the capacity to live a comfortable and fulfilling life. Despite many autistic people having a desire to work, the majority are not employed full-time or are under-employed and have low levels of income. Such circumstances present serious constraints to achieving financial wellbeing – yet virtually nothing is known about this topic.

Objectives: We sought to understand the ways in which Australian autistic adults understand financial wellbeing, and the structural, intermediary and individual factors that support autistic people to achieve good financial wellbeing.

Methods: This study followed a two-phase explanatory sequential mixed-methods design (participant selection model). In Phase 1, 191 adults took part in an online survey designed to assess financial wellbeing in autistic people. In Phase 2, 21 participants were purposively selected based on the quantitative data (subjective financial wellbeing; Kempson et al., 2017) they provided in Phase 1, including 12 people with high financial wellbeing and nine with low financial wellbeing. We report on Phase 2 data here. We followed Braun and Clarke's method for reflexive thematic analysis to analyse the data using an inductive (bottom-up) approach to identify patterned meanings within the dataset. We also adopted a participatory approach, such that one autistic researcher, who was a paid member of the team, interviewed all participants and was integral to the interpretation of the results.

Results: We identified four themes (see Figure 1). Having access to a stable income made an enormous difference to people's financial wellbeing (Theme 1). It allowed them to have enough money to cover their expensive/meet their needs, and it removed some uncertainty by allowing them to put some money aside, to have a buffer and build some financial resilience (in terms of savings). Participants also emphasised how their broader social supports shaped their financial wellbeing (Theme 2), particularly support from family either through financial assistance or guidance at various times in their lives. Nevertheless, planning – for the present and the future – was reported to be a challenge (Theme 3), especially for people in the low financial wellbeing group, who often did not have enough money to meet their basic needs (housing, clothes, food): “Sometimes tomorrow is a pie-in-the-sky concept”. Despite all these challenges, our participants reported a strong drive to stay in control and avoid unnecessary risk (Theme 4).

Conclusions: Our findings revealed how crucial a reliable income is for autistic people's financial wellbeing. Low incomes meant that our interviewees did not feel they had enough to cover day-to-day expenses and a savings safety net for the unexpected. They felt this ultimately limited their life opportunities. These difficulties came despite the fact that many were extremely disciplined in their accounting and budgeting strategies, and that people worked hard to find financial security. Future research should investigate the ways in which autistic people could secure more reliable incomes and identify what is needed to help support autistic people to achieve financial resilience in often demanding and unpredictable personal and societal circumstances.

#### **227.003 (Panel) A Living Environment Adapted to the Needs of Autistic Adults: What Does Literature Offer?**

**A. M. Nader**<sup>1</sup>, **M. Charette**<sup>2</sup>, **E. St-Jean**<sup>3</sup>, **V. Lasalle**<sup>2</sup>, **N. Jeanneret**<sup>4</sup>, **B. Forgeot d'Arc**<sup>5</sup>, **I. Courcy**<sup>4</sup> and **R. Godbout**<sup>1</sup>, (1)University of Quebec in Montreal, Montreal, QC, Canada, (2)Faculty of Design, Université de Montréal, Montréal, QC, Canada, (3)Psychiatry, Université de Montréal, Montréal, QC, Canada, (4)CIUSSS Nord-de-l'Île-de-Montréal, Montréal, QC, Canada, (5)Département de Psychiatrie, Université de Montréal, Montréal, QC, CANADA

**Background:** A majority of autistic adults live in one form of residential care (adapted apartment, group-home, etc.) while the majority wish to live independently (Sosnowy et al, 2018). Associated conditions (e.g. Intellectual disability, mental health issues) are common in autism, resulting in further challenges for long-term housing. What is a good living environment and what should be consider when conceiving home for autistic adults?

**Objectives:** To identify the scientific literature on best practices in the conception of living environments for autistic adults. This literature review aimed to 1) describe the variables studied (population, types of home, outcome measures associated to quality of life (QoL), etc.); 2) identify environmental factors associated with the QoL of autistic adults in residential living, especially with regard to the built and the social environments.

**Methods:** A transdisciplinary systematic literature search was performed combining information from health, human, social sciences as well as architecture fields (e.g. PubMed, PsycINFO, CINAHL, ERIC, Wiley, Design and Applied Arts Index, Sociological Abstracts; 2011-2021). Key word included ["autism", "Asperger", "PDD"] AND ["residential", "house", "home", "facilities", "accommodation"]. A total of 69 900 citations were identified. After duplicate removal, 17991 studies were screened by titles/abstracts for eligibility; documents that were relevant underwent full text review. Two investigators independently screened studies according to predetermined criteria, focusing on finding informative articles on conditions related to residential care. 35 studies met the inclusion criteria (participants aged  $\geq 18$ ; residential care (excluding family home); empirical studies, French or English). Descriptive qualitative analysis of the content was done following a systemic model (factors related to the a. individual; b. immediate physical and relational environment; c. community).

**Results:** Objective 1: A majority of studies focus on autistic adults with intellectual disability and behavioral challenges living in group-home. Current literature suggests that behavioral problems and comorbidities are two components adding complexity of designing adapted residential facilities. Overall, the most assessed primary outcome across studies was behavior, followed by QoL measures through questionnaires completed by proxy (parents, staff). Only two studies addressed the subjective perception of autistic people on what they consider a good living environment for them. Most studies were conducted with small samples and only two assessed the impact of residential care model on QoL. Objective 2: 5 relevant key themes were identified including 1) sensory issues; 2) social regulation; 3) communication; 4) security 5) social participation. Those themes were mainly addressed in the context of architectural design principles and much less in the context of relational environment (other residents or staff), nor the role of community.

**Conclusions:** This systematic review reveals that little is known on the impact of residential facilities on the QoL of autistic individuals, and on factors associated with their wellbeing in the context of living facilities. A better understanding of conditions associated to QoL when designing living environment is a starting point to a profound change in how clinician, administrators and researchers conceive housing for adults with complex conditions. Including autism communities in priority-setting is imperative for designing home *with* and *for* autistic adults.

**227.004 (Panel)** Later Age of Autism Diagnosis Is Associated with Poorer Mental Health and Subjective Quality of Life in Autistic Adults  
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**Background:** Earlier diagnosis of autism spectrum disorder (ASD) is associated with better outcomes; conversely, later diagnosis can be detrimental to outcomes, including poorer mental health and subjective quality of life (QoL). Existing studies have primarily examined associations between age of ASD diagnosis and mental health in pediatric samples or in samples which include both youth and adults, thereby not capturing or potentially missing impacts of diagnosis in late adolescence and adulthood. To date few quantitative studies have directly examined effects of diagnostic timing on mental health and QoL in autistic adults. Further, extant studies that have examined QoL have primarily examined only social QoL, and have not controlled for effects of factors that may impact diagnostic timing among individuals without intellectual disability (e.g., female birth-sex).

**Objectives:** Examine effects of diagnostic timing on mental health and on a comprehensive measure of QoL in a large sample of autistic adults while controlling for key, potentially confounding variables.

**Methods:** 609 autistic adults aged 18.2-50.0 years [y] (62.1% female; age:  $M=34.01y$ ,  $SD=8.91$ ; diagnosis age:  $M=22.3y$ ,  $SD=13.2$ , range 0.5-49.08y) were recruited via Simons Powering Autism Research Knowledge (SPARK) Research Match to complete an online battery of surveys. Participants self-reported on a) anxious (Generalized Anxiety Disorder-7 [GAD-7]) and depressive (Patient Health Questionnaire-9 [PHQ-9]) symptoms, b) global perceived stress (Perceived Stress Scale [PSS]), c) four domains of subjective of QoL measured by the World Health Organization Quality of Life (WHOQOL-BREF) and d) autism-specific QoL (Autism Spectrum Quality of Life [ASQOL]). Eight hierarchical linear regressions were conducted in which the mental health and QOL measures served as dependent variables of interest. These models included birth-sex and interview-age in the first step as control variables; age at autism diagnosis, the primary independent variable of interest, was entered in the second step. Results were corrected using the false-discovery-rate method, and a corrected  $q$  value of  $<.05$  was considered significant.

**Results:** Regression models (Table 1) revealed that, after controlling for birth-sex and age of survey completion, age of autism diagnosis contributed additional variance to mental health (depression:  $\Delta R^2=.01$ ; anxiety:  $\Delta R^2=.01$ ; perceived stress:  $\Delta R^2=.04$ ). Further, diagnosis age explained additional variance in autism-specific QoL ( $\Delta R^2=.02$ ), and in WHOQOL-BREF Psychological ( $\Delta R^2=.02$ ), Social Relationships ( $\Delta R^2=.007$ ), and Physical Health ( $\Delta R^2=.01$ ) domains.

**Conclusions:** For the first time, to our knowledge, this study shows that later age of autism diagnosis is associated with detrimental impacts on both mental health and on multiple domains of subjective QoL. Importantly, these effects of age at autism diagnosis are robust and remain after controlling for birth-sex, which as Table 1 shows, has a significant impact on all mental health measures, and all QoL measures except Social Relationships. These results in a large sample with a wide range in age of autism diagnosis point to the importance of timely diagnosis, and also to the critical need to provide supports to later diagnosed individuals that will decrease the burden of mental health symptoms and improve all aspects

## POSTER SESSION — ADULT OUTCOME: MEDICAL, COGNITIVE, BEHAVIORAL

### 415 - Adult Outcome: Medical, Cognitive, Behavioral

**415.001** (Poster) Sex Differences in Rates of Coping Self-Efficacy, Depression, and Suicidal Ideation Among Autistic Adolescents and Young Adults

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#### Background:

Autistic adolescents are reported to have elevated rates of suicidality and depression (De-la-Iglesia & Olivar, 2015; Hedley & Uljarevic, 2018). In non-autistic populations, transitional periods like that from adolescence to adulthood are often marked by increased rates of depression, lower rates of self-efficacy, and higher rates of suicidal ideation in females compared to males (Garrison et al., 1991). Given the increased rates of autism in males compared to females, little is known about the specific experiences of adolescent females and whether they show the same elevations in depression and suicidality that is seen in non-autistic female adolescents.

#### Objectives:

The purpose of this study is to examine the possible differences in rates of suicidal ideation, coping self-efficacy, and depression between male and female autistic adolescents and young adults. Similar to non-autistic populations, we predicted elevated rates of depression, suicidality, and lower coping skills in adolescent autistic females.

#### Methods:

Participants (N=184, 72% male, 27% female) were individuals with a prior diagnosis of autism, ages 16-21, who participated in a transition to adulthood intervention program (TEACCH School Transition to Employment and Post-Secondary Education Program; T-STEP). Prior to the intervention, participants were asked to complete questionnaires assessing suicidality (P4 Suicidality Screener), emotion coping (Coping Self-Efficacy Scale Revised; CSES-R) and depression (Center of Epidemiologic Studies Depression Scale Revised; CESD-R).

#### Results:

A structural equations model was performed to examine relationships among sex, suicidal ideation, depression, and coping self-efficacy. The results indicated there to be no significant relationship between sex and suicidal ideation ( $p=0.88$ ) with equal suicidal ideation among both males (37.69%) and females (36.00 %). Females had higher rates of depression ( $B=0.254$ ,  $p=0.012$ ) and lower coping self-efficacy scores ( $B=-0.354$ ,  $p<0.001$ ) than males. Across males and females, depression and coping self-efficacy had a significant negative relationship with higher depression associated with lower coping self-efficacy ( $B=-0.541$ ,  $p<0.001$ ). Across both males and females, higher rates of suicidal ideation were related to higher rates of depression ( $B=0.564$ ,  $p<0.001$ ) and lower coping self-efficacy scores ( $B=-0.325$ ,  $p=0.001$ ).

#### Conclusions:

As is true for non-autistic adolescents and young adults, transition-aged autistic females were more likely to be depressed and more likely to struggle with coping self-efficacy than autistic males. Despite autistic males having lower rates of depression than autistic females, they did not differ in their rates of suicidal ideation. Future research is needed to examine whether intervention programs targeting depression, coping, and suicidal ideation are differentially effective for autistic females compared to autistic males.

**415.002** (Poster) Affective Responses Predictive of College Students' Attitudes and Willingness to Interact with Peers with ASD

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Background: Typically developing (TD) peers generally demonstrate negative attitudes toward (Butler & Gillis, 2011) and low willingness to interact with peers with autism spectrum disorder (ASD; Sasson et al., 2017). Few researchers have investigated which affective mechanisms underlie these findings (e.g., Ling et al., 2010). Researchers investigating peer responses toward individuals with a variety of mental health conditions have found that positive affect is positively associated with a greater willingness to interact (O'Connor et al., 2020). Additionally, anger is negatively correlated with willingness to interact (Griffin, 2018) and to help (Ling et al., 2010) and positively associated with punitive intentions; sympathy is positively associated with willingness to interact (Angermeyer et al., 1997; Dolphin & Hennessey, 2014); and pity is positively associated with helping behaviors (Corrigan et al., 2013; Dolphin & Hennessey, 2014).

**Objectives:** This study aimed to test whether an expanded range of affective responses would be significantly predictive of TD peers' attitudes toward and willingness to interact with a hypothetical peer with ASD. It was hypothesized that fear, guilt, hostility, and shyness would be negatively associated with peers' attitudes and behavioral willingness to interact while self-assurance would be positively associated.

**Methods:** 469 male and female college students (79.3% female), ages 18-24 ( $M = 18.62$ ,  $SD = .94$ ), read a vignette depicting a character demonstrating characteristics of ASD. Participants were told to consider that the character asked them to be partners on a class project. Participants then responded to questions assessing their affective responses (*Positive and Negative Affect Schedule-Expanded Form*; PANAS-X; Watson & Clark, 1994), attitudes (*Multidimensional Attitudes Scale Toward Persons with Disabilities*; MAS; Findler et al., 2007), and willingness to interact (*Shared Activities Questionnaire-Form B*; SAQ-B; Campbell, 2008) with the vignette character.

**Results:** The first multiple regression analysis explained significant variance when predicting peers' attitudes,  $F(5, 463) = 26.28$ ,  $p < .001$ , adjusted  $R^2 = .213$ . Peers' hostility ( $\beta = -.349$ ,  $p < .001$ ) and self-assurance ( $\beta = .318$ ,  $p < .001$ ) emerged as significant predictors of attitudes. The second multiple regression analysis revealed significant variance when predicting peers' willingness to interact,  $F(5, 463) = 35.171$ ,  $p < .001$ , adjusted  $R^2 = .267$ . Peers' hostility ( $\beta = -.330$ ,  $p < .001$ ), shyness ( $\beta = .118$ ,  $p = .012$ ), and self-assurance ( $\beta = .368$ ,  $p < .001$ ) emerged as significant predictors of willingness to interact.

**Conclusions:** The results of this study demonstrate that TD peers' hostility (i.e., anger and disgust) toward a peer with ASD and their self-assurance (i.e., confidence, fearlessness) were the strongest predictors of their attitudes toward and willingness to interact with peers with ASD. Additionally, shyness predicts willingness to interact. These findings provide evidence that measuring affective responses beyond anger, sympathy, and pity may be important for better understanding how TD peers perceive and interact with their peers with ASD.

**415.003 (Poster)** An Examination of Coping Strategies in Relation to Emotion Regulation Difficulties and PTSD-Symptoms Among Autistic Adults  
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**Background:** The Brief-Coping Orientation to Problems Experienced (Brief-COPE) is a widely used measure of coping strategies that has been examined limitedly among autistic individuals, as little is known regarding the general coping skills of autistic adults. Similarly, little research has examined how general coping strategies relate to important clinical outcomes such as emotion regulation and trauma symptoms more broadly among autistic adults, despite research that suggests that autistic individuals may be more vulnerable to emotion regulation difficulties and experiencing traumatic or stressful events. Understanding how autistic adults are impacted by stressful events and how they cope with stress is therefore a critical research priority that holds broad implications for clinical practice and future intervention.

**Objectives:** The goals of the current study were to (1) examine the factor structure of the Brief-COPE among autistic and non-autistic adults, (2) evaluate differences in coping strategies between autistic and non-autistic adults, and (3) explore associations between coping strategies, difficulties in emotion regulation, and PTSD-symptoms among autistic and non-autistic adults.

**Methods:** Participants included 276 autistic adults, including adults who reported being given an autism diagnosis and adults who self-identify as autistic, and 361 non-autistic adults drawn from a United States nationally representative sample. Participants completed an online survey of self-report measures which included the Brief-COPE, Difficulties in Emotion Regulation Scale (DERS), and the PTSD Checklist for DSM-5 (PCL-5).

**Results:** Confirmatory factor analyses showed that the original 14-subscale model of the Brief-COPE had strong fit for both autistic and non-autistic groups. Multivariate analysis of variance (MANOVA) results suggested that autistic adults differ significantly from non-autistic adults in their reports of engaging in 10 of the 14 Brief-COPE subscale coping strategies (see Table 1). In particular, autistic adults reported lower levels of Acceptance and Religion strategies, and higher levels of Self-Distraction, Denial, Emotional and Instrumental support, Behavioral Disengagement, Venting, Humor, and Self-Blaming. Correlations between the coping subscales with emotion regulation and PTSD symptoms are presented in Table 2. Across both groups, results suggested significant associations between the Self-Distraction and Self-Blame subscales across all DERS and PCL domains, as well as between Denial, Substance Use, Behavioral Disengagement, and Venting subscales across most DERS and PCL subscales. Humor more strongly associated with most DERS and PCL domains for non-autistic adults, whereas Religion more strongly associated with PCL domains for autistic adults. Most Brief-COPE subscales were more strongly associated with DERS Goals and PCL-C symptoms for non-autistic adults.

**Conclusions:** Overall, our results support the use of the original proposed subscale structure of the Brief-COPE among autistic and non-autistic adults. Moreover, autistic adults reported differences in coping strategies on this measure, including lower levels of Acceptance and Religion strategies and higher levels of Self-Distraction, Denial, Emotional and Instrumental support, Behavioral Disengagement, Venting, Humor, and Self-Blaming strategies. Among both groups, coping strategies are associated with difficulties in emotion regulation and various PTSD-symptom clusters (i.e., intrusions, avoidance, negative alterations in cognition and mood, alterations in arousal and activity), though additional research is needed to clarify the patterns among these associations.

**415.004 (Poster)** Assessing Retrospective Learning Challenges in Autistic Adults with a Screening Tool Used in Vocational Rehabilitation Settings  
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**Background:** Individuals with autism spectrum disorder (ASD) face a number of unique challenges, including poorer outcomes in adult life across multiple metrics (i.e., employment, social relationships/activities, independent living). While there is clear evidence for this at the group-level, there is also evidence for heterogeneity in outcomes among autistic adults. Identifying potential sources of this heterogeneity may help to provide supports



to those with specific needs. One potential source of heterogeneity is a history of academic/learning challenges. However, measures to assess learning challenges retrospectively are limited, and to the best of our knowledge, have not been validated in samples of autistic adults. The current research presents a first step in validating such a measure, the Learning Needs Screening Tool (LNST), a retrospective, self-report measure of academic challenges used in vocational rehabilitation settings to identify job-seekers who may benefit from additional services.

**Objectives:** The study's primary objective was to evaluate the psychometric characteristics of the LNST by a) assessing its internal consistency, and b) evaluating its external validity through an examination of its association with a history of special education receipt and with current vocational outcomes.

**Methods:** 401 autistic adults, recruited via Simons Powering Autism Research and Knowledge (SPARK) Research Match, participated in this study (40.5% male, mean age=28.9). All participants completed the LNST, which collects responses to 13 questions about learning (such as challenges with memorization, note taking, spelling and identifying arithmetic signs) and yields a total score from 0-30. A score of 12 or greater is considered a "screen positive" on the LNST. In addition, participants completed questionnaires that assessed history of prior educational service provision and current vocational activities. To evaluate internal consistency within the sample, the 13 screening items of the LNST were evaluated using Cronbach's alpha. To evaluate the external or convergent validity of the measure, chi-square was used to examine if screen positive status on the LNST was associated with a history of special education receipt. In addition, vocational status as measured via the Taylor Vocational Index was contrasted for those who screened positive and negative. In particular, rates of independent work/post-secondary educational pursuits vs. no vocational/educational activities were contrasted for those who screened positive vs. negative via chi-square.

**Results:** The 13 screening items of the LNST were found to have high internal consistency (Cronbach's  $\alpha=.81$ ). Overall, 56% ( $n=224$ ) of the sample screened positive on the LNST indicating a history of learning challenges. Individuals who screened positive for learning challenges were more likely to have received special education services as a child [ $\chi^2$  (1, $n=400$ )=29.99,  $p<.001$ ] and to have no vocational/educational activities as an adult [ $\chi^2$  (1,  $n=386$ )=19.5,  $p<.001$ ].

**Conclusions:** These results support the utility of the LNST as a possible screening tool to evaluate retrospective learning challenges in adult job seekers with ASD. As those who screened positive were more likely to have no vocational/educational activities, knowledge of retrospective learning needs may help vocational counselors identify autistic adults who need greater supports when seeking and obtaining jobs.

#### **415.005 (Poster)** Assessing the Association between LGBTQ+ Individuals and Co-Occurring Conditions in Autistic Adults

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**Background:** Research suggests that autistic adults have higher rates of co-occurring conditions (e.g., depression) than the general population (Hollocks et al., 2019). One possible explanation is the Minority Stress Model (MSM; Meyer, 2003), which proposes that minority groups may face especially difficult stressors leading to higher rates of mental health problems (Valentine, Shipherd, 2018). According to the MSM, a minority group includes any group that faces prejudice, including gender, racial, or sexual minorities or neurodiverse people. Autistic adults are more likely to identify as LGBTQ+ (Hillier et al., 2019). The potential intersectionality of two minority statuses means autistic individuals may experience greater levels of stress than the general population, placing them at higher risk of negative mental health outcomes.

**Objectives:** 1) To examine the association between co-occurring conditions and dual minority identities (autistic and LGBTQ+). 2) Compare prevalence of co-occurring conditions between LGBTQ+ and non-LGBTQ+ autistic adults. We hypothesized that LGBTQ+ autistic adults would report higher frequencies of co-occurring conditions than autistic adults who do not identify as LGBTQ+.

**Methods:** Our secondary analysis is based on participants enrolled in the Simons Powering Autism Research (SPARK) cohort who participated in a Research Match study (RM0030). SPARK Research Match is a service that helps researchers recruit for their studies. RM0030 invited 2,887 independent autistic adults to participate. Demographic information was collected on 980 respondents between 18-46 years ( $M=31.34$ ,  $SD=6.98$ ). The survey asked about sex at birth, sexuality, gender, and co-occurring diagnoses. The LGBTQ+ identity was used as an inclusive grouping for any participants who did not identify as cisgender and heterosexual. Co-occurring conditions of interest included: depression, anxiety, bipolar disorder, post traumatic stress disorder (PTSD), obsessive compulsive disorder (OCD), panic disorder, eating disorders, and substance abuse disorder.

Chi-square tests were performed to examine the association between co-occurring conditions and having dual identities of autistic and LGBTQ+. Post-hoc pairwise z-tests with Bonferroni correction were used to examine specific differences in proportions of co-occurring conditions between autistic individuals who identify as LGBTQ+ and those who do not.

**Results:** Fifty-five percent of the autistic adults identify as women, and 40% of the sample identify as LGBTQ+ (sexual and/or gender minorities). LGBTQ+ identity is significantly associated with co-occurring conditions in autistic adults (Table 1). As hypothesized, the proportion of individuals with autistic and LGBTQ+ identities and co-occurring conditions was significantly higher than the proportion of autistic adults who do not identify as LGBTQ+ (Table 2).

**Conclusions:** Mental health conditions are significantly related to LGBTQ+ status in autistic adults. Specifically, LGBTQ+ autistic adults have higher rates of co-occurring conditions. These findings suggest that individuals with dual minority identities (autistic and LGBTQ+) may face additional stressors and stigmatization leading to more mental health problems. It is important to provide additional resources and support for these individuals. Future studies should examine LGBTQ+ groups separately to see if differences exist by sexual orientation and/or gender identity.

**415.006** (Poster) Associations between Protective and Vulnerability Factors of Aging: Network Estimation in Subgroups of Autistic Adults  
**T. A. Radhoe, J. Agelink van Rentergem, C. Torenvliet, A. P. Groenman, W. J. van der Putten and H. M. Geurts, University of Amsterdam, Amsterdam, Netherlands**

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**Background:** Autism spectrum condition (ASC) is considered to be marked by heterogeneity, which complicates the search for causes and support for individuals with an ASC diagnosis. In our previous study (presented at the INSAR 2021 meeting, and currently under review; Preprint: <https://psyarxiv.com/hs4bx/>), we identified two ASC subgroups that differed on cognitive failures, psychological difficulties, and quality of life. We named these subgroups (a) HighSocial/HighGrip and (b) LowSocial/LowGrip.

**Objectives:** We will test whether the previously identified subgroups differ in the interactions between vulnerability and protective factors of aging. Moreover, we aim to identify which variables in the network are most important.

**Methods:** The input for the network analyses were 16 variables measured with self-report questionnaires on the following domains: ASC traits, demography, psychological characteristics, and quality of life. As preregistered (AsPredicted no. 49209), we perform three analysis steps. Step 1: We estimate the network structure separately for autistic adults and comparisons analyzing a data set of N=545 adults (30-85 years, 52% males; 258 ASC, 287 comparisons) using Gaussian Graphical Models. Step 2: We estimate the network structure separately in the previously identified ASC subgroups. Step 3: We test for differences between the ASC subgroups using a network comparison test.

**Results:** Step 1: In the ASC and comparison networks, psychological difficulties appeared most central. Step 2: When we estimated the networks of the two ASC subgroups, psychological difficulties again were most central. In the HighSocial/HighGrip subgroup, they were related to negative affect and level of worries. In the LowSocial/LowGrip subgroup, psychological difficulties next to negative affect and worries, were related to quality of life and cognitive failures. None of the other variables, such as education, ASC traits, and age, reached the set threshold for interpretation.

**Conclusions:** In the HighSocial/HighGrip subgroup, we see more resilience in the network as only two variables are involved in the rise and fall of psychological difficulties, which can prevent spreading of problems across domains. In the LowSocial/LowGrip subgroup, we see that more variables are connected. This could potentially result in spreading of problems across domains, from cognitive failures to psychological difficulties, negative affect, quality of life and worries, or vice versa. Formal statistical network comparisons between the two subgroups (Step 3) will be performed before the INSAR 2022 meeting.

**415.007** (Poster) Autism Severity and Cognitive and Behavioral Studies in Individuals with Fragile X Syndrome

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**Background:** Fragile X syndrome (FXS) is the most common single-gene disorder causing autism spectrum disorder (ASD). Presence and severity of ASD can modify the profile and have implications for clinical management of FXS.

**Objectives:** To determine the effect of severity of ASD on cognitive and behavioral outcomes in individuals with FXS.

**Methods:** Data for this study was obtained from the baseline data of participants in a clinical trial of metformin in FXS at a tertiary institution. Inclusion criteria included individuals with FXS and 1) age between 6 to 40 years, 2) baseline cognitive IQ score < 75 and 3) minimal verbal language at a 3-word phrase level. Presence and severity of ASD was determined by the Autism Diagnostic Observation Schedule-2 (ADOS-2). Baseline measures for this study included standardized assessments (Leiter-III cognitive assessment and Vineland Adaptive Behavior Scales-third edition (VABS-III)) and caregiver-reported questionnaires (Pediatric Quality of Life (PedsQL), Anxiety, Depression and Mood Screening (ADAMs), Aberrant Behavior Checklist – community edition (ABC-C), and Swanson, Nolan and Pelham questionnaire (SNAP-IV) for inattention and hyperactivity). One-way Analysis of Variance followed by Tukey post-hoc test was used to compare between ASD severity groups on cognitive and behavioral measures. Significance of differences was determined at p-value <0.05.

**Results:** Data from 47 individuals was utilized for this analysis (mean age 15.3, SD 6.25; males 94.2%). ASD severity was classified into no/mild ASD (N=7), moderate (N=17) and severe (N=23) based on ADOS scores. The Leiter-III score of the no/mild ASD group (mean 68.1, SD 12.2) significantly differed from the moderate ASD (mean 44.3, SD 8.9,  $p=0.004$ ) and severe ASD (mean 45.5, SD 14.7,  $p=0.004$ ) groups (Table 1). The Aberrant Behavior Checklist total score was significantly lower in the no/mild ASD group as compared to the moderate ASD group ( $27.3 \pm 19.9$  vs.  $59.3 \pm 29.7$ ,  $p = 0.034$ ). The PedsQL school functioning total score was also significantly lower in the moderate ASD group as compared to the severe ASD group ( $52.5 \pm 12.4$  vs.  $65.0 \pm 16.9$ ,  $p=0.040$ ). Severity of ASD did not significantly associate with any other behavioral outcomes. There was no significant association between ASD severity and the CGG repeat length.

**Conclusions:** The severity of ASD has a negative effect on cognitive outcomes and more challenging behavior of individuals with FXS. Interestingly, caregiver reported school-related quality of life is lowest in individuals with moderate ASD as compared to those with more severe ASD. This could be related to their more severe behavioral problems and perhaps relatively better functional abilities leading to fewer supports at school. Targeted early intervention especially for individuals with FXS and ASD and facilitating school accommodations and inclusion can help to improve their cognition and quality of life.

Table 1:

| Measure                                 | No/Mild Autism             | Moderate Autism          | Severe Autism            | 1-way ANOVA Overall <i>p</i> -value |
|---|----------------------------|--------------------------|--------------------------|-------------------------------------|
| Leiter-III Score                        | 68.1 <sup>1,2</sup> ± 12.2 | 44.3 <sup>1</sup> ± 8.9  | 45.5 <sup>2</sup> ± 14.7 | 0.03                                |
| Aberrant Behavior Checklist total score | 27.3 <sup>1</sup> ± 19.9   | 59.3 <sup>1</sup> ± 29.7 | 49.5 ± 27.7              | 0.04                                |
| PedsQL School Functioning Total score   | 57.2 ± 14.1                | 52.5 <sup>1</sup> ± 12.4 | 65.0 <sup>1</sup> ± 16.9 | 0.005                               |

#### 415.008 (Poster) Characteristics of COVID-19 Vaccine Hesitant Autistic Adults in the SPARK Cohort

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**Background:** Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite availability of vaccination services (MacDonald et al. 2015). While preliminary data on the prevalence of vaccine hesitancy during the COVID-19 pandemic is similar to observed trends pre-pandemic (Khubchandani et al. 2021), there is little known about COVID-19 vaccine hesitancy within the autism spectrum disorder (ASD) population—specifically among independent adults. Identifying specific characteristics of the ASD population with regards to vaccine hesitancy may serve to inform public campaigns to vaccinate the ASD community in the US.

**Objectives:** To describe COVID-19 vaccine hesitancy in a sample of independent adults with ASD within the Simons Foundation Powering Autism Research (SPARK) cohort and to elucidate characteristics associated with COVID-19 vaccine hesitancy.

**Methods:** SPARK is a U.S. based online research study with a cohort of over 100,000 individuals with autism. From March 2nd 2021 through March 23rd 2021, SPARK surveyed independent adults to examine the impact of COVID-19 on their lives as well as their sentiment about available vaccines—before the first FDA approval on August 23rd, 2021. 636 participants completed the survey, and those without a completed Basic Medical Screener previously collected in SPARK were excluded from analysis.

Chi-square tests of independence were performed to identify whether there was a link between vaccine hesitancy and age, sex, employment and educational characteristics, metropolitan vs non-metropolitan residence (Urban Influence Code, UIC), personal experience with COVID, and self-reported mood disorder and ADHD. Fisher's exact test was used when  $n < 5$ . Individuals that were missing UIC code data were removed from the chi-square analysis. To analyze race, mutually exclusive race categories were created by splitting the sample into white vs. people of color.

**Results:** Table 1 includes demographic information and chi-square tests of association between vaccine hesitancy and characteristics of the sample.

The individuals who were COVID-19 vaccine accepting were more likely to live in a metropolitan area than the COVID-19 vaccine hesitant individuals,  $\chi^2 (1, N = 282) = 5.62, p < .05$ . COVID-19 vaccine hesitant respondents were more likely to be non-Hispanic than respondents who were not COVID-19 vaccine hesitant. There were no significant associations between vaccine hesitancy and the following variables; age, sex, race, current employment status, enrollment in school, personal experience with COVID-19, and self-reported mood disorder and ADHD.

**Conclusions:** This study elucidates the characteristics of autistic adults with COVID-19 vaccine hesitancy. Overall, 20% of respondents reported COVID-19 vaccine hesitancy, which is comparable to 22% of respondents in the general population (Khubchandani et al. 2021). COVID-19 vaccine hesitant autistic adults in this sample were more likely to reside in non-metropolitan areas—a finding consistent with the regional differences associated with general vaccine hesitancy within the U.S. (Abbas et al. 2018). Additional studies are needed to measure the change in COVID-19 vaccine hesitancy within autistic adults over time, in order to evaluate the impact of emerging FDA approvals and vaccine mandates implemented after initial survey responses were collected.

#### 415.009 (Poster) Depressive Symptoms in Individuals with Autism Spectrum Disorder or Attention-Deficit/Hyperactivity Disorder: A 10-Year Longitudinal Study

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**Background:** Depressive symptoms are common in individuals with Autism Spectrum Disorder (ASD) and contributes to functional impairments and reduced quality of life. Understanding the development of depressive symptoms in individuals with ASD is important for development of preventive interventions and treatment. Since ASD and Attention-Deficit/Hyperactivity Disorder (ADHD) are two related neurodevelopmental disorders, comparing the trajectories of these two groups can provide information about the shared and/or unique factors contributing to depressive symptoms in these individuals.

**Objectives:** To examine the developmental trajectory of depressive symptoms over a 10-year period in individuals with ASD compared with individuals with ADHD and typically developing (TD) individuals.

**Methods:** Individuals with ASD ( $n = 38$ ), ADHD ( $n = 85$ ), and TD individuals ( $n = 50$ ) completed the Short Moods and Feelings Questionnaire (SMFQ) as a measure of depressive symptoms at baseline ( $M_{age} = 11.7$ ,  $SD = 2.1$ , 64% male), two-year follow-up ( $M_{age} = 13.8$ ,  $SD = 2.1$ , 64% male,

97% retention rate), and 10-year follow-up ( $M_{age} = 21.4$ ,  $SD = 2.3$ , 63% male, 73% retention rate). Between baseline and follow-ups, the groups received treatment as usual. We conducted Linear Mixed Models for analysis of the developmental trajectories of depressive symptoms.

**Results:** At baseline, the ASD ( $p < .001$ ; Hedges  $g = 1.17$ ) and the ADHD ( $p < .001$ ; Hedges  $g = 1.13$ ) group displayed significantly more depressive symptoms than the TD group. From baseline to two-year follow-up, all groups displayed a stable trajectory of depressive symptoms. From two-year follow-up to 10-year follow-up, an increase of depressive symptoms across the three groups was found ( $p = .009$ ). The slopes of the three groups were not significantly different. At the 10-year follow-up, both the ASD ( $p = .001$ ; Hedges  $g = .94$ ) and the ADHD ( $p = .001$ , Hedges  $g = .74$ ) group displayed significantly more depressive symptoms than the TD group.

**Conclusions:** Individuals with ASD report more depressive symptoms than TD individuals and similar levels as individuals with ADHD across time. The developmental trajectory of depressive symptoms in individuals with ASD did not differ from that of individuals with ADHD or TD individuals. The similarity in levels of depressive symptoms across individuals with ASD and individuals with ADHD, could indicate that common factors such as executive dysfunction and/or social difficulties contributes to the depressive symptoms. The common trajectory across all three groups, suggests that the transition from childhood to adulthood can be troublesome also for individuals with ASD or ADHD and be accompanied by an increase in depressive symptoms. The results highlight the importance of addressing depressive symptoms in the clinical care and treatment of individuals with ASD and individuals with ADHD, particularly in the transitional period of adolescence. Our findings indicate that depressive symptoms may not wane by themselves. A limitation with our study is that the SMFQ is intended for children and adolescents, however, psychometric analyses indicated good validity and reliability also at the 10-year follow-up.

**415.010 (Poster)** Developing a Measure of Adult Function Outcomes in Autism Spectrum Disorder: Conceptual Model and Item Generation of the Adult Functioning Scale

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**Background:** Autistic individuals continue to experience considerable challenges in adulthood, with difficulty in social functioning, independence, and maintaining competitive employment. However, researchers lack the ability to systematically assess these outcomes, relying on suboptimal reporting across gross categories (i.e. employed, not employed) or adaptive behavior scales developed for use with children. The absence of validated measures of functional outcomes serves as a methodological barrier to supporting positive outcomes for autistic adults.

**Objectives:** This research includes the first steps to develop a proxy and self-report measure of functional outcomes for autistic adults– the Adult Functioning Scale (AFS), reporting on the initial development of the conceptual model. Development occurred in three phases with the following respective aims: 1) to evaluate whether the existing Vineland Adaptive Behavior Scales-3 (VABS-3) was an adequate measure of adult functional outcomes in ASD compared to functional outcome measures not validated in ASD, 2) to generate a conceptual model using stakeholder input to inform AFS measurement development, and 3) to conduct cognitive interviews to assess comprehension of items and response categories, factors that influence how participants respond to items, and the inclusiveness of the item pool in capturing pertinent concerns.

**Methods:** In phase 1, preliminary baseline data were collected from 48 adults participating in an ongoing trial of Cognitive Enhancement Therapy for autistic adults. Participants completed the VABS-3, the Social Adjustment Scale-II (SAS-II), the Specific Levels of Functioning Scale (SLOF), and the Major Role Adjustment Inventory (MRAI). General linear models were constructed to examine differences in functional outcome measures by levels of employment and social functioning. In phase 2, investigators conducted a literature search of existing adult functional outcome instruments and compared instrument domains to inform AFS conceptual model generation. Key stakeholders reviewed the model, which was further revised, and items were generated. In phase 3, autistic adults ( $n = 13$ ) and caregivers of autistic adults ( $n = 13$ ) completed in-depth cognitive interviews assessing the measure.

**Results:** Phase 1 results revealed that the VABS showed poorer sensitivity than the SAS-II, SLOF, and MRAI in detecting differences between adult outcomes in employment and social functioning, suggesting that adult functional outcome measurement in ASD can be improved. Phase 2 yielded a final conceptual model of adult functional outcomes with 3 subdomains (social functioning, employment, and autonomy) including assessment of satisfaction within each domain (see Figure 1). Cognitive interviews indicated that further revision of all subdomains is warranted, given heterogeneity across the adult ASD population.

**Conclusions:** This study developed the first conceptual model of functional outcomes specific for autistic adults utilizing stakeholder input and in-depth feedback from both autistic adults and caregivers of autistic adults. Cognitive interviews revealed substantial heterogeneity necessitating greater attention to measuring nuanced contextual factors related to adult living, potentially explaining why the VABS-3 is insufficiently sensitive to variation in adult functional outcomes. Future work will involve the collection of data from 1000 self-reporters and their caregivers to conduct psychometric analyses and validate an efficient, precise, and broadly applicable measure of adult functional outcomes in ASD.

**415.011 (Poster)** Neuropsychological Profile of Executive Functions in Autism Spectrum Disorder and Schizophrenia Spectrum Disorders: A Comparison Study in Adults

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**Background:** Autism Spectrum Disorder (ASD) and Schizophrenia Spectrum Disorders (SSD) are two conditions that show similar deficits in Executive Functions (EF) as assessed by neuropsychological tasks. Research suggests that the most affected components of EFs are Inhibition (ability to suppress unwanted responses and irrelevant information), Updating (ability to use or maintain information of ongoing behaviors) and Shifting (ability to disengage from one activity or mental set to another).

**Objectives:** Because there is little known about differences in EF between ASD and SSD our goal was to conduct a comparative study between the two disorders in a series of neuropsychological tasks tapping Inhibition, Updating and Shifting. We wanted to establish whether or not each condition shows a different neuropsychological profile by looking at each of the three EF domains. We further wanted to explore in all groups whether the reaction times (RT) can predict the Hit-Rate performance (HR-P) on these tasks.

**Methods:** Twenty-five controls (TDC), 24 participants with ASD and 9 with SSD took part in the study. We used the Unity and Diversity approach, which consists of assessing the core components of EF, each with 3 tasks. For Inhibition we used Antisaccade, Stop-Signal and Stroop-Task, for Updating we used Keep-Track, Letter-Memory and Spatial 2-Back and for Shifting Number-Letter, Color-Shape and Category-Switch-Task. The tasks were computerized adaptation of this approach. Also, to our knowledge this is the first time these tasks were used in Spanish language. Group differences were examined with Kruskal-Wallis-H test. A linear regression was conducted to assess if delayed RTs predicted a better outcome in HR-P.

**Results:** Significant group differences ( $p > .05$ ) were found on Inhibition-RT (SSD>ASD>TDC), Updating HR-P (TDC>ASD>SSD), Shifting HR-P (TDC>ASD>SSD) and Shifting-RT (SSD>ASD>TDC). No significant group differences for Inhibition HT-P and Shifting Switch-Cost were found. Average delayed RTs of the groups were not statistically significant to predict HR-P. See Figure 1, for visual representation of the neuropsychological EF profile. We used Standardized Mean Differences (SMD) to plot our results.

**Conclusions:** People with autism and schizophrenia seem to share some difficulties in the core components of EFs. We found that SSD group had lower scores in HT-P and had more delayed responses in RT than the other groups. Furthermore, in line with past research, the self-paced task format did not lead to better performance in neither of the groups. We also found that Updating impairments in SSD were greater in tasks that required more than one cognitive task simultaneously (e.g., Keep-Track and Letter-Memory tasks). Lastly, Inhibition difficulties were found in the amount of total RT individuals with ASD and SSD needed to accomplish the inhibition tasks. Our work contributes, thus, to the growing body of evidence towards a better understanding of EF impairments in these clinical groups. We argue that differentiating between spared and impaired components of EF in each disorder is especially important for improving interventions and developing guidelines toward a better quality of life, independence, adaptability and other daily living aspects of these individuals.

#### **415.012 (Poster) Differences in Daily Life Executive Functioning between People with Autism and People with Schizophrenia**

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**Background:** People with Autism Spectrum Disorder (ASD) and Schizophrenia Spectrum Disorders (SSD) share similar impairments associated with executive functions (EF) which impact their independence and their adaptive behavior. The observable executive problems associated with these disorders are often attributed to a Dysexecutive Syndrome (DS) that encompass problems at planning, inflexibility, autoregulation, disinhibition among other everyday EFs. Both conditions are associated with a limited capacity to perform everyday life tasks that are essential to maintain a relatively independent, healthy and safe life.

**Objectives:** Our main objective was to conduct a comparative analysis of everyday executive functioning between ASD, SSD individuals and controls using the Dysexecutive Questionnaire-Spanish (DEX-Sp), to identify patterns of difficulties among the groups. We also wanted to assess the relationship between EF with the DEX-Sp and its role in adaptive behavior using the Vineland Adaptive Behavioral Scale-II (VABS-II). We predicted that both clinical groups would show a DS and therefore score high on the DEX-Sp. We also expected to find an association between the reported deficits in EF and poorer adaptive behavior.

**Methods:** To test our hypothesis we used the DEX-Sp for the first time to compare a sample of 35 adults with ASD, 22 adults with SSD and 32 typically developed controls. Group differences were examined with Kruskal-Wallis test; for the targeted variables multiple ANCOVAs were used. A hierarchical multiple regression was conducted to predict adaptive behavior with the EF measure.

**Results:** We found higher scores in the DEX-Sp and its Disinhibition/Apathy and Disorganization/Impulsivity subscale for the ASD group, showing significant difficulties in everyday executive functioning which are typically associated to a DS. The SSD group showed moderate impairments in everyday EF. Also, we found a strong association of impaired everyday EF and adaptive behavior, using the DEX-Sp and VABS-II, but only for the ASD group.

**Conclusions:** This study found greater deficits in everyday executive functions in ASD than SSD and controls and these difficulties were associated with poor adaptive behavior. Our results revealed that adults with ASD reported severe difficulties in their ability to initiate or maintain a behavior with the purpose of organizing or planning effectively. We also found shared executive function deficits within ASD and SSD groups as compared to typically developing controls in areas related to inhibiting inappropriate behavioral responses and generating impulsive behaviors. The SSD group denoted moderate impairments in EFs, however we did not find an association between their scores on the DEX-Sp and the scores obtained on the VABS-II. Our findings add evidence to existing literature in children and adolescents with ASD, indicating that deficits in everyday executive functioning continue into adulthood. As for the adults with SSD, the moderate difficulties on EF seem to remain relatively constant throughout

development. These findings together suggest that DEX-Sp could be a useful tool in differentiating areas of strength and weaknesses in clinical groups such as ASD and SDD.

**415.013 (Poster)** Direct and Indirect Influences of Depression Symptoms on Subjective Quality of Life Among Autistic Adults

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**Background:** Quality of life (QoL) is repeatedly identified as a leading research and clinical priority by the autistic community. Autistic adults often report significantly lower subjective QoL (i.e., one's evaluation of their own outcomes, such as 'Is one happy with their job?') than neurotypical adults across a range of domains, including their physical health, emotional well-being, living environment, and social functioning. While some research has examined predictors of QoL among autistic adults, investigations often examine the impact of a single predictor (e.g., anxiety symptoms, autism traits) on QoL using hierarchical regression analyses. While these approaches have been helpful in elucidating factors that contribute to subjective QoL, they fail to capture the potentially meaningful interplay of multiple factors and mediating variables, which are undeniably influential during early adulthood.

**Objectives:** To determine the association of multiple interacting factors (activities of daily living, anxiety symptoms, depressive symptoms, autistic traits) with subjective QoL in autistic adults during early adulthood.

**Methods:** Participants included 398 autistic adults (ages 18-39 years), who were recruited via Simons Powering Autism Research and Knowledge (SPARK) Research Match. All participants completed surveys measuring autistic traits (Autism Quotient Short Form; AQ28), daily living skills (Waisman Activities of Daily Living; W-ADL), depression symptoms (Patient Health Questionnaire-9 – PHQ-9), anxiety symptoms (General Anxiety Disorder-7; GAD7), and two QoL instruments (abbreviated World Health Organization Quality of Life measure; WHOQOL-BREF and Autism Spectrum Quality of Life; ASQoL supplement). To achieve the study objective, eight path analysis models were run and compared using maximum likelihood estimation (Figure 1); significance testing of mediation effects were complemented with estimates of indirect effect sizes using a 95% bootstrapped confidence interval (CI) based on 20,000 bootstrapped samples. CIs that do not contain zero indicate significant mediation.

**Results:** In Models 1-4, depressive symptoms mediated the relationship between the predictors of daily living skills and autistic traits and the outcome of subjective QoL in all path analyses (all  $ps < .03$ , all CIs do not contain 0, see Table 1 and Figure 1a). In contrast, in Models 5-8, daily living skills did not mediate the relationship between the predictors of autistic traits, depressive and anxiety symptoms, and the outcome of subjective QoL (all  $ps > .06$ , all CIs contain 0, values not displayed in Table 1 but see Figure 1b). Though autistic traits correlated significantly with all subjective QoL measures in isolation, path analysis models demonstrated that the direct paths between autistic traits and QoL on the WHOQOL-BREF (Social, Environmental and Physical) domains were not significant after accounting for the mediating effects of depressive symptoms (Models 1-4, see Table 1).

**Conclusions:** This study supports the call by the autistic community to focus on mental health in adulthood because it plays a major role in their subjective QoL. Here, depressive symptoms influence subjective QoL across all five domains both directly and indirectly. These findings emphasize the importance of developing and implementing evidenced-based depression interventions for autistic adults during early adulthood, as they may cascade from improving mental health to improving subjective QoL.

**415.014 (Poster)** An Examination of Connectedness and Socialization in an Autistic and Neurotypical Sample in the United States

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**Background:** Individuals with autism spectrum disorder (ASD) generally experience more challenges with socializing than neurotypical (non-autistic) individuals due to the inherent social communication differences in autism (American Psychiatric Association, 2013). These challenges can lead to difficulty with forming friendships and romantic relationships and higher levels of internalizing disorders (Mazurek, 2014; Stice & Lavner, 2019). The present study examines the relationship between social connectedness and assurance, autism characteristics, and psychosexual socialization. A better understanding of the intersection of these elements of social functioning may help to inform future intervention work with autistic individuals.

**Objectives:** To understand whether feeling more connected to others and assured in social situations can predict level of psychosexual socialization beyond the effects of an autism diagnosis.

**Methods:** A total of 132 adults participated in this study from across the United States, representing 23 states. Participants included both adults with ASD without intellectual disability (44 ASD) and neurotypical adults (88 NT). Diagnostic group was based on self-report. Mean age was 26.89 (SD = 5.929). Participants completed an anonymous online survey; measures for this survey included the Social Connectedness and Social Assurance Scales (Lee & Robbins, 1995). and the Teen Transition Inventory, Psychosexual Socialization subscale (Dekker et al., 2017). A sequential linear regression model was estimated to determine if social connectedness and assurance predicted any variation in psychosexual socialization over and above the variation predicted by autism diagnostic group.

**Results:** Diagnostic group was a significant predictor of psychosexual socialization score by itself,  $R^2 = .068$ ,  $F(1,130) = 9.45$ ,  $p = .003$ , when social connectedness/assurance was added the model,  $R^2 = .072$ ,  $F(2,129) = 4.99$ ,  $p = .008$ , and when the interaction between the two predictors was further added,  $R^2 = .075$ ,  $F(3,128) = 3.48$ ,  $p = .02$ . However, neither social connectedness/assurance nor the interaction term were significant predictors over and above diagnostic group, indicating that significant findings were driven by diagnostic group.

**Conclusions:** Due to the inherent social challenges that are part of the autism diagnosis, it was expected that autistic participants would be predicted to score lower on socialization, which was supported by the analysis. This finding contributes to the ongoing conversation about the nature of sociability in autism spectrum disorder. However, failing to find significant predictive power of social connectedness and assurance for psychosexual socialization opens the door to additional analysis of interpersonal and intrapersonal domains of social functioning for autistic and neurotypical adults. It is likely that diagnostic group was such a strong predictor of psychosexual socialization than any additional variable would not have an impact on the model. Because of the inherent social differences in autism, distinct aspects of social functioning may need to be looked at separately for autistic and neurotypical people.

**415.015 (Poster)** Exploring the Experiences of Physical Fitness with Autistic Adults

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**Background:** Understanding the motivation and barriers of physical fitness for autistic adults is an understudied research area. Autistic children and adolescents are less physically active compared to their neurotypical peers (Stanish et al., 2017). These gaps in activity widen as youth get older (Stanish et al., 2015), and contribute to health risks in adulthood including heart disease and diabetes (Must et al., 2017; Wright, 2015) and can exacerbate mental health conditions like anxiety and depression. By qualitatively exploring the physical activity experiences of autistic adults, we can better understand characteristics that are associated with engagement in or avoidance of physical activity. In the future, these findings can inform exercise and trainer education programs that are more inclusive and tailored to meet the needs of a neurodiverse population.

**Objectives:** Explore the motivation, barriers, and experiences of physical fitness of autistic adults. Through understanding these elements, we believe that physical exercise programs can adapt to meet the needs of autistic adults, benefiting both their physical and mental health.

**Methods:** Seven autistic adults, who were over the age of 18 and diagnosed with autism, participated. Participants completed a semi-structured interview via Zoom that was then transcribed. Qualitative analyses were completed on these transcripts and themes/sub-themes were organized into a visual network.

**Results:** Seven main themes emerged from the data: health benefits, sense of accomplishment, sensory issues, having a structured plan, being alone, being with others, and a broad definition of physical activity. From these themes, sub-themes were developed as seen in Figure 1.

**Conclusions:** There is much to be learned from exploring the motivation and barriers of physical activity for autistic adults. This study highlights some expected themes, such as health benefits, sense of accomplishment, and sensory sensitivities, but also brought to light new elements that may not have been discovered if not having talked directly to autistic adults about their experiences. Participants tended to have much broader definitions of physical activity than what is considered typical when thinking about fitness. This is important to consider as physicians may ask these adults if they are physically active by listing more traditional fitness activities like running, biking, or swimming. Additionally, understanding the social needs of autistic individuals related to fitness may help physical fitness programs become more inclusive and welcoming to neurodivergent members. Future research into this area would allow better insight into the needs of autistic adults to overcome barriers to fitness, stay motivated, and have more positive experiences with physical activity.

**415.016 (Poster)** Improvements in Social and Role Functioning in Autistic Youth Transitioning to Young Adulthood

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**Background:**

Given the ever-growing number of autistic teenagers transitioning to adulthood, determining effective interventions to help the transition to independent life is crucial. This study adapted the Global Social Global Role (GS/GR) scale, originally developed for schizophrenia (Cornblatt et. al., 2007), to measure social (friendships) and role (school/work) functioning in an autistic sample. This clinical interview was administered at two time points (T1, T2) of a longitudinal study of teenagers and young adults with ASD and without (TYP). The present analyses explore cognitive and psychological factors related to improvements, to inform future interventions.

**Objectives:**

- Determine if autistic participants improve in their GS/GR functioning with time.
- In those who do improve, see if measures of cognition and psychopathology are different compared to those who do not improve.
- Compare cognition in ASD and TYP groups with equivalent levels of functioning.

**Methods:**

75 autistic and 70 TYP participants completed the modified GS/GR scales twice, on average 2 years apart. Each GAF-type scale ranges from 1-10 (10 = highest functioning). Mean age at T1 was 17 years for both groups. ASD diagnosis was confirmed using the ADOS-2, with IQ (WASII),

cognition (NIH Toolbox Cognition Battery) and adaptive functioning (The Maps task (McLaughlin et. al., 2016)) also assessed at T1. Parents completed the ASEBA to assess psychopathology at T1 and T2. T-tests were used to compare groups.

#### Results:

Fifty percent of the ASD group improved in their GS/GR scores from the first to the second time point (Table 1). In both groups, change in GS correlated moderately with change in GR (ASD:  $\rho=.253$ ,  $p=.028$ ; TYP:  $\rho=.310$ ,  $p=.009$ ).

Autistic participants who improved GS scores had lower ADOS CSS scores ( $M=7$ ,  $SD=2$ ) compared to those who didn't change ( $M=8.5$ ,  $SD=1$ ;  $t(60)=2.8$ ,  $p=.007$ ). Those who improved their GR scores had significantly lower non-verbal IQ scores ( $M=102$ ,  $SD=20$ ) compared to those who decreased their GR ( $M=112$ ,  $SD=16$ ;  $t(62)=2.1$ ,  $p=.041$ ). Autistic participants who improved GR also had significantly lower parent-reported Anxiety Problems on the ASEBA at T2 ( $M=55$ ,  $SD=6$  vs.  $M=61$ ,  $SD=9$ ;  $t(32)=2.8$ ,  $p=.008$ ) (Figure 1).

In matched groups equal on T1 GS or GR scores, ASD and TYP did not differ on IQ, age, adaptive functioning (Maps Task), and crystalized cognition. The TYP group had higher fluid cognition scores by 10 points compared to ASD ( $p<.001$ ).

#### Conclusions:

Many autistic youth increased in their social and role functioning over two years. However, the relationship between improving in social functioning was only moderately correlated with improving in role functioning, suggesting varied patterns of improvement between social and role domains. In the ASD group, increasing social ability was related to lower autism symptom severity scores, but increasing role ability was related to lower anxiety. Many autistic participants with lower non-verbal IQ scores improved GR, and between the TYP and ASD groups equal in GS/GR scores, only a deficit in fluid cognition remained. These results suggest nonverbal ability does not impede improvement, and interventions might benefit from focusing on verbal skills. Anxiety treatment may also help improve role functioning during development.

#### **415.017 (Poster)** Development of a Self-Report Tool for Measuring Change in Aspects of Autism

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#### Background:

There are few self-report measures developed specifically for use in ASD. Existing tools are not designed for assessing clinical outcomes, nor are they validated for use in therapeutic treatment trials (Brugha et al., 2015). Further, few measures were developed with input from autistic people to help establish content validity. Representative input from the autistic community is critically important for identifying meaningful outcomes, particularly when developing novel therapeutics.

#### Objectives:

Understanding autistic adults' perspectives on treatment of autism-related features

#### Methods:

Participants in the current study were adults ( $n=30$  TDI,  $n=10$  CI) over aged 18 years with a confirmed diagnosis of ASD before age 18 by a qualified clinician using DSM IV/5 criteria. Participants had reading ability at or above a 3rd / 4th grade level and a high school certification, GED or diploma. Interviews were conducted by a moderator trained in qualitative research methods, with special focus on how to avoid introducing bias during the interview process.

There were two study phases: 1) anonymized exploratory Telephone In-Depth Interviews (TDI), and; 2) cognitive interviews (CI) to test potential items for a self-report measure. Respondents were given a 'study preparation exercise' prior to interview. The in-depth interview format was semi-structured concept elicitation, following 3 topic areas: 1) Introduction and Patient History; 2) Symptomology, and; 3) Identification of Relevant Aspects of Autism and Interest in Treatment. A draft item set was derived from the TDI and presented in Cognitive interviews prior to the planned development of a self-report measure.

#### Results:

Preliminary data from 9 participants in the Autistic Community reflected a high level of agreement about the need for a self-report tool to track changes in symptoms of autism (89% of participants). Qualitative analysis suggested that autistic adults desired support (via individual treatment and/or environmental modifications) to help to manage sensory issues, social communication difficulties and social anxiety (100%), sensitivity to change (89%), restlessness/stimming (56%), insomnia and depression (22%). 34% of participants identified that their interest in treatment was not completely individual as their desire for change in some areas was driven by stigma and judgment from peers. 11% of participants spontaneously



expressed preferences for an environment that was more supportive of their differences. Further qualitative analysis is underway and detailed descriptive data on items tested during cognitive interviews will be available for presentation at the time of the conference.

#### Conclusions:

Preliminary information collected via in-depth interviews of autistic people during the development of a self-report tool identified symptom targets for which autistic adults were interested in support and, consistent with previous literature (Kapp et al., 2019), highlighted perspectives in support of individual treatment and environmental modifications. This work will aid in the development of self-report tools that can be used to measure changes in symptoms associated with autism in adulthood. Information gained from this project will also provide insight into the types of supports and/or interventions that autistic adults may be interested in seeking.

**415.018 (Poster)** Physical, Psychological and Environmental Barriers and Facilitators to Physical Activity Engagement in Autistic Adults with Mild Intellectual Disability: A Qualitative Study

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**Background:** Physical activity (PA) involvement among autistic people and those diagnosed with intellectual disability is significantly lower than the general population (Borland et al., 2020), which is related to increased mortality, obesity, and lower quality of life (Feehan et al., 2012). Moreover, the risk of adverse health outcomes is more severe for the one-third of autistic people who are also diagnosed with intellectual disability (CDC, 2020; van Dooren et al., 2016). To help address the health needs that uniquely affect autistic adults with intellectual disability, more research is needed to identify the factors influencing their PA engagement.

**Objectives:** Explore the self-reported barriers and facilitators to PA involvement of autistic adults with mild intellectual disability.

**Methods:** Fifteen adults diagnosed with autism and mild intellectual disability between the ages of 19 and 56 years ( $M_{age}=26.11$ ,  $SD=10.81$ , 10 males) completed a semi-structured interview about their PA engagement, adapted from van Schijndel-Speet et al. (2014). Diagnosis was confirmed through provision of their clinical diagnostic report for their autism and intellectual disability diagnoses. A phenomenological approach was followed to understand how the unique experiences of participants have influenced their behaviours and thoughts about PA. Interviews were transcribed verbatim. Codes were created from the transcriptions and thematically analyzed. Patterns and themes were inductively created from the codes by the first and second authors using QSR NVivo 12.

**Results:** Three main themes were identified: Physical factors, Psychological factors, and Environment factors. With regard to barriers that limited or deterred participants from activities, continuing health problems was a common physical barrier and negative past experiences with PA, such as being yelled at by coaches or bullied by peers, was a common psychological barrier. These experiences reportedly had adverse effects on self-confidence and overall attitudes towards PA. The most frequent environmental barrier was the lack of accommodation, support, or opportunities available in the community. Many participants stated that they have difficulties learning the rules of an activity, do not know who or how to ask for help, and do not have access to opportunities that accommodate their physical or cognitive needs. With regard to facilitators that encouraged PA engagement among participants, a common psychological facilitator was participants' intrinsic motivation to improve skills and achieve personal goals. Common environmental facilitators included extrinsic motivation, such as receiving prizes from local organizations or traveling to new places with their sports team, as well as support through non-profit organizations like Special Olympics.

**Conclusions:** These findings suggest that autistic participants with mild intellectual disability are intrinsically motivated to engage in PA, but face significant barriers to engagement, predominantly from the lack of support or access to accommodations for physical activities in community settings. More education for staff, appropriate support for individuals and attention to motivational factors may help to expand access to inclusive activities for autistic adults with intellectual disability and, in turn, reduce their physical health risk.

**415.019 (Poster)** Positive Repetitive Thinking Predicts Quality of Life in Autistic Adults

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**Background:** Autistic adults often report poorer quality of life than typically developing adults (Mason et al., 2018; Cai et al., 2020). Autistic adults also engage in higher rates of repetitive thinking, such as rumination and engagement in inflexible circumscribed interests (CI), which has broadly been linked with adverse outcomes (e.g., Gotham et al., 2014). The valence and purpose of repetitive thought likely matters, however: Repetitive thinking that is solution-oriented (Watkins, 2008), focuses on positive experiences (i.e. savoring; Ma et al., 2020; Bryant & Veroff, 2007; Smith et al., 2015), and is communicated to others (Tedeschi & Calhoun, 2004) is tied to positive outcomes in the general population. Despite high rates of repetitive thinking in the autistic population, research examining the benefits of positive repetitive thinking and savoring in this population is limited.

**Objectives:** We aimed to examine which cognitive-affective and behavioral factors related to repetitive thinking predict improved quality of life among autistic adults. We hypothesized that forms of positive repetitive thinking, including solution-oriented thinking and savoring positive memories, as well as engaging in one's circumscribed interest with others, would predict improved quality of life among autistic individuals.

**Methods:** Seven hundred sixty-two autistic adults (age  $M=30.89$ ,  $SD=7.05$  years;  $n=414$  females,  $n=77$  nonbinary) were recruited through the Simons Foundation Powering Autism Research (SPARK) registry to complete a survey battery on repetitive thinking and emotional health. A composite "quality of life" score was generated using items from the Autism Specific Quality of Life assessment (ASQoL; McConachie et al., 2018) and the World Health Organization Quality of Life assessment (WHOQoL-BREF; WHO, 1998). A solution-oriented thinking score was generated

based on the results of a network analysis (Gotham & Williams, 2021) on items from various measures of repetitive thinking, such as the Analytical Rumination Questionnaire (ARQ; Barbic et al., 2014) and Measure of Mental Anticipatory Processes (MMAP; Feldman & Hayes, 2005); the final score was comprised of 11 items assessing aspects of adaptive cognition such as the degree to which one sees events from different perspectives and the degree to which one envisions solutions. Savoring was measured with two novel items assessing the degree to which one repeatedly recalls positive memories. Finally, a single item from the Interest Scale (Turner-Brown, Lam, Holtzclaw, Dichter, & Bodfish, 2011) assessed the degree to which one engages in their circumscribed interest with others. A linear regression model was conducted to examine whether these cognitive affective factors predicted increased quality of life.

**Results:** Repetitive positive thinking ( $B=0.28$ ,  $p<0.001$ ), savoring ( $B=0.07$ ,  $p<0.001$ ), and engaging in interests socially ( $B=0.20$ ,  $p<0.005$ ) all predicted increased quality of life independently within the same model,  $F(7,731)=23.64$ ,  $R^2=0.177$ .

**Conclusions:** While repetitive thinking has typically been associated with poorer outcomes in the autistic population, our findings suggest that forms of positive repetitive thinking, such as problem-solving and savoring, as well as engaging in special interests with others (versus alone), are associated with increased quality of life. These findings may help leverage existing strengths and inform intervention targets for improving quality of life in the autistic population.

#### **415.020 (Poster)** Predictors of Suicide Risk in Transition-Aged Youth and Young Adults on the Spectrum

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**Background:** Autistic individuals are at higher risk to ideate, attempt, and die by suicide than non-autistic individuals (Oliphant et al., 2020), with transition-aged adolescents and young adults at the highest risk (Kirby et al., 2019). While research examining risk factors of suicide for this population is limited, considerable evidence suggests that autistic individuals with higher levels of depressive symptoms are at higher risk of suicidal ideation and attempt (Costa et al., 2020; Hand et al., 2019). Lower executive function skills have also been significantly associated with suicide risk in non-autistic individuals (Bredemeier & Miller, 2015). Given the high prevalence of executive function challenges for autistic individuals, its inclusion in the conceptual model of suicide risk for autistic young adults is overdue.

**Objectives:** In order to expand the evidence base for suicide-related intervention targets for individuals on the spectrum, this study aimed to examine executive function and depression as potential risk factors of suicidality in a transition-aged population of autistic adolescents and young adults.

**Methods:** 183 transition-aged autistic adolescents and young adults (ages 16-21) enrolled in a larger randomized controlled trial examining the effectiveness of the TEACCH School Transition to Employment and Post-Secondary Education Program (T-STEP) submitted measures of executive function (BRIEF-A per parent report) and depression (CESD-R per self report) at baseline. Each participant was also administered a suicide risk assessment (P-4 Suicidality Screener) in which they were asked whether they had thoughts of harming themselves, any prior attempts to harm themselves, any specific thoughts of how they might harm themselves, any intent to harm themselves in the future, and any protective factors which may prevent them from doing so. A series of hierarchical logistic regressions were performed to assess the unique effects of executive function and depression on the endorsement of suicidal ideation.

**Results:** Approximately 33% ( $n=61$ ) of the sample reported having thoughts of harming themselves. Of those who endorsed ideation, approximately 34% ( $n=21$ ) reported a previous attempt, approximately 43% ( $n=26$ ) reported specific thoughts of how they would harm themselves, and approximately 10% ( $n=6$ ) reported intent to act on thoughts of harming themselves in the next month. Both executive function (per the BRIEF-A) and depression (per the CESD-R) demonstrated significant effects on suicidal ideation such that participants with greater impairment in executive functioning ( $b=.015$ ,  $SE=.007$ ,  $Wald=5.16$ ,  $p<.05$ ) and higher levels of depression ( $b=.062$ ,  $SE=.014$ ,  $Wald=19.52$ ,  $p<.05$ ) were each more likely to endorse suicidal ideation. No interactions effects were found.

**Conclusions:** In this sample, 33% of autistic individuals endorsed ideation and 11% reported a prior attempt; both executive function impairment and depression independently predicted suicidality. Treatments that aim to improve executive function skills and ameliorate depressive symptoms may help mitigate suicide risk amongst autistic individuals. Despite the high prevalence of co-occurring executive function challenges and depression amongst this population, service delivery is often siloed between ASD specialists and mental health professionals. These findings underscore the need for service accessibility and integration across Developmental Disability and Mental Health systems to target malleable predictors of suicide risk in this population.

#### **415.021 (Poster)** Preliminary Analyses of a Randomized Control Trial of Training to Understand and Navigate Emotions and Interactions

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**Background:** Autism spectrum disorder (ASD) is characterized by difficulties with social interaction, cognition, and communication (Howlin, Moss, Savage, & Rutter, 2013). These difficulties can severely impact functioning and quality of life in family, school, and community settings and persist well into adulthood (Shattuck et al., 2012). Few social functioning treatment programs exist for adults (White, Keonig, & Scabill, 2007; Pallathra et al., 2019). TUNE In (Training to Understand and Navigate Emotions and Interactions) is a novel cognitive behavioral based social skills treatment aimed at improving social functioning in late adolescents and adults with ASD, which has shown preliminary evidence of effectiveness at reducing social functioning impairments in ASD (Pallathra et al., 2018).

**Objectives:** To further test the efficacy of TUNE In. We are conducting a randomized control trial (RCT) of TUNE In with a sample of adults with ASD. Participants complete three, consecutive phases of TUNE In (17 weekly sessions in total) which consist of individual therapy (5 sessions), group therapy (8 sessions), and volunteer/advocacy work (4 sessions).

**Methods:** 27 participants (Mean + SD age = 25.85 ± 8.42; 14 Female) were randomly assigned to either receive TUNE In (treatment) or no treatment (control). The Social Responsiveness Scale, Second Edition for Adults (SRS-2; Constantino, 2005) is the primary outcome measure in the trial and evaluates the presence and severity of the social impairments for each participant. Participants complete the SRS-2 at pre-treatment and post-treatment in both treatment and control groups, while participants in the treatment group additionally complete the SRS-2 after each of the three phases of TUNE In. To date 10 participants in the treatment group and 14 in the control group have completed pre-treatment measures, with the 10 participants in the treatment group also completing the SRS-2 after the first phase of TUNE In. Differences between groups were assessed by an independent samples t-test, while differences within the treatment group were assessed by a paired-samples t-test.

**Results:** At pre-treatment, SRS-2 scores did not significantly vary between treatment and control groups ( $t(23) = -.33, p = .74$ ). After completing the first phase of TUNE In, participants' (in the treatment group) scores on the SRS-2 ( $M \pm SD = 71.10 \pm 10.10$ ) were significantly reduced from pre-treatment scores ( $M \pm SD = 73.90 \pm 10.80$ ), indicating significant improvements in ASD symptomology ( $t(9) = 2.45, p = .04$ ). Participants are currently completing the second phase of treatment. Further SRS-2 scores after the second and third phase of TUNE In, as well as post-treatment scores in both groups, will be available and included in the presentation at the INSAR meeting in May.

**Conclusions:** Overall, early results from the first cohort of this RCT support TUNE In's efficacy in addressing social functioning symptoms of ASD in adults. Specifically, results highlight possible improvements in ASD symptoms from even the brief 5-session individual therapy phase of TUNE In. However, complete data across the further time points, for both treatment and control groups, is required to adequately examine the effectiveness of TUNE In.

#### **415.022 (Poster) Psychometric Properties of the Perma Profiler in Autistic Adults**

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#### **Background:**

Historically, mental health research in autism spectrum disorder (ASD) has been deficits-focused. Positive psychology, a rapidly maturing discipline that has established well-being as a scientifically valid field of discovery, offers a new lens to view disability from a strengths-based perspective. For instance, the PERMA Profiler, a 23-item questionnaire, measures overall well-being across five pillars (Positive emotion, Engagement, Relationships, Meaning, and Accomplishment). To date, very few studies have leveraged positive psychological frameworks to examine well-being in ASD. No studies, to our knowledge, have examined well-being from the first-person perspective/self-report of autistic adults.

#### **Objectives:**

The objective of this study was to examine the psychometric properties (reliability, internal validity, and convergent/divergent validity) of the PERMA Profiler in independent autistic adults.

#### **Methods:**

Participants (ages 21 and older) were recruited through Simons Powering Autism Research for Knowledge Research Match (SPARK; [sparkforautism.org](http://sparkforautism.org)), a national autism registry. All surveys were filled out online (17% response rate). Incentives included raffling off seventy-five \$25 gift cards. The PERMA Profiler, which rates each item on a 10-point likert scale, has strong psychometric properties within general population samples (Butler & Kern, 2006). The reliability, internal validity, and convergent/divergent validity of the PERMA Profiler were assessed via measures of internal consistency, confirmatory factor analysis and correlations between well-being and measures of life satisfaction, excitement about life, and mental health diagnoses, respectively. Life satisfaction/excitement and mental health diagnoses were measured via custom survey items. PERMA scores were reported descriptively.

#### **Results:**

A total of 517 independent autistic adults ( $M_{age} = 39$ ;  $SD_{age} = 13$ ; 85% White; 40% Male; 51% with a collegiate degree; 50% employed) were included. The PERMA Profiler demonstrated strong reliability (Cronbach's  $\alpha = 0.93$ ; min/max split-half reliability = 0.81/0.97). Confirmatory factor analysis revealed strong internal validity ( $\chi^2(80) = 350, p < 0.001$ ; CFI = 0.94, TLI = 0.93, RMSEA = 0.08). Overall PERMA scores were positively correlated with life satisfaction ( $r = 0.76, p < .01$ ) and excitement ( $r = 0.72, p < .01$ ), and negatively correlated with anxiety ( $r = -0.20, p < .01$ ) and depression ( $r = -0.42, p < .01$ ), supporting convergent and divergent validity. The only construct that demonstrated lower psychometrics properties was the engagement subscale. PERMA scores were highest for engagement ( $M = 6.8$ ), accomplishment ( $M = 5.6$ ), relationships ( $M = 5.2$ ), meaning ( $M = 5.2$ ), and positive emotions ( $M = 5.0$ ).

#### **Conclusions:**

The PERMA Profiler demonstrated strong reliability and internal validity, as well as good convergent and divergent validity, among autistic adults. This finding supports the use of gathering information on well-being directly from independent autistic adults. Our findings should encourage researchers to move away from proxy informants when first-person report is possible. The PERMA Profiler, and similar measures of well-being, should also be considered for inclusion in future mental health research, particularly intervention trials. Lastly, findings highlight the need for PERMA interventions, given the average score was at the mid-point for most subscales. Incorporating positive mental health interventions within employment programs may hold particular value given the low employment rate in this sample. Meaningful employment itself holds the potential to increase many pillars of PERMA (e.g., engagement, relationships, meaning).

**415.023** (Poster) Quality of Life, Life Satisfaction, and Psychiatric Comorbidities in ASD and Loss of Autism Diagnosis (LAD) Compared to TD. **J. Crutcher<sup>1</sup>**, **E. Taverna<sup>2</sup>**, **M. F. Dieckhaus<sup>1</sup>**, **C. Larson<sup>1</sup>**, **A. Mohan<sup>1</sup>**, **D. A. Berger<sup>1</sup>** and **I. M. Eigsti<sup>1</sup>**, (1)Psychological Sciences, University of Connecticut, Storrs, CT, (2)Department of Psychological Sciences, University of Connecticut, Storrs, CT

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**Background:** Individuals with autism spectrum disorder (ASD) report reduced quality of life (QoL) compared to typically developing (TD) peers (van Heijst & Geurts, 2015). Psychiatric comorbidities and autism symptomatology, among other factors, likely impact QoL in ASD (Chiang & Wineman, 2014). Our research group has studied individuals with a clear history of ASD who have *lost* the ASD diagnosis (LAD); that is, they no longer display any symptoms of ASD (Fein et al., 2013). These individuals have lower rates of lifetime psychiatric diagnoses than peers with current ASD, but higher rates compared to TD peers (Orinstein et al., 2015).

**Objectives:** The current study asks whether LAD individuals report less depression and anxiety, and greater QoL and life satisfaction, relative to peers with and without ASD.

**Methods:** Adolescents ( $n=14$ ) and their parents completed in-person evaluations; young adults ( $n=34$ ) completed telehealth appointments. Both groups completed Qualtrics questionnaires. Young adults completed an ASD Quality of Life questionnaires and a Satisfaction with Life questionnaires. Psychiatric comorbidities and suicidal ideation (SI) were measured using the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS) parent interview for adolescents or the Structured Clinical Interview for DSM-5 (SCID-5) self-report for young adults. Symptoms were assessed with the age-appropriate Achenbach Checklist (CBCL/ABCL) parent report. Groups differed in chronological age (the ASD group participants were younger), Table 1; as such, age was considered as a covariate in analyses.

**Results:** Young adult groups did not differ in QoL or life satisfaction; Table 1. Groups did not differ in self-reported depression or anxiety; however, parents reported greater anxiety and depression in the ASD compared to LAD and TD groups. More individuals with ASD reported recent SI; lifetime reports of SI were non-significantly elevated in both LAD and ASD groups compared with the TD group. Lifetime symptoms of depression and life satisfaction were negatively correlated; Table 2.

**Conclusions:** Quality of life and life satisfaction did not differ in young adults with either ASD or LAD, as well as not being different from TD. Both ASD and LAD groups had relatively high rates of lifetime depression, anxiety, and SI, but they were not significantly different from the TD group. However, parents of young adults with LAD indicated lower anxiety and depression compared to same aged individuals with ASD and similar to parent-reported rates of depression and anxiety in the TD group. Individuals with LAD were also less likely to report past-week SI than their peers with ASD, despite similarly elevated levels of lifetime SI. This suggests that the severity of current psychiatric comorbidities and SI may be less frequent or persistent for individuals who lose an ASD diagnosis. Symptoms of psychiatric comorbidities may decrease in severity over time, along with characteristics of ASD. The strong, negative relationship between lifetime depressive symptoms and life satisfaction highlights the importance of identifying and treating mood disorders in individuals with ASD/LAD.

**415.024** (Poster) Quantitative and Qualitative Examination of Dating Experience in College Students with Autism **J. McCleery<sup>1</sup>**, **T. Fryczynski<sup>2</sup>**, **K. Ryan<sup>3</sup>**, **C. Rose<sup>4</sup>**, **H. M. Mattern<sup>4</sup>**, **T. McFall<sup>5</sup>**, **A. McDougall<sup>1</sup>**, **A. Gatta<sup>5</sup>**, **M. A. Newell<sup>5</sup>**, **R. Haft<sup>5</sup>**, **C. Morrin<sup>3</sup>** and **A. Jayroe<sup>3</sup>**, (1)Psychology, Saint Joseph's University, Philadelphia, PA, (2)Interdisciplinary Health Studies, Saint Joseph's University, Philadelphia, PA, (3)Saint Joseph's University, Philadelphia, PA, (4)Developmental Psychology, Penn State University, University Park, PA, (5)Kinney Center for Autism Education and Support, Saint Joseph's University, Philadelphia, PA

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**Background:** There is extremely limited research on the dating experiences or dating support needs of individuals with autism spectrum disorder (ASD). A recent study found that 85% of autistic individuals expressed an immediate desire for a romantic relationship, with only 35% in a relationship at the time (Heifetz et al., 2020). It is a common misconception that autistic individuals either do not want, or may not be capable of, a romantic relationship (McMahon et al., 2020). Furthermore, prioritization of academic and other needs in educational and clinical interventions during late childhood and adolescence may result in de-prioritization of supports which would help autistic people fulfill their desire to establish and maintain romantic partnerships.

**Objectives:** To collect and analyze a combination of quantitative and qualitative information about the dating experiences of people with ASD through semi-structured interviews.

**Methods:** College students, autism-specialist clinicians, and autism-specialist researchers developed a semi-structured interview to collect quantitative and qualitative information about the dating experiences of college students with ASD. Interview development included direct input from autistic individuals. Interviews are conducted by undergraduate students, and last 45- to 120-minutes. Quantitative questions address educational experiences and activities, age of onset of dating, number of individuals dated, duration of romantic relationships, and dating network support, among other topics. Qualitative questioning focuses around these same topics, including participants beliefs regarding how their own dating experiences have been similar to and different from those of their peers.

Results: Eleven autistic male college students have completed the study thus far. Eight reported having a “straight” sexual preference, 1 reported “bisexual,” 1 reported “gay,” and 1 reported being “not anything.” The focus of the current analysis includes interest in marriage, age of first date, and self-reported issues which they believe may have negatively affected their previous or current romantic and/or plutonic relationships. Ten out of 11 participants reported that they would like to marry, and 1 reported that they are “not sure.” Of the 6 participants who have dated, 5 had their first date in either 8<sup>th</sup> or 9<sup>th</sup> grade, while 1 had their first date in their first year of college. Regarding issues which may negatively affect their romantic and/or plutonic relationships, 8 listed communication. In addition, 3 listed problems with boundaries, 3 listed opinion disagreements, 1 each listed arguments, control, time, effort, differences in wants, effort, or commitment.

Conclusions: The findings of the current study provide additional support for the notion that the majority of autistic people have a desire for a long-term romantic relationship. Age of first date data suggest that those individuals with ASD who are interested and successful in initiating their dating career during adolescence have their first date around the same age as neurotypical peers (i.e., 8<sup>th</sup> or 9<sup>th</sup> grade). Finally, the majority of the autistic college students in our study recognize the importance and challenges of communication when it comes to establishing and maintaining relationships with others, and also show significant insight into a number of other factors which may be affecting their relationships with others.

**415.025 (Poster)** Sensory Issues Are Linked to Menopausal Symptoms in Autistic Women  
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## **Background:**

The menopause is an often-challenging time women’s life, where a change in hormone levels create physical and psychological symptoms. Little is known about how autistic women experience menopause, though it is shown that menopause can affect their health and well-being (Moseley et al., 2020).

## **Objectives:**

To assess which menopausal symptoms autistic women experience, and whether this is linked to autistic traits and sensory issues.

## **Methods:**

We approached females through social media. The participant group ( $n = 183$ ) consisted of Dutch women in (peri)menopause who reported (1) being formally diagnosed as autistic (ASD,  $n = 134$ ;  $M_{\text{age of diagnose}} = 48.46$ ,  $SD = 7.58$ ) or (2) neurotypical (control group,  $n = 49$ ). Both groups differed significantly on AQ scores ( $M = 34.45$ ,  $SD = 5.57$  and  $M = 12.35$ ,  $SD = 5.54$ , respectively;  $p < .001$ ), not on age categories. Most participants were between 50-54 years (ASD: 43%, control: 51%).

All filled in three online questionnaires: (1) the Menopause-Specific Quality of Life Questionnaire (MENQOL, 29 items; Hilditch et al., 1996), measuring vasomotor, physical, psychosocial, and sexual menopausal symptoms; (2) the Senses (27 items; Turkensteen & Blijd-Hoogewys, 2020), measuring hyper- and hyposensitivity; and the Autism-spectrum Quotient (AQ, 50 items; Baron-Cohen et al., 2001).

## **Results:**

The ASD group had significant higher scores on MENQOL Physical, MENQOL Psychosocial, Senses Total, Senses Hypersensitivity, and Senses Hyposensitivity (Table 1). There were significant positive correlations for Senses Total, Senses Hypersensitivity and Senses Hyposensitivity with both MENQOL Physical and MENQOL Psychosocial. The AQ had significant positive correlations with MENQOL Physical and MENQOL Psychosocial (Table 2).

A hierarchical multiple regression showed that Senses Total improved the prediction of MENQOL Physical and likewise of MENQOL Psychosocial above AQ Total ( $R^2\text{-Total} = .189$  &  $R^2\text{-change} = .112$  and  $R^2\text{-Total} = .282$  &  $R^2\text{-change} = .078$ , respectively, all  $p < .001$ ).

On the question if menopause was associated with more/less/equal number of sensory issues as before, the distribution between both groups differed significantly ( $U = 4069$ ,  $z = 2.83$ ,  $p < .001$ ). Most controls reported no difference (61%), while most autistic women reported more sensory issues in menopause (also 61%).

## **Conclusions:**

In agreement with Groenman et al. (submitted), autistic women experienced more physical and psychosocial, but not more vasomotor menopausal symptoms. However, it is unclear whether these MENQOL statements are truly reflective of menopausal symptoms, or also common in fertile autistic women.

Sensory issues were linked stronger to menopausal symptoms, than were autistic traits to menopausal symptoms. Notable is the positive association of menopausal symptoms with hyposensitivity. This was not an artefact of a possible underlying ASD diagnosis. The same associations were apparent when both groups were analyzed separately.

Autistic people experience more sensory issues, also as was measured with the Senses before menopausal age (Turkensteen et al., 2020). Menopause may worsen these sensory issues. Groenman et al. (submitted) hypothesized that autistic women may be more sensitive to bodily changes during (peri)menopause due to an overall increased sensitivity, making them vulnerable to experience menopausal complaints sooner and longer than non-autistic women.

**415.026 (Poster)** Social Self-Esteem and Social Media Use in College Students with Autism Spectrum Disorder: A Case-Control Study  
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**Background:** Despite academic success, college students with Autism Spectrum Disorder (ASD) experience more social rejection, stigma, isolation, and difficulties making or maintaining friendships than typically developing (TD) peers or peers with other disabilities, although some studies have found little difference between students with ASD and students with other disabilities. The core social communication deficits in students with ASD are associated with lower self-esteem and subsequently poorer mental health in a college setting. Individuals with ASD may spend more time using screen-based media than any other activity; however, some research has found that high levels of social media use in ASD are associated with loneliness and depression, while others have found that social media use can mitigate feelings of isolation. With the covid-19 pandemic lockdown came an abrupt switch to remote online learning associated with quarantines. The impact of this isolation on students with ASD, and the potential long-term effects on social success in college has not been investigated.

**Objectives:** This was an exploratory study performed during the initial pandemic response (summer 2020), aiming to examine the relationship between social self-esteem and social media use in college students with ASD and matched TD peers and peers with Attention Deficit Hyperactivity Disorder (ADHD).

**Methods:** 176 undergraduate students from a private liberal arts college participated in an online survey including demographic information, diagnostic self-identification, the Social Self-Esteem Scale, the Social Media Engagement Questionnaire, average screen time, and self-reported experiences of mental health issues. Eight individuals with ASD were matched on age, gender, and GPA to individuals with ADHD ( $n=9$ ) and TD peers ( $n=10$ ). A one-way ANOVA was used to assess differences in social self-esteem and social media use across diagnostic groups. Bivariate correlations between social self-esteem and social media use were compared across diagnostic groups. A multiple linear regression was used to predict social self-esteem from key variables.

**Results:** There were no significant differences in social self-esteem [ $F(2, 24) = 2.575, p = .097$ ] or social media use [ $F(2, 24) = .398, p = .676$ ] across the diagnostic groups. Social self-esteem was positively correlated with social media use in students with ADHD ( $r = .715, p = .046$ ), but unrelated in students with ASD ( $r = .061, p = .876$ ) or TD ( $r = .165, p = .648$ ). A multiple regression explained 78.5% of the variance in social self-esteem, and social media use was a significant predictor ( $\beta = .732, p = .009$ ). For every single point increase in social media use, social self-esteem increased by .732 points, holding screen time, ASD presence, and presence of depression and anxiety constant.

**Conclusions:** Students with ASD were similar to students with and without disabilities in terms of social media use, screen time, and social self-esteem. Previous studies have argued that social media holds promise as a tool to facilitate social success of students with ASD in college settings, since it requires less decoding of complex social information. However, during periods of isolation, the social self-esteem of individuals with ASD appears unrelated to social media use.

**415.027 (Poster)** Teaching Employment-Related Skills to Autistic Workers; A Review and Call for Research  
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**Background:** Adult outcomes for those with autism are below expectations and rates of employment are lower than those with other disabilities (Shattuck et al., 2012). Individuals with autism spectrum disorder (ASD) frequently experience difficulties with employment despite an ability to perform essential job functions (Hagner & Cooney, 2005). However, research on employment support seems to concentrate on a few areas of the employment process (such as interview preparation) while neglecting other areas. We aimed to review the literature in order to identify these areas of job support, as well as what methods were used to teach employment-related behaviors in these areas.

**Objectives:** To discover which areas of the employment process have been targeted for employment support via teaching-based interventions by researchers.

**Methods:** We employed a traditional literature search in order to identify areas of the employment process targeted for employment supports as described in research literature. Using nine databases and search engines, we extracted manuscripts discussing employment among individuals with ASD. We also identified existing literature reviews on related topics and extracted reference information from each literature review with full text available (18). This method identified 1063 potentially usable manuscripts. We then used PRISMA guidelines for our literature review as described in Figure 1, screening out duplicates (412 removed) and filtering articles based on abstract and full-text screening (366 and 240 studies excluded, respectively). This resulted in 60 usable manuscripts.

**Results:** Of the 60 studies reviewed, average sample size was 18.32 participants ( $SD = 29.35$ ) with an average age of 22.5 (full range 10-47). Studies largely consisted of three basic groupings. The first group of studies (12) targeted job interviews as the primary focus of the study. The second grouping (32) consisted of teaching individuals to do a specific job-related task or series of tasks, which usually used behaviorist methods such as mastery criteria or behavioral skills training. The third and final grouping, "other" (16) consisted of a wide variety of studies, from program reviews to multi-year follow-up studies to studies using traditional instruction methods or group discussions as primary methods of study. Studies tended to

focus on either the interview process or preparations beforehand (12), teaching behaviors relevant to a specific present or future job (36), cognitive, social, or emotional processes related to employment (4), or job outcomes after program participation (6). Certain areas of the employment process, such as identifying and requesting accommodations, transportation, the process of identifying potential job openings, managing a job search, and completing job applications were the target of one or fewer manuscripts.

**Conclusions:** Significant research exists on the topic of teaching employment-related information and behaviors to prospective and current workers with ASD. However, much of this research seems to cluster around certain aspects of job acquisition or retention while neglecting other areas. It is our opinion that study on these areas of the employment process may be beneficial and could lead to programming which positively impacts employment outcomes for autistic adults.

#### **415.028 (Poster)** Longitudinal Effects of Age-Related Cognitive Decline in Autistic Adults

**C. Torenvliet, A. P. Groenman, T. A. Radhoe, J. Agelink van Rentergem, W. J. van der Putten and H. M. Geurts, University of Amsterdam, Amsterdam, Netherlands**

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**Background:** Cognitive aging in autistic adults has mainly been tested in cross-sectional studies. We (Torenvliet et al., 2021; <https://psyarxiv.com/47tyc>), for example, observed that, difficulties in theory of mind and verbal fluency were present in both younger and older autistic individuals. Moreover, age-related cognitive effects did not differ between autistic- and non-autistic adults (i.e., parallel aging). However, these cross-sectional results could be biased by cohort effects, which warrants longitudinal studies. **Objectives:** In this study, we aim to (1) replicate these previously observed parallel age-related effects in a longitudinal sample, and (2) identify those individuals who might be most vulnerable for cognitive decline.

**Methods:** In a sample of 85 adults (24-79 years,  $N_{ASC}=52$ ,  $N_{non-ASC}=33$ ) we administered several cognitive tasks at two time-points (average interval: 5.8 yrs.) Preliminary results on verbal- and visual memory are presented here. During INSAR 2022 we present data from more cognitive domains, and include the participants currently tested ( $N_{tot} \sim 200$ ). First, reliable change indices were used to estimate the extend of age-related cognitive decline. Second, we used multilevel regression analysis to identify the effects of baseline age, interval, and age\*interval interactions. Changes over time were freely estimated in each individual (random intercepts/slopes). Next, we added group to assess differential aging effects of autism. Finally, we assessed effects of baseline IQ and sex.

**Results:** Preliminary results showed that many participants decreased (42-57%), but also increased (27-42%), and remained stable (11-24%) over time on direct- and delayed verbal- and visual memory. On average, negative interval effects were observed on all tasks. Negative age effects were also present on all tasks, except direct visual memory. Results were neither indicative of faster decline with increasing age nor of differential effects of being autistic. Finally, we observed no differences in cognitive aging based on IQ or biological sex.

**Conclusions:** In this longitudinal study, reliable changes over time were present, with large variability in the extend of age-related changes. However, this variability was not related to autism, age, IQ, or biological sex. Most importantly, we seem to confirm our previous cross-sectional results of parallel cognitive aging in autistic and non-autistic adults.

#### **415.029 (Poster)** The Role of Gender, Interests, and Diagnosis Age in Camouflaging ASD

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**Background:** Autism Spectrum Disorder (ASD) historically has a 4:1 male-to-female prevalence ratio. Emerging research on differences in gender phenotypes suggests females are underrepresented, calling this ratio into question (Loomes et al., 2017). Further, research has highlighted that females may experience autism through different expressions of current ASD diagnostic criteria, or they may have additional characteristics that are currently not considered in diagnostic criteria or typically experienced by males (Hull, Petrides, et al., 2020). Specifically, females have been reported to have less focused interests, and these interests tend to be in different subjects than males (Antezana et al., 2019; 2011; Hiller et al., 2014). Females also demonstrate and report increased social camouflage behaviors. Camouflaging is a technique used by individuals with ASD to suppress their autistic traits in social situations through masking, assimilating, and compensating (Hull et al., 2017), which has been found to report to late diagnosis of ASD (Hull et al., 2020). A late diagnosis for females on the spectrum increases the risk for psychiatric comorbidities (Cassidy et al., 2014; Geurts & Jansen, 2012; Lai & Baron-Cohen, 2015).

**Objectives:** The purpose of this study is to explore the significance that gender, focused interest types, and age of diagnosis have on social camouflaging behaviors. Understanding the interactions of these factors can help the diagnostic process of autistic adults, while also understanding gender differences and vulnerabilities.

**Methods:** 50 participants (n=30 female, n=9 male, and n=11 non-binary people) completed an online survey which included the Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull et al. 2019) and an adapted Interests Scale from Bodfish's Interests Scale (2003). By spring 2022, we anticipate having 66 participants (n=25 males). Reported primary interests were coded and grouped for commonality by two independent researchers.

**Results:** As shown in Figure 1, CAT-Q scores differed across the three genders [ $F(2, 46)= 9.486$ ,  $p = .000$ ], where non-binary participants reported greater camouflaging behavior than females and females reported greater camouflaging behaviors than males. There was a significant effect of age of diagnosis on CAT-Q scores [ $F(1, 42)= 4.446$ ,  $p = .041$ ]; those not formally diagnosed, or diagnosed after 13 reported more camouflaging behaviors than those diagnosed before the age of 13. Figure 2 illustrates the relationship between gender, age of diagnosis, and CAT-Q scores. There was no

effect of gender on the sociability of interests [ $F(2, 47) = 1.023, p = .367$ ]. Further, CAT-Q scores did not impact the average of interests [ $F(1, 48) = 1.252, p = .269$ ]. Most frequent common interests for males were games and sports; most frequent common interests for females were art, reading and writing, science, and psychology. The nonbinary group's interests aligned most with the female interests with the most common being psychology, reading and writing.

**Conclusions:** These preliminary results support previous findings of a gender difference in camouflaging behaviors, while critically including a non-binary group. These implications can help clinicians to be more sensitive to gender differences and promote early conversations about camouflaging behaviors to encourage and support self-acceptance, especially around those who were diagnosed later in life.

**415.030 (Poster) The Role of Internalizing & Externalizing Behaviors on Adaptive Behavior in Autistic Adults**

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**Background:** Autistic adults, across a wide range of cognitive abilities, often need supports related to adaptive functioning, internalizing behaviors, and externalizing behaviors; however, little is known about the way these areas of need impact one another. Adaptive skills are a key predictor of adult outcomes like social engagement, employment, and independent living. Effective educational and psychological evidence-based practices exist for both adaptive functioning and mental health challenges (Hume et al., 2021; Keefer et al., 2018). However, the manifestations of internalizing and externalizing behaviors may create barriers to support implementation. For example, anxiety may cause a person to abstain from group learning situations or aggression may pose safety concerns. Developing an understanding of the association between internalizing and externalizing behaviors and adaptive functioning could inform the sequence and content of support planning.

**Objectives:** The objective of this study is to examine whether internalizing and externalizing behavior predicts adaptive functioning in autistic adults.

**Methods:** We conducted a secondary data analysis of the clinical records of 64 autistic adults (49 male, 15 female) seeking an autism diagnostic evaluation at university-affiliated clinics across a southern state. The battery of assessments included for analysis were the Childhood Autism Rating Scale, 2nd Edition High Functioning rating scale (CARS2-HF) or the Autism Diagnostic Observation Schedule (ADOS), the Vineland Adaptive Behavior Scales Third Edition (VABS-3) or Adaptive Behavior Assessment System Third Edition (ABAS-3), the Adult Self Report (ASR) and the Adult Behavior Check List (ABCL), and a normed IQ assessment. Multiple imputations were employed for missing data on all measures. Hierarchical regression analysis was performed on the imputed dataset to investigate the unique contributions of IQ, autism severity, and self-reported (ASR) and informant-reported (ABCL) externalizing and internalizing behaviors in explaining the variance in adaptive behavior.

**Results:** The sample has an average IQ of 100.74, with ten participants having an IQ score <80. The majority of the participants scored low on the adaptive functioning assessment and reported internalizing and/or externalizing behaviors in the clinically significant range (see Table 1). The results of the hierarchical regression analysis indicate that externalizing and internalizing behaviors predict adaptive functioning for autistic adults, but the measure informant (self- vs. informant-report) impacts the strength of the prediction (see Table 2). Internalizing behavior, as reported by a familiar informant, accounts for the greatest amount of variation and shows an inverse relationship to adaptive behavior. However, self-report is also a significant predictor yet indicates the opposite relationship. Externalizing behavior as reported by a familiar informant is the final significant predictor and shows a positive association.

**Conclusions:** Adaptive behavior is predicted by internalizing and externalizing behaviors, but the direction of the association differs depending upon the identity of the assessment informant. During clinical assessments and research, assessors should include both self and other informant reporting methods. Additionally, quality mental health services may result in an added benefit of improving adaptive functioning in autistic adults.

**415.031 (Poster) Vocational Trajectories and Well-Being in Young Adults with Autism Spectrum Disorder**

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**Background:** Vocational activities are a key component of adulthood and a predictor of well-being (Kaya et al., 2016; Schulenberg et al., 2004). However, the relationship between vocational activities and well-being in autism spectrum disorder (ASD) is unknown. Adults with ASD experience limited social connectedness (Orsmond et al., 2013), difficulty living independently (Anderson et al., 2018; McCauley et al., 2020), and other poor outcomes at high rates (Lord et al., 2020; Shattuck et al., 2012). Understanding vocational trajectories could provide insight into supporting well-being in adults with ASD.

**Objectives:** Characterize vocational trajectories in a sample of adults with ASD ages 18-28, examine the slope of said trajectories, and explore relationships between inclusion in each trajectory group and psychosocial outcomes including subjective well-being, living status, and social connectedness.

**Methods:** 151 adults with ASD were drawn from an ongoing longitudinal study. Data on vocational activities were compiled from parent-report demographic forms and scored using the Vocational Index (VDI). A happiness composite score (McCauley et al., 2020) was used to measure subjective well-being. Vocational trajectories were identified via group-based trajectory modeling. Multilevel modeling was used to investigate the slope of trajectories. One-way ANOVAs and chi-square analyses were used to examine differences in outcomes between trajectory groups.



**Results:** A four-group model best fit the data; the slopes of all four groups were linear (Figure 1). The first trajectory group, No Activities, was characterized by little participation in vocational activities. The second group, Volunteer Activities, was characterized by participation in volunteer activities or sheltered employment for 10 hours/week or less. The third group, Supported Activities, was characterized by participation in supported community employment and/or sheltered employment for more than 10 hours/week. The fourth group, Independent Activities, was characterized by participation in postsecondary educational programs and/or independent employment for more than 10 hours/week. There was no significant effect of age on VDI scores ( $p = .787$ ). Participants in the Independent Activities group had significantly higher parent-report well-being than participants in the No Activities group and significantly higher self-report well-being than participants in the Volunteer Activities group (Table 1). The Independent Activities group was also significantly more likely to have at least one social contact ( $X^2(3, 118) = 10.54, p = .014$ ). There was no difference between groups in the likelihood of living independently ( $X^2(3, 120) = 1.71, p = .634$ ).

**Conclusions:** This study investigated the relationship between vocational trajectories and well-being in adults with ASD. We identified four distinct trajectories. The slopes of all four trajectories were stable, suggesting individuals not engaged in vocational activities early in adulthood are unlikely to transition to independent employment or an appropriate educational placement later in adulthood. Participants who engaged in independent activities had higher parent- and self-reported well-being and were more likely to have social contacts than participants who did not engage in vocational activities or engaged only in volunteer activities. Future studies should assess change in vocational activities in later adulthood and identify intervention targets to increase the likelihood adults with ASD engage in vocational activities.

**415.032 (Poster)** Work-Related Psychological Needs and Job Satisfaction of Autistic Adults: The Mediating Role of Self-Determined Work Motivation

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**Background:** Self-Determination Theory (SDT) of motivation has been widely substantiated in the general population, providing work-related theoretical insights and practical implications. It has been suggested as a useful framework for understanding and promoting employment integration of autistic adults, addressing both personal and environmental factors (Goldfarb et al., 2019, 2021). SDT theorizes that: (a) work motivation that is self-determined in a sense that it is driven by choice and autonomy, leads to positive employment outcomes such as job satisfaction (b) all employees share the aspiration to satisfy three work-related psychological needs: autonomy, social-relatedness, and competence. Satisfaction of these needs promotes Self-Determined Motivation (SDM) and its' positive outcomes (Gagné & Deci, 2005).

**Objectives:** To explore the relevance of SDT in employed autistic adults, hypothesizing that higher satisfaction of the work-related psychological needs (autonomy, social-relatedness and competence) will lead to higher SDM, which will in turn lead to increased job satisfaction.

**Methods:** Data was collected from a sample of 36 autistic employees (5 females) aged 19-53, who filled a cross-sectional survey. Self-reports included measures of: satisfaction of psychological needs at work (Psychological Need Satisfaction and Frustration – Work domain); SDM (the Multidimensional Work Motivation Scale) and job satisfaction (Minnesota Satisfaction Questionnaire).

**Results:** To test the hypothesis, three mediation analyses were computed, using the Process Macro for SPSS (Model 4), predicting job satisfaction by each of the three work-related psychological needs, with SDM as the mediator. Results are illustrated in Figure 1.

The predictive model for *social-relatedness* ( $R^2=0.33, F(1, 34)=16.52, p<0.001$ ) indicated that the association between social relatedness and job satisfaction was fully mediated by SDM ( $\beta=0.40, C.I. 0.15-0.61$ ). Similarly, the predictive model for *autonomy* ( $R^2=0.32, F(1, 34)=16.32$ ) indicated that SDM fully mediated the path between satisfaction of autonomy and job satisfaction ( $\beta=0.34, C.I. 0.14-0.51$ ). Finally, the predictive model for *competence* ( $R^2=0.09, F(1, 34)=3.31$ ) showed a marginally significant effect for SDM ( $\beta=0.30, p<0.08$ ), indicating that higher satisfaction of competence is associated with higher SDM, with marginal significance. Estimates of the indirect effect for SDM ( $\beta=0.22, C.I. 0.0042-0.4056$ ) were significant, indicating that SDM fully mediated the path between competence and job satisfaction.

**Conclusions:** Results confirm the relevance of work-related SDT constructs for autistic adults. Autistic employees who feel competent, socially connected to their employer and colleagues, and are given a feeling of choice, will consequently present work motivation which is self-determined and volitional. The emphasis on the work environment, which can be shaped and adjusted to respond to employees' psychological needs, contributes the notion that motivation is not just a given state, but can rather be facilitated towards a feeling of autonomy and volition. Findings can inform the implementation of SDT driven practice in vocational rehabilitation services and work-related supports of autistic adults.

**415.033 (Poster)** “F\*\*\*\*\*!”: The Impact of COVID-19 on the Well-Being of Autistic Adults

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**Background:** Autistic adults may be at increased risk for anxiety related to increased day-to-day experiences of uncertainty and changes in routines caused by the global COVID-19 pandemic. Yet, some autistic adults may feel more at ease in pandemic times due to the decreased expectation for socialization. More research is needed on how autistic communities in the U.S. will need support in navigating a post-COVID world.

**Objectives:** To explore positive and negative themes on how the COVID-19 pandemic has impacted autistic adults' well-being and moods. Results from this study will shed light on specific challenges, targets for intervention, and potential health outcomes that many autistic adults may face post-pandemic.

**Methods:** A total of 143 adult participants with a self-reported autism diagnosis (118 confirmed) electronically consented to complete a 30-minute survey regarding their mental health, employment and education. Participants were recruited from our existing research database and through word-of-mouth. The survey was open from February to May 2021. As part of the survey, participants were asked an open-ended question "How has the COVID-19 pandemic affected your overall health, well-being, and daily life?"

**Results:** Descriptive analysis indicated that more than 60% of survey respondents reported some impact, although a significant minority of individuals ( $N = 56$ ; 39%) described no impact from COVID-19. However, even within those reporting no to minimal change, some individuals reported either positive or negative changes. About 83% of participants' responses contained negative themes and about 31% contained positive themes. Commonly reported positive themes were the benefits of limited social interactions. Some participants also reported making adjustments to adapt to the changes from COVID-19, for example "taking up drawing as a hobby to fill free time." Common negative themes were feeling isolated by limited social interactions, financial distress from reduced hours or job loss, and health decline. Many participants reported that transition to remote work and school limited social opportunities and increased difficulty in physically interacting with family and friends. Responses also include "difficulties making ends meet," "rapidly running out of money." Some of the health compromises were weight gain and sleep changes. Perhaps our most poignant response began with a strong expletive, beginning with an F then strung out across the page with the main vowel typed 57 times.

**Conclusions:** Autistic adults have been greatly impacted by the COVID-19 pandemic including struggles with social interactions, financial concerns, work changes, and physical health. These stressors are likely associated with major change and upheaval, which may disproportionately impact autistic people due to their tendency to prefer sameness and difficulty managing uncertainty. Changes in routines are generally challenging for autistic people, and the many changes caused by the pandemic have created a great deal of uncertainty surrounding when life will go back to normal. Autistic adults will benefit from extra support and understanding from family and friends, employers, and health/mental health professionals is needed. Recognizing how hard this unusual but intense situation has been for autistic adults may improve self-awareness and connection to others with similar struggles.

**415.034 (Poster)** "Social Vulnerability" Is Predicted By Cognitive More Than Emotional Factors in Women with Social Difficulties  
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**Background:** Autistic adults without language or cognitive delays may succeed academically in school but struggle to make the transition to independent living and pursuit of higher education and employment as much as they would like. Emerging research in this area has targeted outcomes in everyday adaptive behavior and quality of life. The concept of "social vulnerability" was developed to describe the risk for victimization including financial, emotional and physical exploitation that is common in individuals diagnosed with intellectual disabilities but has not been frequently used in samples with average to above-average intellectual function.

**Objectives:** To explore contributing factors to social vulnerability in a sample of adult women with social difficulties including autistic and/or socially anxious women. We examined three core factors including cognitive, social communication, and emotional domains.

**Methods:** The study consisted of 46 adult women (age range 18-42, mean=25) who responded to an advertisement asking "In social situations, do you often find yourself confused, anxious, or exhausted?" and who further scored at least moderately high on the BAPQ measure of broader autism traits. IQ, executive function, anxiety and depression, and social responsiveness scores were collected from the women in the study. Data for the Social Vulnerability Questionnaire were collected from parents of the women participants (38 mothers, 1 grandmother, 7 fathers). We have been analyzing these samples dimensionally rather than by diagnosis to better understand the shared factors underlying social difficulties that contribute to real-life challenges.

**Results:** Mean score from the WASI-2, 2-subtest IQ estimate was 114.21 (range 83-137, SD=11.507), indicating a sample with overall strong cognitive ability. Descriptive analyses indicated compared to previously-reported samples with intellectual disability, several domain scores were a bit lower but this group scored especially high on the Parent Independence domain ( $M=10.80$ , previous ID samples  $M=5.87$ ), meaning more dependence on parents despite their high average IQ. A regression model including measures of each domain (IQ, executive function, social responsiveness and mental health) was statistically significant  $R^2=.586$ ,  $F(5,37)=12.873$ ,  $p < .001$ . The strongest predictors were in the cognitive domain including the BRIEF Behavior Regulation Index ( $\beta=.623$ ,  $p<.001$ ) and the WASI-2-2 estimate ( $\beta=.214$ ,  $p=.044$ ). SRS-2 and ADOS scores (social responsiveness) and mental health (DASS-21 anxiety, depression and stress) scores did not add predictive value to the model.

**Conclusions:** High verbal skills and cognitive ability do not always protect against victimization and social vulnerability and autistic adults can be highly susceptible to exploitation by others and remain dependent on parent guidance more than they wish. In this sample of women with IQ in the average to above-average range who find social situations challenging, executive function especially around behavioral regulation (including flexibility and inhibition), along with IQ, best predict this everyday vulnerability. Helping individuals, family systems, and other social support to be aware of the risk for exploitation and develop active avoidance strategies is a vital component of success in adulthood.

**415.035 (Poster)** Atypical Cortical and Subcortical Brain Activation Associated with Precision Visuomotor Control in Autistic Adults

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**Background:** Although conceptualized as a childhood disability, autism spectrum disorder (ASD) has increasingly been recognized as a lifelong neurological condition that could significantly impact adult functioning and quality of life. A recent clinical study has identified a more than 25-fold increased risk of Parkinsonism from two independent cohorts of autistic adults, suggesting that neurological conditions may evolve and even become more prominent as affected individuals age. However, studies focused on neuromotor control in autistic adults are scant, and we do not yet know to what degrees autistic adults might be at risk of developing neurological symptoms and neurophysiological systems show abnormal levels of degeneration.

**Objectives:** The objective of this study is to elucidate cortical and subcortical brain activation associated with precision visuomotor control in autistic adults.

**Methods:** Sixteen autistic adults ages 30-73 years and 19 age-, sex-, and IQ-matched non-autistic controls completed a visually guided precision grip task during fMRI. Participants pressed an MRI-compatible load cell with their thumb and forefinger while viewing two horizontal bars from a visual display inside the scanner. Participants pressed to move the lower force bar upwards to the height of the static target bar and maintained a constant grip force for 2 sec followed by a one sec rest. This was completed 10 times per block. A total of 4 blocks were administered and alternated with 10 sec rest. The target bar was set at 15% of individuals' maximum voluntary contraction (MVC). This design has shown strong sensitivity in probing basal ganglia and cerebellar activations in neurotypical controls, autistic children, and Parkinson's disease patients. Grip force variability and peak force were examined. Whole brain, voxelwise analyses were conducted on the fMRI imaging data.

**Results:** Our results showed no group differences in MVC. Autistic adults showed both mean and peak force reductions relative to non-autistic controls. Increased BOLD signal was observed in well-established regions of the visuomotor network including motor and premotor cortex, inferior parietal lobule, extrastriate visual cortex, thalamus, putamen, and cerebellum. Autistic adults showed greater BOLD activation than controls in the left precentral (M1) and postcentral (S1) gyrus, bilateral inferior frontal gyrus (IFG), and right cerebellum lobule VIII (CBL.VIII). Increased age was associated with increased task-related activation in bilateral IFG and right CBL.VIII in ASD. On the contrary, increased age was associated with activation reductions of the left M1, RIFG, and right CBL.VIII in non-autistic controls. In autistic adults, decreased activation of RIFG was associated with more severe clinical ratings of repetitive behaviors.

**Conclusions:** Overall, these results provide new evidence that neuromotor alterations in autistic adults involve aberrant cortical and subcortical organization that may contribute to critical aging-related clinical issues in ASD.

**VIRTUAL POSTER SESSION — ADULT OUTCOME: MEDICAL, COGNITIVE, BEHAVIORAL**

**515 - Adult Outcome: Medical, Cognitive, Behavioral --- (V)**

**515.001 (Virtual Poster)** Autism-Friendly Public Bus Transport: Hearing the Voices of Autistic Persons to Better Understand Their Needs

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**Background:**

Being able to participate fully in the community and form social networks is crucial for leading a qualitative life. To this end, transportation plays an essential role. Autistic persons often rely on public transport to fulfill their mobility needs. Nevertheless, previous research shows that it is not always easy for them to use it. What issues autistic people face while traveling with public bus transport and how to make public bus transport more autism-friendly has not been researched in-depth to date.

**Objectives:**

The current case study in Flanders aimed to (1) allow autistic persons to express the issues they face while using public bus transport and (2) create awareness for more autism-friendly public transportation.

**Methods:**

A qualitative hermeneutic phenomenological study was carried out. Semi-structured interviews were conducted and processed based on the interpretative phenomenological analysis method.

**Results:**

The interviews were conducted with 17 autistic individuals (mean age: 23.4 years, 53% male) and 3 non-autistic employees of a public transportation company about their experiences when taking (autistic individuals) or driving (employees) the bus. After analysis, three main themes emerged: (1) creating predictability (subthemes: providing an overview, presence of consistency, and providing factual and accurate information), (2) limiting

stimuli, and (3) communication tailored to autistic persons. In addition, various coping strategies were described, such as using noise-canceling headphones or using a smartphone application to follow the route.

#### Conclusions:

The current study was one of the first to give an indication of how autistic persons experience public bus transportation. The results are both interesting to the autism community and public bus transportation companies. The coping strategies described are relevant for autistic persons in case they feel reluctant to use public bus transport. Furthermore, the current study's findings could also help public bus transportation companies further develop a universal and inclusive design to provide access to public transport at the same level of service for everyone.

#### 515.002 (Virtual Poster) A Snapshot of Self-Reported Experiences Under the COVID-19 Pandemic

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**Background:** Previous research studies have demonstrated negative impacts of COVID-19 on psychological and mental health of autistic adults greater than that of the general population (Oomen et al., 2021). However, the impact of COVID-19 pandemic on overall well-being of autistic adults remains largely unknown. Given that autistic individuals are a particularly vulnerable population, understanding various challenges this population experiences regarding social interactions, daily routines, service access, and other life domains is crucial in identifying priority areas that maximize meaningful community participation.

**Objectives:** Using self-reported survey data, we provided a point-in-time profile of personal experiences during the COVID-19 pandemic in five areas: social outcomes, mental well-being, activities, services, and personal experiences with COVID-19.

**Methods:** The data were collected from March to September 2021 from a pool of autistic adults who participated in a previous study. Individuals in the previous study who consented to future contact were recruited through mail, email, telephone, and text messages. A total of 189 autistic adults responded to this new survey. Respondents were an average age of 27.8 years (SD=26.0) and mostly white (n=161, 85%). About 25% (n=47) were women and 7% (n=13) reported a non-binary gender.

#### Results:

**Social Outcomes.** About 43% (n=81) of the participants were employed. Twenty-four (13%) participants reported that their employment status changed due to COVID 19. Regarding social interaction, 40% of the participants (N=82) reported lost contact with some or most of family or friends, while 40% of participants (N=82) reported increased interactions with others virtually or online. Most participants (n=134, 71%) reported decreased participation in the community under the pandemic compared to before the pandemic.

**Mental Well-Being.** Most of the participants (n=160, 85%) experienced some level of stress related to the pandemic. About 41% (n=78) had felt lonely more frequently than before COVID-19.

**Activities.** About 86% (n=162) of participants reported a change in their daily routines. More than one-third of participants (n=74, 39%) reported major changes where most or all activities they normally participated in were canceled, delayed, or substantially changed.

**Health Care Access.** Nearly 20% (n=35) reported not being able to access needed mental health care or experienced delays in making appointments or getting prescriptions. However, 21 of them accessed telehealth. Similarly, 34 (18%) reported no access to needed mental or behavioral health services or experienced delays in making appointments, and 22 participants accessed telehealth.

**Experiences with COVID-19.** More than half of respondents had or knew someone that was diagnosed with COVID-19 (n=112, 59%). About two-thirds of participants (n=127, 68%) felt unsafe participating in the community to some extent because of COVID-19.

**Conclusions:** Results highlight the burden of COVID-19 on autistic adults across different life domains and provide insights on crucial supports. It is likely that autistic adults will continue to experience challenges in coping with ongoing uncertainty, transitions, and life changes resulting from the pandemic. Guidance may focus on maintaining social interactions, either in-person or online, and adjusting to rapidly changing information and the impact on daily routines.

#### 515.003 (Virtual Poster) Case Study of an Autistic Calendar Calculator

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**Background:** The savant syndrome is characterized by exceptional abilities contrasted with lower cognitive and/or adaptive functioning (Miller, 1999). Its prevalence is around 0.06%. About 75% of savant individuals are on the autism spectrum. Most studies on the savant syndrome have focused on single cases, given its low prevalence and the heterogeneity of the abilities presented. In savants with autism, calendar calculation is the most common exceptional skill. It consists to complete calendar information. There is no consensus on the process(es) used by calendar calculators, especially since the case studies generally involve one participant, whose unique characteristics are described in uneven detail across studies.

**Objectives:** To explore the exceptional ability of an autistic adult with different questions that may reveal possible mechanisms used.

**Methods:** A 21-year-old autistic male capable of calendar calculation, FB, with unique access conditions (interest in and enjoyment of the tasks, supportive family), was evaluated. FB was diagnosed with autism at age four by a multi-disciplinary team. His exceptional ability was explored during two sessions with a total of 468 questions. All questions were presented nonverbally. The session was recorded and for each question, the reaction time and the success rate were compiled.

**Results:** A series of pre-test questions determined which question and answer mode he was most comfortable with. He preferred handwritten questions with nonverbal response choices. FB responded to simple questions (such as: what day of the week is March 21, 2016;  $M = 3.90$  seconds;  $SD = 1.80$ ) significantly faster ( $p < .001$ ) than to reverse questions (such as: what years have March 1 as a Tuesday;  $M = 21.55$  seconds;  $SD = 25.94$ ). However, both question types had similar success rates ( $p = .457$ ). FB succeed 93.50 % ( $n = 72$ ) of the simple questions and 90.00 % ( $n = 54$ ) of the reverse questions. FB limits (the dates for which the response rate is above the chance level) were set between 1945 to 1955 for the past and 2040 to 2055 for the future. The potential role of synesthesia in its performance was explored in the context of the calendar. Three conditions were compared to see if the colors of the questions and answer choices could influence reaction times and success rates. However, at this stage, the results did not allow us to propose a conclusion on its implication. The year 2001 was explored in its entirety. However, with the preliminary data, no error pattern was observed in the success rates and reaction times for each day of the week and for each month.

**Conclusions:** Although the results are preliminary, they suggest that calendar information is not accessed by following explicit algorithms. However, the perceptual or memetic nature of this information remains to be determined. Further sessions will be conducted with FB to better understand its capabilities. Other calendar calculators will also be tested to compare their results.

**515.004 (Virtual Poster) Continuity and Change in Loneliness and Stress during the COVID-19 Pandemic: A Longitudinal Study of Autistic and Non-Autistic Adults**

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**Background:**

Several studies have reported a deterioration in the mental health of autistic adults during the COVID-19 pandemic (Adams et al., 2021; Oomen et al., 2021; Pellicano et al., 2021). This deterioration comes on top of a higher co-occurrence of mood disorders, more psychological distress and increased risk of loneliness in autistic people compared to the general population in pre-pandemic times.

**Objectives:**

We aimed to examine continuity and change in, and predictors of, self-reported loneliness and stress during the COVID-19 pandemic in autistic and non-autistic adults living in the Netherlands utilizing data from the Netherlands Autism Register (NAR) cohort study. We hypothesized that:

- 1a) stress and loneliness would increase in autistic adults from pre-lockdown (T0) to first lockdown (T1) but 1b) would remain stable from the first (T1) to the second lockdown (T2) in both groups;
- 2) autistic adults would report more loneliness and stress than non-autistic adults; and
- 3) autistic and non-autistic adults would share similar risk factors for more loneliness and stress (i.e., being female, younger, a prior mental health condition, unemployment, low social support, few social contacts, and more COVID-19 related worries).

**Methods:**

We measured loneliness and stress via online surveys in autistic and non-autistic adults at different time-points (see Figure 1): pre-lockdown (T0: March 2020; autism group only), during the first lockdown (T1: April 2020) and during the second lockdown (T2: October 2020). We used repeated-measures analyses of variance (ANOVAs) and multiple hierarchical linear regression analyses.

**Results:**

1a) Contrary to expectations, loneliness and stress levels did not increase from pre-lockdown to lockdown in autistic adults (no Time effect on loneliness:  $F(2, 596) = 0.77, p = .46$ ; or stress:  $F(2, 606) = 0.87, p = .42$ ). 1b) Bayesian ANOVAs indicated moderate evidence in favor of the hypothesis that autistic and non-autistic adults would show stable loneliness and stress levels from the first to the second lockdown.

2) Autistic adults reported more loneliness (autism: T1  $M = 16.65$ , T2  $M = 16.87$ ; non-autistic: T1  $M = 13.67$ , T2  $M = 13.40$ ) and stress (autism: T1  $M = 19.13$ , T2  $M = 19.57$ ; non-autistic: T1  $M = 13.87$ , T2  $M = 13.44$ ) compared to non-autistic adults, even after controlling for other factors in the regression model.

3) Predictors of more loneliness and stress were similar in both groups: lower perceived social support, more COVID-19 related worries, younger age (stress only), and a prior mental health condition (stress only). We found no significant effects of gender, unemployment or amount of social contact.

#### Conclusions:

Overall, loneliness and stress levels remained stable in autistic adults in the Netherlands over a period of eight months during the COVID-19 pandemic. They reported more loneliness and stress than non-autistic adults, possibly indicating unmet social needs and stressful daily lives. Although, on a group level, we noticed stability of loneliness and stress over time, on an individual level the wellbeing of some autistic individuals worsened during the pandemic while others remained stable or even, in some cases, improved. Individual differences deserve further attention.

#### **515.005 (Virtual Poster)** Coping-Resilience Profiles and Experiences of Stress in Autistic Adults

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**Background:** Emerging studies have alluded to high stress and frequent stressful encounters in the autistic adult population. Stressful encounters that characterise everyday life (i.e., daily hassles) and the degree to which one's life is perceived as stressful (i.e., general perceived stress) are suggested to be elevated in autistic individuals. Given the detrimental impact of stress on physical and psychological health outcomes, it is important to examine malleable individual resources such as coping and resilience, which may influence the extent to which stress is experienced.

**Objectives:** Using a person-focused approach, the objectives of this study were to: 1) derive coping-resilience profiles based on patterns of coping strategies and resilience, and 2) examine profile-level differences in relation to general and domain-specific stress (i.e., general perceived stress and daily hassles stress) in a sample of autistic adults.

**Methods:** The sample consisted of 86 Australian-based autistic adults, aged 19-74 years, recruited through an online study. Using cluster analytic procedures, coping-resilience profiles were derived based on the characterisation of coping strategy use (i.e., engagement coping and disengagement coping strategies; Brief COPE) and resilience (Connor-Davidson Resilience Scale). Profile-level differences in relation to daily hassles (Daily Stress Inventory) and total perceived stress (Perceived Stress Scale) were examined using ANOVA.

**Results:** Coping-resilience profiles were derived based on patterns of coping, which either reflected degrees to which *both* strategies were used (i.e., high or low use) or a dominance of one strategy over the other (i.e., high engagement and low disengagement, or vice versa), and levels of resilience, characterised as high or low. Four coping-resilience were identified (see Figure 1): *high cope/ low resilience* ( $n = 15$ ), *low cope/ high resilience* ( $n = 27$ ), *adaptive cope/ high resilience* ( $n = 20$ ), and *maladaptive cope/ low resilience* ( $n = 18$ ). Significant profile-level differences in general perceived stress [ $F(3,76) = 6.40, p < .001$ ] were noted. Individuals in the *high cope/ low resilience* and *maladaptive cope/ low resilience* profiles had higher general perceived stress than those in the *low cope/ high resilience* and *adaptive cope/ high resilience* profiles. Further, individuals in the *high cope/ low resilience* profile reported higher general perceived stress than those in the *low cope/ high resilience* group. Similar patterns were noted in daily hassles stress; however, these differences did not reach statistical significance [ $F(3,76) = 1.74, p = 0.17$ ].

**Conclusions:** Our findings suggest that jointly addressing coping and resilience (i.e., honing engagement coping and resilience, reducing disengagement coping) has the potential to cumulatively benefit the levels of perceived stress in autistic adults. Practical implications of utilising coping-resilience profiles may include: 1) the personalisation of stress management options, where individual-specific aspects of coping and/or resilience that need to be addressed can be determined, and 2) the identification of individuals who might be most at risk for experiencing high stress (i.e., *maladaptive cope/ low resilience* profile). Importantly, addressing the high levels of stress increasingly reported by the autistic adult population may have a cascading effect into other areas of life otherwise impacted by stress.

#### **515.006 (Virtual Poster)** Developing a Tool to Measure Frequency, Severity, and Impact of Meltdowns and Shutdowns in Autistic Adults

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**Background:** Autistic meltdowns and shutdowns have been explored from the perspective of parents of children on the autism spectrum and extensively discussed in online autistic spaces, but there is little research on how these events are experienced from the perspectives of autistic adults. Previous research on childhood meltdowns identifies these as "problem behaviors" that are a significant cause of parental stress and stigma.

**Objectives:** To develop and pilot test a tool to measure the frequency, severity, and perceived impact on overall wellbeing of meltdowns and shutdowns based on interviews with autistic adults.

**Methods:** In an initial qualitative strand, we used Krippendorff's method of content analysis to conduct a secondary analysis of interviews with 33 autistic adults about the experience of having an autistic meltdown and/or shutdown. Meaning units were identified and clustered into themes using dendrograms, or tree-like diagrams. Then, items for the tool were developed using in-vivo quotes from participants to capture identified themes. The pilot tool included 73 items, with most items rated on a 5-point Likert-type agreement scale. Identity-first language was used throughout the tool. The tool was distributed to 54 autistic adults via an online survey with areas for open-ended comments to explore understandability, acceptability, and psychometric properties of the tool.

**Results:** Initial qualitative analysis revealed four themes that captured the experience of meltdowns, including: triggered by social or sensory stress, loss of control, expression is outward, and intense negative emotions. Four themes that captured the experience of shutdowns included: triggered by social or sensory stress, inhibited functioning, expression is internalized, and negative or dulled emotions. However, participant comments on the pilot test revealed flaws in our initial analysis, leading us to stop data collection prematurely. While some participants provided positive feedback about the tool, others shared that they detected an underlying sense of ableism throughout the tool. Participants questioned our very assumption that such a tool would be helpful. One participant shared that he was offended by items that sought to measure aggressive and/or violent behavior. Participants also expressed a perceived diversity in experiences that were difficult to capture in close-ended items. For example, participants frequently added individualized details in comment boxes because they perceived the items to be too broad to be applied to their specific experiences. Finally, one participant commented on the importance of meltdowns and shutdowns as coping mechanisms, which was not captured in our tool.

**Conclusions:** Participant feedback highlights the need to reapproach this project with a strengths-based lens, acknowledging that meltdowns and shutdowns hold different meaning for different people. We now recognize that we cannot (and should not) attempt to measure this experience in a tool that presumes that certain feelings, thoughts, and behaviors correspond to a negative experience for the person living it. We plan to redevelop this tool as a communication aid for autistics to share information about their own experience of meltdowns and shutdowns, including open-ended opportunities to share strengths and challenges.

**515.007 (Virtual Poster)** Differences in Self-Reported Mental Health Diagnoses between Autistic Adults Diagnosed before and after 21 Years of Age

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**Background:** Adult autism studies are increasingly comprised of later-diagnosed adults. Little is known about how the mental health of these adults compares to those diagnosed earlier in life. In a Danish cohort registry, children diagnosed with autism in later childhood (11-15 years) were more frequently diagnosed with co-occurring psychiatric conditions, such as affective or anxiety disorders, than children diagnosed in early-to-mid-childhood (Rødgaard et al., 2021). Analyses comparing mental health conditions of those diagnosed in childhood vs. adulthood could provide important insights with which to contextualize findings in the adult autism literature.

**Objectives:** The present study aims to characterize the SPARK independent adult sample and document differences between adults diagnosed with autism before age 21 and later-diagnosed adults (those diagnosed at 21 or older).

**Methods:** The present study focused on 4,657 independent adults drawn from SPARK (V5, 12/2020) who completed a medical questionnaire. Participants were 18 years of age or older, legally independent (i.e., not have a conservator or guardian), able to read and understand English, had a professional diagnosis of ASD, and resided in the United States. Age at completion of questionnaires ranged from 18 to 85 ( $M=33.4$ ), with more females than males (1.41:1 female:male). For analytic purposes, age of diagnosis was divided at age 21 (to maintain consistency with Fombonne et al., 2020's characterization of SPARK dependent adults). Chi-square analyses and logistic regressions were used to compare self-reported behavioral and psychiatric conditions in adults diagnosed before 21 years and later-diagnosed adults.

**Results:** Just over half (52.4%) of all participants were diagnosed before the age of 21. The proportion of later-diagnosed adults was higher in older age groups, ranging from 13.2% in the 20-24 year old group to 80.3% in the 40+ year old group ( $X^2(20)=1478.95$ ,  $p<0.001$ ; Table 1). A higher proportion of males (58.2%) than females (48.4%) were diagnosed before 21 ( $X^2(1)=42.72$ ,  $p<0.001$ ). High rates of co-occurring psychiatric conditions were reported across the age groups. Those diagnosed at 21+ were more likely to report anxiety ( $OR=2.37$ ,  $p<0.001$ ), affective ( $OR=2.05$ ,  $p<0.001$ ), personality ( $OR=1.38$ ,  $p=0.002$ ), and eating ( $OR=1.58$ ,  $p<0.001$ ) disorders, even after controlling for age at reporting. Differences in attention or behavioral concerns (e.g., conduct disorder) were nonsignificant after controlling for age at reporting.

**Conclusions:** In the independent adult SPARK sample, older age groups, especially those 40+ years, had higher proportions of adults diagnosed later in life. Those diagnosed later in life also showed higher rates of co-occurring psychiatric conditions, even after controlling for current age. These findings suggest attention is needed to the timing of ASD diagnosis when conducting adult research. It is critical that researchers report timing of diagnosis and consider how timing of diagnoses may affect comparisons across studies. Findings also underscore previous research demonstrating high rates of co-occurring mental health challenges in autistic adults (Hollocks et al., 2019). Further research is needed to understand whether the mental health needs of childhood- vs. later-diagnosed adults are similar and whether these groups will require different types of adaptations to therapeutic programs to support psychological well-being.

**515.008 (Virtual Poster)** Dropping the Mask: It Takes Two

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**Background:**

Autistic people are a minority group, comprising approximately 1% of the population (Baio, et al., 2018). Consequently, everyday social situations for many autistic people predominately involve interacting with non-autistic work colleagues, family members, and friends. Often, autistic people report feeling that they need to camouflage or mask their natural or usual behaviour during these cross-neurotype social situations in order to cope, fit in, or get by (e.g., Hull et al., 2017; Livingston et al., 2020). Such camouflaging or masking is associated with negative consequences including feelings of exhaustion, identity confusion and mental health difficulties (e.g., Hull et al., 2017, 2021). However, some autistic people report that in

certain social situations or around certain non-autistic people they feel less pressure or need to camouflage or mask. Instead, they feel they can be more like their natural, authentic, or true selves. This later experience has rarely been examined within the camouflaging/masking literature.

#### Objectives:

We aimed to explore autistic adults' experiences of interacting in ways that felt natural or authentic to them during cross-neurotype interactions.

#### Methods:

The current study involved an online qualitative survey. To ensure the quality of data collected, we developed the survey in consultation with members of the autistic community using cognitive interviewing techniques. Cognitive interviewing is a qualitative methodology used in survey design to examine how participants interpret and respond to questions with respect to their idiosyncratic lives, experiences, and perceptions (Miller & Baena, 2014). Whilst the use of online surveys with autistic populations is recommended, in practice the use of online qualitative questionnaires is relatively novel, and thus little is known regarding the ways in which autistic people interpret and respond to qualitative questions presented in this format. One hundred and thirty-three autistic adults (58 women, 57 men, 12 non-binary individuals and 6 individuals who preferred not to disclose their gender) completed the survey. Survey responses were analysed thematically following the reflexive thematic analysis approach developed by Braun and Clarke (2006, 2013, 2019).

#### Results:

The degree to which participants felt they could safely and enjoyably engage in a manner that felt authentic or natural to them during cross-neurotype interactions, was related to the interpersonal behaviour of their non-autistic social partners. In this way, authentic engagement appeared to be best understood as an interpersonal process, dependent on the actions of both autistic and non-autistic social partners. Four themes were generated related to participants' experiences of authentic engagement within the context of safe and comfortable cross-neurotype interactions: (i) embracing diverse communication styles interests and perspectives; (ii) creating a more inclusive social environment together; (iii) minimising and managing miscommunication in mutually beneficial ways; and (iv) enjoyable interactions involving reduced anxiety and exhaustion as well as genuine connection and rapport.

#### Conclusions:

Given the growing body of research demonstrating the negative consequences of camouflaging/masking for autistic people (e.g., Hull et al., 2021), the knowledge and insights gained from this study will contribute to the development of systemic approaches for improving the social experiences and wellbeing of neurodivergent people.

#### **515.009** (Virtual Poster) Examination of Differences in Enrollment, Attendance, and Participation in an Intervention to Increase Community Participation in Rural Communities

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**Background:** Community participation is defined as engagement in natural contexts with others with or without disabilities within the general community outside of supported environments. Deficits in individuals with Autism Spectrum Disorder (ASD) result in significant challenges to and impairment in the ability of these individuals to gain greater inclusion and integration into the community in the way that they choose to. Community participation is further impacted for those living in rural communities as opportunities to fully participate may be more limited. Preliminary data from a pilot project examining the feasibility of an intervention to increase community participation in adults with ASD points to variable engagement in the intervention.

**Objectives:** To explore patterns of engagement including enrollment, attendance, and participation in an intervention to increase community participation for adults with Autism Spectrum Disorder living in rural communities.

**Methods:** Data is currently being collected as part of a larger longitudinal study of an intervention consisting of a 12-week module with the option of completing 3 additional 12-week modules targeting community participation. Twenty participants will be enrolled by March, 2022 (15 enrolled to date). Inclusion criteria is diagnosis of ASD, 18- to 40-years-old, and ability to self-report. At enrollment, participants will complete the Temple University Community Participation measure (quantity and variability of community participation) and the Visual Activity Sort (activities sorted by activity preference and desire to engage in the activity). Each participant will complete a 60-minute semi-structured qualitative interview with probes such as "What makes these activities important to you?" and "How do you choose which activities to do?" Additional predictors of engagement collected include demographics (including level of geographic rurality), severity of ASD, motivation for behavior change, perceived community discrimination, self-efficacy, physical health and mental health symptoms. Finally, during the intervention in addition to attendance ratings of engagement were scored by the clinician including percent completion of homework and engagement during the session.

**Results:** To date, all 13 participants completed the initial 12-week module with variable levels of engagement (2 individuals are still in Module 1 at this time). Following the first 12-week module, 3 participants exited the intervention (23% attrition rate). Following the second 12-week module, 2 more participants exited the intervention (20% attrition rate). Of the 13 who completed Module 1, we identified sub-groups of high, moderate, and low engagers. Preliminary results indicate that severity of ASD is not correlated with type of engagement. We will be exploring these classes of



engagers in light of the additional variables listed above. We anticipate high engagers will report higher access to resources (e.g., active natural supporters, higher socioeconomic status), higher motivation for behavior change, and lower comorbid physical and mental health symptoms.

**Conclusions:** Given the recent emphasis by experts in ASD and providers of services for adults with ASD on increasing community participation, it is important to understand who may be the most receptive to interventions to increase community participation and for those who demonstrated moderate to low engagement, what barriers may be modifiable to improve engagement and likely outcome.

**515.010 (Virtual Poster) Eye-Tracking on the Eyes Task in Adults with Autism Spectrum Disorder**

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**Background:**

Theory of mind was hypothesized as core deficits in autism spectrum disorder (ASD). Processing emotion through facial expression is a fundamental mechanism of theory of mind. The Eyes task developed by Baron-Cohen et al. tests the attribution of mental states from the eye region of the face alone. It involves both complex emotion recognition and the first stage of theory of mind, namely mental state attribution. Little is known whether the difficulty in attribution of mental states in ASD children persisted in to adulthood particularly in cognitive able adults.

**Objectives:**

This study aims to investigate theory of mind deficits on the Eyes task by using eye-tracking and pupil dilatation measurement in Taiwanese adults with ASD.

**Methods:**

This cross-sectional case-control study compared emotion reading between adults with ASD and age- and sex-matched typically-developing controls (TDC). Autism spectrum disorders (ASD, n=30; mean age 26.0, SD 5.1). The inclusion criteria was cognitive-able adults (aged > 18 years) with a DSM-5 diagnosis of autism spectrum disorder. We also recruited 30 typically-developing controls (TDC, mean age 23.0, SD 2.2). All participants completed the Eyes tasks, in which each photo with a forced choice between four mental state terms printed around each picture, including complex emotions such as reflective, arrogant, scheming, planning, etc. The gazing points were recorded with Tobii X2-30 Eye Tracker. The specified areas of interest are defined onto each frame of the stimuli to enable the subsequent statistical analysis of the gazing points. The behavioral response, eye region gazing durations and pupil dilatation of each stimulus were compared between ASD and TDC groups.

**Results:**

For the Face task response, the ASD group correctly answered 14.8 items in total 20 items, performed significantly lower the TDC group. For the Eyes task response (Taiwanese version), the ASD group (19.2 items/37 items) still performed worse than the TDC group. The items of complicated expression showed significant difference between ASD and TDC. For the UK version, although the ASD group (27.4 items/43 items) still performed worse than the TDC group, the two groups showed no statistical difference. In the Taiwanese version, different set of complicated emotions showed significant difference between ASD and TDC. Eye tracking analysis suggests eye region gazing percentage overall was not statistically different between ASD and TDC. The analysis on pupil dilatation is undergoing and will be added later.

**Conclusions:**

Our findings suggest that adults with ASD may have difficulties in reading emotions, supporting theory of mind deficits in adults with ASD even in cognitive-able individuals. The eye gazing percentage was not significantly different between ASD and TDC, suggesting that the Eyes task may not be suitable for eye tracking analysis in cognitive-able ASD adults.

**515.011 (Virtual Poster) Interpersonal Violence in Autism Spectrum Conditions: A Systematic Review and Meta-Analysis**

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**Background:** Interpersonal violence is an issue of critical importance in autism spectrum disorder (henceforth, autism). Research shows autistic individuals are at heightened risk for victimisation relative to the general population, and also experience worsened outcomes associated with such experiences. Further, the *multiple minority stress* model, suggests that within autism, gender minorities (i.e., females and non-binary individuals) may be at increased vulnerability. To address concerns relating to the heightened vulnerability of autistic individuals, the current study involved a comprehensive systematic review of the current findings on experiences of interpersonal violence in autism.

**Objectives:** A systematic database search was conducted to identify studies assessing exposure to interpersonal violence. Interpersonal violence was defined as any act resulting in physical, sexual, or psychological violence that occurs between individuals.

**Methods:** We selected papers relating to autistic participants of any age and level of autism severity, compared by gender. From the search, 49 studies of varying methodologies and designs were identified as meeting inclusion criteria.

**Results:** A comprehensive synthesis of the findings indicated potential prevalence and identified several risk factors, and outcomes associated with interpersonal violence among autistic individuals in relation to age, gender, and autism severity. The types of interpersonal violence that are more prevalent among autistic individuals of varying gender identities were identified, while individual and contextual risk factors and mental health outcomes associated with these experiences were identified among autistic individuals, in relation to gender.

**Conclusions:** Findings reveal key areas of concern for autistic individuals by age, gender, and level of autism severity in relation to interpersonal violence prevalence, risk factors, and outcomes. In particular, findings provided initial insight into the significant role violence exposure has on worsened mental health outcomes for this population, and indicate the need for further research on this topic.

**515.012 (Virtual Poster) Multi-Layer Temporal Network Analysis Reveals Differences in Psychopathology Dynamics across Neurodevelopmental Disorders**

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**Background:** Traditional psychiatric assessments rely on the retrospective descriptions of the average intensity of clinical manifestations. Clinicians are therefore typically blind with regards to the dynamics of how different psychiatric symptoms fluctuate in daily life. However, the dynamics of how symptoms fluctuate and interact with one another and with the environment could carry important information for determining prognosis, predicting treatment response, or understanding underlying pathophysiological mechanisms. Novel tools of digital phenotyping, such as the Experience Sampling Method (ESM), promise to “open the black box” of daily life, by allowing to evaluate symptoms when and where they occur. Still the application of digital phenotyping tools to clinical practice has been limited by difficulties in drawing clinically meaningful conclusions from statistically complex data.

**Objectives:** Here we propose a novel approach based on Dynamic Multi-Layer Temporal Network Analysis, to analyse ecological data derived from the Experience Sampling Method (ESM). The approach provides an intuitive characterization of differences in the dynamic interactions between symptoms. We employ this approach to explore whether differences in psychopathology dynamics can help differentiate subjects affected from two different neurodevelopmental disorders from one another and from healthy controls. Multiple ecological self-assessments of psychopathology were collected over the course of 6 days for 33 individuals with 22q11.2 Deletion Syndrome (22q11DS) (13 females), 28 individuals with Autism Spectrum Disorders (ASD) (13 females), and 44 typically developing healthy controls (HCs). Multilayer temporal networks were reconstructed by considering both the propensity for symptoms to manifest together and the propensity for symptoms to dynamically influence one another across time. Networks were compared using non-parametric permutation testing.

**Methods:** Multiple ecological self-assessments of psychopathology were collected over 6 days for 33 individuals with 22q11.2 Deletion Syndrome (22q11DS) (13 females), 28 individuals with autism (13 females), and 44 typically developing controls (TD). Multilayer temporal networks were reconstructed by considering both the propensity for symptoms to manifest together and to dynamically influence one another across time. Networks were compared using non-parametric permutation testing.

**Results:** Network analysis provided an intuitive characterization of the propensity for different symptoms to manifest together, revealing an overall similar network structure across samples. However the relationship between real-time social context and symptoms of psychopathology differed significantly across populations. Moreover, samples differed substantially in terms of the dynamics interaction between symptoms across-time. Individuals with 22q11DS and idiopathic autism were located at opposite ends of a spectrum compared to TD. 22q11DS was characterized by weaker within-time correlations but stronger across-time correlations compared to autism and TD. Individuals with autism presented more coherent fluctuations of symptoms within a same time-point that were however more erratic and less stable across time.

**Conclusions:** These results suggest that different neurodevelopment disorder, that appear similar to clinical diagnostic assessment, can be differentiated in terms of psychopathology dynamics. Such differences in dynamic interactions between symptoms can be intuitively captured using temporal network analysis techniques. These results suggest that high-resolution ecological behavioural phenotyping could help identify patients affected by different neurodevelopmental disorders, and ultimately help path the way to a more personalized approach to clinical care.

**515.013 (Virtual Poster) Psychological and Sociocultural Influences in Camouflaging and Its Relationship with Mental Health in Autistic Adults: Findings from a Cross-Sectional Survey**

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**Background:** Camouflaging (also known as masking) involves the use of strategies by autistic people to minimise the visibility of their autism in social situations. While camouflaging can be an adaptive social strategy at times, it has also been consistently associated with poorer mental health outcomes. Most quantitative research to date has largely focused on individual correlates of camouflaging that are largely biologically determined or

stable over time (e.g., age, sex/gender, IQ, executive functioning). Given that camouflaging is a response predominantly driven by an individual's social environment, the process by which it develops is likely also influenced by an interplay of psychological characteristics and social experiences. However, little is known about psychosocial variables associated with camouflaging or implicated in the relationship between camouflaging and mental health.

**Objectives:** This study aims to investigate (a) whether specific hypothesised psychological (i.e., autistic burnout, autistic identity, fear of negative evaluation) and social experiences (i.e., perceived social support, stigma, vulnerability events, perceived social norms, desire to individuate or maintain social harmony) predict camouflaging, and (b) whether these psychosocial factors mediate or moderate the relationship between camouflaging and mental health in autistic adults.

**Methods:** This study was developed in partnership with an autistic consultant. Approximately 300 autistic adults were recruited through Prolific, autism organisations, and social media between 2019 and 2021. Inclusion criteria for participants were (a) individuals 18 years old and above, (b) able to self-report in English, and (c) have a professional diagnosis of autism or self-identify as autistic. Participants completed online self-report measures on demographic information, autistic traits, camouflaging, and the aforementioned psychosocial factors. Hierarchical linear regression analyses were performed to investigate whether psychosocial factors predict self-reported camouflaging, after controlling for age, gender, and autistic traits. Moderation and mediation analyses were conducted to examine the role of psychosocial factors in the relationship between camouflaging and mental health.

**Results:** Data analysis of the full dataset is ongoing. Preliminary analyses based on a subsample of 77 autistic (18-57 years; 62.3% female) suggest that camouflaging in autistic adults was largely driven by perceptions of stronger social norms and lower tolerance for deviance. Having a weaker autistic identity, a greater fear of negative evaluation, and a weaker desire to individuate from others also predicted higher levels of different camouflaging behaviours in autistic adults. The relationship between camouflaging and depressive/ anxiety symptoms was weakened among autistic individuals who reported a stronger autistic identity. We will present findings from our full analyses at INSAR 2022.

**Conclusions:** Camouflaging as a social coping strategy is likely influenced by individual psychological characteristics and perceived sociocultural pressures to conform. Our preliminary analyses suggest the need for both individual psychological and societal-level changes to shift from pathologising to accepting and embracing autistic differences, to alleviate the negative impact of camouflaging on mental health, and to minimise the need for autistic individuals to camouflage at the outset.

#### **515.014** (*Virtual Poster*) Repetitive Behaviors and Restricted Interests in Different Age and Cognitive Level Groups in Children and Youth with ASD

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**Background:** Individuals with Autism Spectrum Disorder (ASD) exhibit repetitive behaviors, which range from lower-order behaviors that require less cognitive engagement (e.g., hand flapping) to higher-order behaviors that require more cognitive engagement (e.g., narrow interests; Turner, 1999). Although classifying repetitive behaviors into lower- vs. higher-order behaviors is helpful in elucidating the complexities of the behavior, it may obscure important differences within each "order". Thus, there is growing interest in using a more comprehensive classification of repetitive behaviors (Lam & Aman, 2007). Interestingly, research has shown that the severity and presentation of repetitive behaviors differ depending on an individual's age and IQ (Leekam et al., 2011). However, findings on age and IQ differences in repetitive behavior presentations have been ambiguous and further research is needed. The use of IQ in neurodevelopmental research has been debated and some researchers have encouraged the use of an uncorrected cognitive level (i.e., not corrected for age as IQ scores are; Rizeq et al., 2017). Individuals with ASD also experience a range of comorbid psychopathology (Gabriels et al., 2005; Stratis & Lecavalier, 2013). Despite the high overall prevalence of comorbid problems, more research is needed to elucidate the level of different comorbid problems present in different age and cognitive level groups.

**Objectives:** Thus, this research addressed the following research questions: 1) What are the levels of comorbid internalizing and externalizing psychopathology present in different age and cognitive level groups?; and 2) What are the different severities and presentations of repetitive behaviors in different age and cognitive level groups?.

**Methods:** These questions were addressed using secondary data analyses from the Simons Simplex Collection (SSC) dataset, which is part of a larger database the Simons Foundation for Autism Research Initiative (SFARI). The sample consists of over 2000 children and youth with ASD, ranging in age from 4 to 18 years with a wide IQ range. The research questions were addressed via ANOVA. Psychopathology was measured using the Internalizing and Externalizing scores from the Child Behavior Checklist (Achenbach, 1992) and repetitive behaviors using the Repetitive Behavior Scale-Revised (Lewis & Bodfish, 1998) using the Lam & Aman (2007) 5-factor scores: ritualistic/sameness, self-injurious, stereotypy, compulsive, and restricted interests.

**Results:** In terms of age differences, early and middle childhood groups showed more externalizing behaviors and more stereotypy than the adolescence group. Further, the middle childhood group demonstrated more ritualistic/sameness than the early childhood group. Those in the early childhood and adolescence group showed more internalizing behaviors than the middle childhood group. In terms of cognitive level, the overall trend was that the lower functioning groups demonstrated more externalizing and repetitive behaviors than the higher functioning. Further, the highest functioning group showed significantly more internalizing behaviors than all the lower functioning groups.

**Conclusions:** There are robust differences in comorbid psychopathology and repetitive behaviors in different age and cognitive level groups. This is clinically valuable as clinicians would benefit from considering the role of age and cognitive level in determining the repetitive behavior presentations and risk of comorbid psychopathology.

**515.015 (Virtual Poster)** Symptom Profiles in Autism Spectrum Disorder Versus Attention Deficit Hyperactivity Disorder Versus Autism Spectrum Disorder Comorbid with Attention Deficit Hyperactivity Disorder: A Systematic Review

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**Background:** Attention deficit hyperactivity disorder (ADHD) is the most common comorbid psychiatric disorder diagnosed in children with autism spectrum disorder (ASD), particularly in those with intact intellectual capacity. The comorbidity estimates reported for ADHD fall within the range of 30% to 80%. A comorbid diagnosis of ASD and ADHD can be made in DSM-5, this represents a significant step forward and likely boosted research on the shared and specific pathways related to comorbid ASD and ADHD. It is important to study ASD and ADHD symptomatology as the comorbidity places children at a higher risk for psychiatric hospitalization, positively correlated with receiving mental health services, also side effects of medications are seen more in patients with comorbid ADHD and ASD.

**Objectives:** To present common symptoms reported in ASD versus ADHD versus ASD comorbid with ADHD (ASD + ADHD) regarding cognitive deficits, adaptive, and social functioning.

**Methods:** PRISMA (preferred reporting items for systematic reviews and meta-analyses) guidelines were used in conducting this systematic review. A literature search was conducted using the databases PubMed and Web of Science to identify the relevant studies (January 2000 to September 2021) using the combination of keywords as follows: ADHD AND Autism, social cognition, social impairments, language difficulties, behavioral difficulties, attentional problems, executive dysfunction, memory. Inclusion criteria were studies that (1) Investigated comorbid symptomatology with ADHD and ASD diagnosis (2) children aged 5-18 (4) boys and girls (5) Low (<70) and high (> 70) IQ (6) English language journals. Papers excluded when (1) main area of study was treatment (pharmacological/ nonpharmacological), classification, genetics, or imaging, (2) Included only ADHD or only ASD diagnosis, and (3) studies included other psychiatric disorders like OCD, tic disorder, anxiety disorder, sleep problems, auditory processing disorder, and Specific learning impairment. We found 978 papers, 53 papers were included and reviewed, as demonstrated in (figure 1).

**Results:** Data is presented on clinical and neurocognitive levels. Common symptoms reported in ASD versus ADHD versus ASD + ADHD are shown in (table 1 and table 2), it includes executive dysfunction, aberrant reward processing, impaired social cognition, biased self-recognition/perception, memory problems, adaptive dysfunction, and differences in attention/ hyperactivity/ impulsivity symptoms profile. ASD + ADHD present with greater deficits in working and verbal memory, recognizing facial affect, regulating impulsivity, more socio-emotional and behavioral impairment, and more psychopathology than ASD or ADHD subgroups. Girls diagnosed with ASD+ADHD were found to have more impaired executive functions and scored less on the theory of mind tasks than boys. children with ASD+ADHD had a lower cognitive functioning, more severe social impairment, and greater delays in adaptive functioning than children with ASD only.

**Conclusions:** The overlapping domains found in ASD+ADHD category can guide the evaluation for comorbidity, in patients presenting with either ASD or ADHD diagnosis. Utilized at an early age, this can provide a more comprehensive evaluation for better treatment planning and outcomes.

**515.016 (Virtual Poster)** The Relationship between Autism Spectrum Quantitative Phenotypes, Resilience, and Anxiety during the COVID-19 Pandemic.

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**Background:** Resilience refers to the complex process through which deleterious effects of stressors can be diminished and prevented (Bitsika & Sharpley, 2014). Previous work examining resilience and autism primarily focuses on the family members of autistic people, rather than on autistic people, themselves. We sought to better understand the relationships among autism spectrum traits, resilience, anxiety, and depression during the COVID-19 pandemic. This builds upon previous work by this group in that it seeks to establish this relationship when autistic traits are parsed into dimensions of social and restricted repetitive behavior.

**Objectives:** To evaluate the interaction between autism-related traits, other psychiatric constructs (i.e., anxiety and depression), and resilience during the COVID-19 pandemic in a sample enriched for adults high in autistic traits.

**Methods:** Two hundred and seven participants were recruited from the Autism Spectrum Program of Excellence (ASPE) genetics study at the University of Pennsylvania, including autistic individuals (n = 92) and their family members (n = 115), (57.4% female, 89.4% white, mean of 39.7 (+18.5 SD) years old). An additional one thousand four hundred and eighty-one participants were recruited from the general population during the COVID-19 pandemic (73.3% female, 88.5% white, mean of 48.3 (+15.7 SD) years old). Each participant completed self-report questionnaires about their autistic traits (SRS), severity of anxiety symptoms (GAD7) and depression symptoms (PHQ2), and resilience (Penn Resilience and CD-RISC). The SRS was examined as a total score and through its subscales (restricted repetitive behavior, social motivation, social communication, social cognition, and social awareness) to understand dimensions within the overall autism phenotype. Resilience is categorized differently by each questionnaire, with the CD-RISC being less predicated on social attributes than the Penn Resilience Questionnaire.

**Results:** Pearson correlations showed strong negative associations between resilience as measured by the CD-RISC and overall autistic traits as measured by the SRS ( $r = -0.52$ ,  $p < 0.01$ ), as well as restricted repetitive behaviors and social motivation, communication, cognition, and awareness. Similar results were found when measuring resilience through the Penn Resilience Questionnaire. Pearson correlations also showed strong positive associations between severity of anxiety and depression and quantitative autistic traits. All correlation findings are shown in Table 1. Moderation

analysis demonstrated that resilience (Penn Resilience and CD-RISC) has a strong, positive moderating effect on the relationship between anxiety and autistic traits but not on the relationship between depression and autistic traits (Table 2).

**Conclusions:** We found that autism-related traits across several dimensions are highly correlated with resilience and anxiety and depression, and that this association is maintained when examining specific dimensions of the autism phenotype. We also found that resilience moderates the interaction between anxiety and autistic traits, with resilience appearing to buffer the association between autism-related traits and heightened risk for anxiety. Further, despite different conceptualizations of resilience, there were minimal differences in both analyses between the two resilience questionnaires. Future analyses will investigate which dimensions of anxiety (i.e., social anxiety) drive the association between anxiety, autistic traits, and resilience.

**515.017 (Virtual Poster)** Health Related Quality of Life in Children with Autism Spectrum Disorder: A Cross-Sectional Study from Apex Center in North India

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**Background:**

Health related quality of life (HRQOL) of children with autism spectrum disorder (ASD) and caregivers is thought to be affected negatively, but exact measures and domains have not been clearly determined.

**Objectives:**

To determine the HRQOL parameters, its determinants and correlation with severity and behavioral comorbidities of autism.

**Methods:**

The HRQOL of children aged 3 -12yrs with ASD (DSM-V criteria) as measured by PedsQL-TM (Pediatric Quality of Life Inventory TM) Version 4.0 was compared with age and sex matched controls. Correlation of HRQOL with severity of autism {Childhood Autism Rating Scale (CARS) score}, development/intelligence quotient (Development Profile 3), behavioral co-morbidities {Child Behavior Checklist (CBCL)} and sleep disturbances {Childhood Sleep Health Questionnaire (CSHQ)}, HRQOL of caregivers by World Health Organization Quality of Life (WHOQOL), General stress levels of parents {Parenting Stress Index (PSI)} and coping strategies of parents (COPE inventory) were also analyzed.

**Results:**

141 children with ASD and age/sex matched controls were enrolled between August 2017 and April 2018. HRQOL of ASD children ( $p=0.0001$ ) and caregivers ( $p=0.001$ ) were significantly impaired as compared to controls. The HRQOL of autism children had strong negative correlation with severity of autism (CARS score) {co-relation coefficient( $r$ ) = 0.63}, moderate negative correlation with behavioral co-morbidities( $r=0.57$ ), total stress of parents( $r=0.53$ ), development quotient( $r=0.51$ ) and sleep disturbance ( $r=0.46$ ). Commonest coping strategies of parents were suppression of competing activities, behavioral disengagement, mental disengagement and religious coping. Parents of children with hyperactivity and CSHQ score  $>41$  had more impairment in HRQOL and parental stress ( $p=0.02$  and  $0.04$  respectively).

In a previous study on 125 ASD children in our center, more than three-quarters (76.8%) of the mothers reported depression. Most (60%) of them had mild and moderate depression. One seventh (14.4%) of mothers had severe depression and 2.4% had very severe depression. Levels of depression in the mothers were significantly associated with their physical health and quality of life. Mothers of children with severe autism (44.8%) had higher levels of depression than those with mild (25.6%) and moderate (29.6%) degrees of autism.

**Conclusions:**

Impairment of HRQOL of autism children correlates with the severity of autism and behavioral co-morbidities. Impairment of HRQOL of caregivers has also been observed and we need to develop coping strategies for the same.

**515.018 (Virtual Poster)** Being Autistic and Bilingual: A Thematic Analysis of the Experiences of Autistic Bilingual Adults Living in the UK  
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**Background:** While being bilingual or living in a bilingual environment is becoming a more common experience around the world, little is known about the combined experience of bilingualism and autism. Most of the research available focuses on quantifying the language and cognitive development of autistic bilingual children, and the only qualitative accounts of the first-hand experience of autistic bilinguals are from either bilingually-raised children or highly multilingual adults (with 4 languages or more), which may not represent the wider autistic bilingual population.

**Objectives:** This qualitative study aims to report the experiences of autistic bi- and multilingual adults living in the UK, focusing on their perceived benefits of bilingualism, and on the barriers and enablers to bilingualism.

**Methods:** A group of 39 autistic bilingual adults (41% female, mean age = 33.2 years, range = 16-61) with reported knowledge of 2 to 7 languages (mean = 3.6, SD = 1.4) and residing in the UK completed an online Demographic and Language Questionnaire including three open-ended questions about the interplay between autism and bilingualism. A thematic analysis was conducted on the responses to these open-ended questions.

**Results:** Respondents reported social communication as being a major benefit of being bilingual, as well as being better able to both understand other perspectives, and express their own self. They also perceived many opportunities and benefits brought by bilingualism, in terms of relationships, hobbies, mobility, employment, education, or cultural insight. They also discussed how bilingualism had shaped their self-understanding, in terms of increased awareness of their own skills, broadened mindset, and identification of difficulties linked with autism. Finally, they also identified several factors that had enabled or challenged their language learning journey, especially the learning environment, the opportunities for practice or specific language competences that were considered by some as difficult and by others simple.

**Conclusions:** This study builds upon the few qualitative reports available to highlight experiences that are shared by autistic bilingual people regardless of the number of languages they know. It is the first study to report the perspectives of autistic bilingual adults who, in most cases, did not have a special interest in languages and simply became bilingual through their life journey. Importantly, their accounts of the factors that can facilitate or hinder language learning will inform the development of adapted strategies to better support autistic people in their bilingual journey. Overall, these findings will have implications for bilingual families and the clinical and educational practitioners accompanying autistic bilingual people.

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**515.019 (Virtual Poster)** Conversational Dynamics during Interactions between Autistic and Non-Autistic Partners

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**Background:** Autistic adults (AA) are characterized by differences in social communication and interactions which can include reduced reciprocity and verbal fluency. However, these differences are based upon interactions with non-autistic (NA) people, who tend to evaluate AA negatively compared to NA controls (Sasson et al 2017). Previous studies suggest that AA may have enhanced interaction quality and outcomes—and establish greater rapport—with other AA who more similarly reflect their communication preferences (Crompton et al 2020). Such findings are consistent with the Double Empathy theory of autism (Milton 2012), which conceptualizes social interaction difficulties between AA and NA people as not solely driven by autistic “deficits” but by a mutual lack of understanding and a difference in communication styles.

**Objectives:** The current study tests whether, as predicted by the Double Empathy theory, autistic adults demonstrate different conversational dynamics when interacting with other autistic people compared to NA people.

**Methods:** Sixty-nine autistic and 71 NA adult males, comparable on age, ethnicity, and intelligence, participated in a 5 minute “get to know you” conversation with an unfamiliar partner in one of three dyadic conditions: both AA, both NA, or one AA and one NA. Transcripts of the conversations were analyzed to determine if the number of questions asked, the amount of turn-taking, and the number of words spoken during conversations for AA differed when interacting with NA adults compared to another AA.

**Results:** AA demonstrated significantly less turn-taking ( $p < .001$ ) and words spoken ( $p = .004$ ) compared to NA participants. Questions asked did not differ significantly between AA and NA participants ( $p = .393$ ). AA-AA dyads had reduced turn-taking compared to NA-NA and AA-NA dyads ( $p < .001$ ), but questions asked and number of words spoken did not significantly differ between dyad types. AA demonstrated significantly more turn-taking when interacting with NA partners than with AA partners ( $p = .039$ ), but diagnosis and dyad type did not significantly interact for number of questions asked or word count.

**Conclusions:**

Turn-taking and words spoken were significantly higher for NA than AA participants, confirming different social communication preferences in the two groups. Turn-taking was lower in conversational dyads whenever an autistic person was present, regardless of whether the partner was AA or NA. Although AA participants did not significantly differ on the number of words spoken or questions asked when their partner was NA relative to AA, they increased their turn-taking in conversations when their partner was NA compared to AA. NA people may be pushing for more interaction than AA partners, and AA may be increasing their turn-taking to meet NA conversation demands within mixed dyads. While previous research has found that NA individuals attempt to match the conversational dynamics of autistic individuals (Feldstein et al 1982), here we find evidence that this works in the other direction as well: AA strive to meet the turn-taking demands of NA partners.

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**515.020 (Virtual Poster)** Beyond Friendship: The Spectrum of Meaningful Social Participation of Autistic Adults

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**Background:** While other symptoms of autism often plateau or improve in adulthood, social interaction difficulties persist and potentially contribute to lower rates of social participation, friendships/close relationships, and increased isolation (Mazurek, 2014; Tobin et al., 2014). Yet having a broader network of social contacts supports neurotypical healthy aging and mental health. Measures focused on assessing number of friendships,

frequency of contact or activities with friends, or presence/absence of social activity within a defined period may not accurately capture the extent of social participation of autistic adults.

**Objectives:** This qualitative study describes the range of social participation activities and contacts, from acquaintances to close relationships, of autistic adults to better understand, from the individual's perspective, where and how meaningful social interactions occur.

**Methods:** Two semi-structured interviews assessed the importance of community activities, feelings of belonging, and social connectedness from the autistic adult's perspective. Interviews were conducted before and after a week-long community activity data tracking process. Questions surrounded activities that occurred that week, the importance of different locations visited, and feelings of belonging and social support in the community. Qualitative data from interviews were analyzed using a multi-step approach focused on social and community involvement.

**Results:** Forty adults (24-62 years,  $M=37.8$ ) participated in the study (demographics in Table 1). Participants described meaningful social participation beyond typical friendships in various contexts that contributed to their feelings of community and belonging. Contexts for social participation clustered around five main themes: 1.) Vocational, 2.) Neighborhoods, 3.) Common interests, 4.) Support services and inclusive environments, and 5.) Online networks and apps. In all contexts, participants reported experiences across the spectrum of social participation including casual encounters, engaging with known acquaintances, or engaging in close friendships/relationships. Notably, participants used some contexts to practice social interactions for application in other settings or at other levels of engagement.

For example, participants described work as an important avenue for practicing social interactions. Common interest activities of church, gaming, or improv also offered opportunities for social engagement or practice for many participants. Walking pets promoted social interaction within neighborhoods, which contributed to feeling part of the community. Online platforms such as MeetUp and dating apps were used to facilitate in-person gatherings, while Facebook, online groups, and Twitter provided important connection with others or valued engagement in online communities.

**Conclusions:** With a significant focus in research on loneliness, isolation, and friendship quality in autistic adults, these findings provide initial support to think more broadly about where social participation and meaningful interactions take place. As autistic adults navigate social experiences, this study found evidence of individuals using a variety of in-person and online community contexts to intentionally practice and improve social participation skills. Findings also support adults used specific apps to facilitate in-person meet ups, at times merging the preference for online communication with the desire for in-person connection. These findings suggest moving away from social skills training groups toward more structured opportunities for social interactions and exploring new ways to tailor interventions to support a range of desired social participation preferences.

**515.021 (Virtual Poster) COVID-19 As a Natural Experiment Paradigm: Implications for Personal Wellbeing and Stress in Autistic Adults.**  
**C. M. Brown<sup>1</sup>, D. Hedley<sup>2</sup>, M. Fuller-Tyszkiewicz<sup>3</sup>, M. Hooley<sup>4</sup> and M. A. Stokes<sup>5</sup>,** (1)School of Psychology, Deakin University Australia, Melbourne, Australia, (2)Olga Tennison Autism Research Centre, La Trobe University OTARC, Melbourne, VIC, Australia, (3)Deakin University, Melbourne, Australia, (4)Psychology, Deakin University, Burwood, VIC, Australia, (5)Deakin University, Burwood, VIC, Australia

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**Background:**

In 2020, COVID-19 restriction measures introduced by the Victorian and Australian governments impacted aspects of most people's daily life. It is currently unclear what implications these restrictions had for the mental health and wellbeing of Autistic adults, who are known to experience disproportionately high rates of mental health concerns.

**Objectives:**

The aims of the present study were threefold: To measure mental health and personal wellbeing in Autistic and Non-Autistic adults in Australia during the first six months of the COVID-19 pandemic; to understand aggregate changes to mental health and personal wellbeing against baseline levels collected prior to the COVID-19 pandemic; and to understand and compare group level changes by both location and by autism diagnosis.

**Methods:**

We recruited 391 Australian adults, comprised of 199 autistic ( $M_{age}=43.71$ ,  $SD=14.40$ ) and 192 non-autistic participants ( $M_{age}=38.38$ ,  $SD=9.92$ ). Severity of depression, anxiety, stress, eating disorder symptoms (DASS-21 & EDE-QS) and personal wellbeing (PWI) data were collected in two discrete phases. Phase 1: 2019 baseline levels; and Phase 2: at monthly intervals from June to November 2020.

**Results:**

We found that autistic traits were associated with lower personal wellbeing and increased mental health symptom severity. However, relative to 2019 baseline levels, aggregate severity of depression, anxiety and stress decreased among autistic adults across the Victorian second wave of the COVID-19 pandemic in Australia. We also found that stress significantly mediated the relationship between autistic traits and personal wellbeing at all time points.

**Conclusions:**

The results show personal wellbeing and mental health symptoms were not worsened by government COVID-19 restrictions. In fact, they appear to have had a somewhat protective effect. These results provide some insight into the difficulty autistic individuals experience in many daily situations, and suggest paths toward supportive measures that may be undertaken in future. In a clinical setting, understanding the critical role of stress for Autistic people will be crucial for managing mental health and poor ratings of satisfaction with life.

**515.022 (Virtual Poster)** Cardiovascular Risk Factors in Middle-Aged and Older Autistic People and Their Associations with Depression Symptoms and Executive Function

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**Background:** Cardiovascular risk factors (CVRF) increase during later life and are significantly associated with the presence of depression symptoms and difficulties with executive function among older adults. Few studies have examined CVRF among older autistic adults, including whether CVRF influence depression symptoms or are linked to executive function, as has been shown for non-autistic older people.

**Objectives:** This study examines the frequency of CVRF and associations between CVRF, depression symptoms and executive function in a large group of middle-aged and older autistic adults.

**Methods:** 387 participants (52.9% were assigned female at birth) aged 40-83 years old, were recruited online via Simons Foundation Powering Autism Research for Knowledge research match. Individuals provided demographic and health information in order to assess the number of CVRF (overweight/obesity, hypertension, high cholesterol, diabetes). Participants also self-reported their autistic traits (Autism Quotient-28), depression symptoms (Patient Health Questionnaire, 9 item), and executive functions in the domains of inhibitory control and emotional regulation (Barkley Deficits in Executive Functioning Scale).

**Results:** CVRF were common among middle-aged and older autistic people (Mean number CVRF=2), see Figure 1. Age was positively correlated with the number of CVRF ( $r=.183$ ,  $p<.001$ ) but not self-reported executive function. A negative correlation between age and depression symptoms was found ( $r=-.149$ ,  $p=.003$ ), indicating lower depression symptoms among older people.

Stepwise regressions were conducted to explore the variables that predicted depression symptoms (see Table 1). After accounting for the effects of age and sex assigned at birth, CVRF contributed to explaining a small but significant (1.6%,  $p=.004$ ) proportion of the variance in depression symptoms ( $F=6.82$ ,  $p<.001$ ). This pattern of results remained when autistic traits were included in the model. A final regression model examined the impact of executive function. Emotional regulation (unlike inhibitory control) explained a significant proportion of the variance in depression symptoms (24.2%,  $p<.001$ ), with CVRF and age also contributing to the model ( $F=50.06$ ,  $p<.001$ ).

**Conclusions:** CVRF are common among middle-aged and older autistic adults; in this sample autistic people reported CVRF more frequently than in the general population. As expected, CVRF increase with age in autism. CVRF explain a significant (albeit small) proportion of variance in depression symptoms. In this study, CVRF occur at high rates in middle-aged and older autistic adults but may not be as important a mechanism for developing depression as among typical older people. Among middle-aged and older autistic adults in this study, depression symptoms are primarily explained by executive function – specifically emotional regulation. Difficulties in emotional regulation have been linked with depression in many previous studies of neurotypical older adults. Further studies are required to examine the impact of CVRF on outcomes for autistic older people and to explore factors important for late-life depression.

**515.023 (Virtual Poster)** Effectiveness of a Peer Support Transportation Intervention Program for Individuals with Autism Spectrum Disorders

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**Background:** Transitional age youth and young adults with Autism Spectrum Disorders (ASD) often face serious transportation challenges that impede healthcare access, community participation, and employment opportunities (Risser et al., 2015). Interventions to support travel skills, which makes use of one-on-one instruction, may help people with ASD overcome transportation barriers and increase community mobility. Peer support is identified as an effective mediator when implementing interventions for people with ASD (Chan et al., 2009). Peer support interventions are founded on the concept that someone with lived experience can best understand the unique perspective of the individual while increasing the acceptability and feasibility of an intervention.

**Objectives:** The objective of this study was to examine the impact of a peer support intervention on the travel skills and individualized community mobility goals of youth and young adults with ASD.

**Methods:** A quasi-experimental pre-test post-test design was used to evaluate travel skills before and after a travel training intervention delivered through peer support. Thirty-eight transitional age youth and young adults with ASD aged 16-27 were recruited through local service agencies to participate in an eight-step plan for teaching independent travel on public transit (Kennedy Center, 2021). The program was delivered using certified Peer Support Specialists who were individuals with ASD. Pre and post-test data were collected on the Progressive Evaluation of Travel Skills (PETS) and individualized Goal Attainment Scaling (GAS), as well as mode(s) of public transportation used, purpose of use, and number of training sessions collected. Qualitative and quantitative data was collected on feasibility and acceptability of the intervention. Quantitative analysis included both descriptive statistics and paired sample t-tests. Qualitative data was coded into themes using a grounded theory approach.



**Results:** Participants made substantial gains on the competencies needed for independent travel. Paired t-tests were conducted to examine the differences between the baseline and follow-up scores on the GAS and the PETS measures. There were large, statistically significant increases on the GAS ( $t(df=32) = 26.12$ ;  $p < .0001$ ) and the Travel Skills measure ( $t(df=35) = 10.56$ ;  $p < .0001$ ). Feasibility data identified that 98% of all data was collected and there were no drop-outs in the study. Qualitative themes identified strong acceptability for peer support and individualized community mobility goals.

**Conclusions:** Effective interventions for youth and young adults with ASD to improve independent transportation use are essential for access to healthcare, community participation, and employment. The results of this study provide preliminary support for the use of a structured and comprehensive travel intervention program delivered using peer support to improve overall travel skills needed for public transportation. Further research is needed using experimental designs, larger sample sizes, and broader outcomes.

**515.024 (Virtual Poster) How Have Participation Outcomes of Autistic Young Adults Been Measured? a Scoping Review**

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**Background:** Participation has been identified as an important overall indicator of the impact of services, treatments, and supports provided to autistic individuals. However, autistic young adults are reported to experience challenges participating in the workforce, post-secondary schooling, and living in the community. Evidence from multiple fields of inquiry has shown that gains in skills or alleviation of impairments often do not correspond to improved participation. Thus, participation must be examined directly in order to determine the overall impact of services, treatments, and supports provided to individuals with disabilities.

**Objectives:** This scoping review was undertaken to examine how participation outcomes have been measured in young adults on the autism spectrum. The purpose of this scoping review was to identify aspects of participation in need of further study and measurement issues that may be limiting our understanding of participation outcomes for autistic young adults.

**Methods:** A total of 113 articles employing quantitative methodology to capture participation in autistic young adults were identified through a search of six databases and citation tracking. Using a previously published model of participation from the literature, two reviewers extracted data for each measure of participation that was identified in the selected articles.

**Results:** Study participants in the included articles were from 14 countries, with the majority from the USA (58%), followed by the UK (9%) and Australia (7%). Studies that employed measures of participation for autistic young adults reported participant details inconsistently, often neglecting to provide data on co-occurring conditions or race and ethnicity. Although there was some breadth to the diversity of life situations examined, there was limited depth in how participation life situations was captured. Twenty-nine percent of measures were simple dichotomous outcomes (e.g., has at least one friend vs. does not), and 58% of measures captured only the presence or absence of an occurrence (e.g., employed full time, employed part time, unemployed). Only 15 of the measures we identified were pre-existing measures; accordingly, psychometric support for measures were rarely reported (6.5%).

**Conclusions:** Over the past 10 years, there has been a significant increase in studies examining participation outcomes of autistic young adults, which are building a more detailed picture of the young adults' engagement in important life roles and situations. However, there are a number of areas where refinement of measures or application of alternative approaches would greatly enhance the quality of information obtained and help distinguish meaningful variations in participation outcomes. Addressing these short-comings would support efforts to provide services that enhance autistic young adults' access to opportunities and their experience of participation in their communities.

**515.025 (Virtual Poster) Internalizing Symptoms in Autistic Young Adults: The Role of Emotion Regulation**

**S. A. Lehman<sup>1</sup>**, **E. J. Adler<sup>1</sup>**, **H. K. Schiltz<sup>2</sup>**, **A. D. Haendel<sup>2</sup>**, **M. Carlson<sup>3</sup>**, **N. S. Gordon<sup>1</sup>** and **A. V. Van Hecke<sup>1</sup>**, (1)*Psychology, Marquette University, Milwaukee, WI*, (2)*Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI*, (3)*Education, Marquette University, Milwaukee, WI*

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**Background:** Autistic people are at heightened risk for experiencing co-occurring mental illness (Simonoff et al., 2008), particularly internalizing disorders (depression and anxiety) (Joshi et al., 2012). Emerging evidence points to emotion regulation strategies (e.g., cognitive reappraisal and emotion suppression) as a key factors to explicating this phenomenon. Prior research has focused primarily on anxiety in autistic adolescents (Cai et al., 2018; Rieffe et al., 2011), with less emphasis on emotion regulation and *depression*, or the extent to which these relationships continue into *young adulthood*; a critical transition period associated with decreased access to age-appropriate services, and slowed progress in the improvement of internalizing symptoms (Tantam 2003; Taylor & Seltzer, 2010).

**Objectives:** The present study explores 1) whether emotion suppression is predictive of increased internalizing symptoms and 2) whether cognitive reappraisal is predictive of decreased internalizing symptoms in a sample of autistic young adults.

**Methods:** 64 autistic young adults ages 17-29 ( $M = 20.11$ ; 17.2% female) completed self-report measures assessing symptoms of depression (BDI; Beck et al., 1988), symptoms of social anxiety (LSAS; Fresco et al., 2001), and uses of specific emotion regulation strategies (cognitive reappraisal and emotion suppression) (ERQ; Gross & John, 2003). Autism diagnoses were confirmed using the ADOS-G (Lord et al., 2002) and IQ information was obtained using the KBIT (Brian & Jaspers, 2010). IQ among the sample was  $\geq 70$ . SPSS version 27 was used for analysis.

Results: Bivariate Pearson correlations indicated greater use of emotion suppression was significantly associated with increased depressive symptoms ( $r(64) = 0.255, p < .05$ ), and increased anxiety symptoms ( $r(64) = 0.365, p < .01$ ). Cognitive reappraisal was not significantly correlated with either depressive ( $r(64) = -0.194, p > .05$ ) or anxiety symptoms ( $r(64) = -0.223, p > .05$ ). Using two linear regression models, emotion suppression and cognitive reappraisal accounted for 14.2% of the variance in depressive symptoms ( $F(2, 61) = 5.042, p < .01, R^2 = 0.142$ ) and 24.8% of the variance in anxiety symptoms ( $F(2, 61) = 10.059, p < .01, R^2 = 0.248$ ). Use of emotion suppression ( $\beta_1 = 0.336, p < .01$ ) and cognitive reappraisal ( $\beta_2 = -0.289, p < .05$ ) were both significant predictors of depression, using a two tailed test  $\alpha = 0.05$ . Use of emotion suppression ( $\beta_1 = 0.464, p < .01$ ) and cognitive reappraisal ( $\beta_2 = -0.353, p < .01$ ) were also both significant predictors of anxiety, using a two tailed test  $\alpha = 0.05$ .

Conclusions: This study underscores the role of emotion regulation in the manifestation of internalizing symptoms in autistic young adults. These findings indicate that greater usage of emotion suppression and less usage of cognitive reappraisal are predictive of increased symptomatology for both depression and anxiety. These findings expand upon the current literature by exploring a range of internalizing symptoms in relation to emotion regulation during the critical transition period of young adulthood. This research aids in the development of more targeted treatments to better support autistic young adults during this pivotal time.

**515.026** (Virtual Poster) Language and Social Cognitive Profiles of 7 Autistic Bilingual Adults Who Were Minimally-Speaking in Childhood  
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Background: Bilingualism, an increasingly common experience in our hypermobile and multicultural society, has been demonstrated to have positive language and cognitive effects in autistic and non-autistic people alike. However, data available with the autistic population mostly focuses on children, and almost exclusively represents speaking people. As around 40% of autistic children are non- or minimally-speaking, it is essential to better understand the developmental trajectory of autistic bilingual people who were non- or minimally-speaking in childhood.

Objectives: This multiple case study seeks to explore the language and social-cognitive profiles of bilingual autistic adults who self-reported being non- or minimally-verbal in childhood.

Methods: This is an exploratory secondary descriptive data analysis of 7 autistic bilingual adults (overall group  $n=39$ ), who self-reported being non- or minimally-verbal in childhood. Measures included a Demographic & Language Questionnaire, the Wechsler Abbreviated Scale of Intelligence 2nd Edition, and the Adult-Theory of Mind-extended test. The 7 participants were UK residents, but were born in different countries around the world (located in Asia, Africa, Europe, North and South America, and Oceania).

Results: The seven participants were aged 24-61 years ( $M=44, SD=14.9$ ), with an age at autism diagnosis of 3- 56 years ( $M=29, SD=21.6$ ), and a mean non-verbal IQ (Perceptual Reasoning Index) of 113.9 ( $SD=4.3, 107-121$ ). Visual representation (Figure 1) of their language profiles (i.e. proficiency in their languages) and cognitive skills (i.e. non-verbal IQ and sociocognitive skills) showed they did not differ from their autistic bilingual peers who were verbal in childhood ( $n=32$ ).

Conclusions:

This study is the first to explore the language profiles of bilingual autistic adults who were non- or minimally-verbal in childhood. It revealed diversity in the language and social-cognitive skills and profiles of autistic people, whether or not the development of their expressive language skills followed a typical trajectory in childhood.

The late age of diagnosis of some of the participants despite their expressive language skills in childhood could be linked with the discrepancies in diagnosis practices across time and countries of birth. Indeed, while autism recognition has significantly increased over the past decades in most high-income countries, there are still delays in many lower-income countries.

This study supports the literature regarding the ability of autistic people to learn multiple languages, and seeks to provide a basis for more research and changes in clinical practice.

**515.027** (Virtual Poster) The Influence of Bilingualism on Cognitive and Affective Perspective-Taking Abilities in Autistic and Neurotypical Adults  
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Background: Research in neurotypical children found a positive influence of bilingualism on cognitive perspective-taking. However, findings in adulthood are inconsistent, potentially due to varying binary definitions of bilingualism. Crucially, an understanding of the sociocognitive influence of bilingualism in autism is still lacking, especially regarding perspective-taking, a recognized source of challenge for autistic people.

Objectives: This study aims to describe the influence of bilingualism on cognitive and affective perspective-taking skills in autistic and neurotypical adults, focusing on whether the sociocognitive influence of bilingualism is similar across neurotypes.

Methods:

We recruited 39 autistic and 96 neurotypical adults living in the U.K., who knew more than one language. Participants completed a language history and demographics questionnaire, an executive function task, a non-verbal IQ test (Perceptual Reasoning Index - PRI), and the Adult-Theory of Mind – extended (AToMe) task.

The AToMe involved 6 social videos each followed by 5 questions (general, level 2 cognitive and affective, level 1 cognitive and affective), and 6 control videos, each followed by a non-social question. The videos lasted 30 to 60 sec, and participants had 30 sec to answer each question orally. Answers were scored 0, 1, or 2 points by two coders, based on their accuracy. Points were summed to obtain the following 9 scores: Control, Overall Social, General, Cognitive, Affective, Cognitive Level 1, Cognitive Level 2, Affective Level 1, Affective Level 2. Further details are available at <https://osf.io/vjfnh>.

Stepwise multiple linear regressions were conducted on each AToMe outcome score, independently between autistic and neurotypical participants, to identify their more influential predictors from bilingualism (number of languages, age of acquisition (AoA) and proficiency of the 2<sup>nd</sup> language (L2), language switching habits) and control (age, PRI, sustained attention, switching, inhibition) variables.

#### Results:

Autistic participants (41% female, mean age = 33.2 years, mean PRI = 119.8) had a wide range of AoA (i.e. L2 AoA: 0 to 58 years, M = 7.5 years, SD = 6) and proficiencies in all their languages.

Neurotypical participants (72% female, mean age = 28.5 years, mean PRI = 109.2) had a wide range of language profiles (i.e. L2 AoA: 0 to 14 years, M = 4.7 years, SD = 3.7) as well.

Across the final regression models (except the control score), the bilingualism variable consistently selected was L2 AoA, negatively predicting perspective-taking scores above and beyond the other control variables.

#### Conclusions:

This study is the first to chart the influence of bilingualism on the cognitive and affective perspective-taking skills of autistic adults. It describes a long-lasting developmental stimulating influence of early bilingualism on social cognition in autistic and neurotypical adults alike, above and beyond the role of other individual differences such as non-verbal IQ or executive skills.

This deepens our understanding of the ability of the developing autistic mind to approach and respond to language learning, in terms of non-linguistic social processes. This contributes to an evidence base to support autistic people in their language learning journey.

#### **515.028** (Virtual Poster) Predictors of Sustainable Autism Employment: An 8-Year Longitudinal Study.

**S. M. Bury<sup>1</sup>, S. Begeer<sup>2</sup>, D. Hedley<sup>3</sup>, X. Li<sup>4</sup>, M. Uljarevic<sup>5</sup> and M. A. Stokes<sup>6</sup>,** (1)Olga Tennison Autism Research Centre, School of Psychology and Public Health, La Trobe University, Melbourne, VIC, Australia, (2)VU University Amsterdam, Amsterdam, Netherlands, (3)Olga Tennison Autism Research Centre, La Trobe University OTARC, Melbourne, VIC, Australia, (4)La Trobe University, Melbourne, VIC, Australia, (5)School of Psychological Sciences, University of Melbourne, Stanford, CA, Australia, (6)Deakin University, Burwood, VIC, Australia

Background: Autistic individuals are significantly underrepresented in employment, with low employment rates across the globe (Australian Bureau of Statistics, 2019, Roux et al., 2017; Zwicker et al., 2017), however, around one quarter of autistic individuals achieve good employment outcomes (Hedley et al., 2019; Howlin et al., 2004). Thus, much is to be gained from understanding what factors lead to some individuals having better employment outcomes than others. Previous research suggests household income, gender, parental and individual education level, as well positive parental attitude to employment (Chiang et al, 2013; Ohl et al., 2017, Holwerda et al., 2013) predict employment for autistic people. However, previous studies tend to have small samples or are cross-sectional. Firm findings in large, well-characterized, longitudinal cohorts are essential in order to better understand the underlying mechanisms and predictors of sustainable autism employment (Hedley et al., 2019, Howlin, 2000).

Objectives: The present study aimed to capitalize on the availability of a large longitudinal cohort with comprehensive participant characterization to identify factors that predict changes in employment status of autistic people over time.

Methods: Participants were 2449 adults (1077 men, 1352 women, 20 other) with a mean age of 42.25 years ( $SD=14.24$ ) at their most recent wave, recruited through the Netherlands Autism Register (NAR) – an annual online survey recruiting autistic adults, parents, and legal representatives. Data represents eight annual waves (2013-2021), with participants with a reported autism diagnosis aged 16 years and above included in the study. Participants indicated involvement in 18 daily activities (Table 1), from this an employment score was calculated (0 = no reported employment, 1 = reported employment). Mixed-effects multinomial logistic regression models (MMLR) were used to investigate the impact of fixed factors (i.e., Autism Quotient [AQ]), age, gender, age of diagnosis, parent and participant highest education, importance of employment to parents, co-occurring conditions, urbanicity) and time variant factors (i.e., household income, presence of coaching) on employment status.

Results: Table 1 shows the frequencies of participation in 18 daily activities, with chi-square suggesting that overall reports of participation in more structured daily activities (e.g., employment) remain relatively stable over time, with greater variability in less structured activities (e.g., hobbies). However, the Sankey plot (Figure 1) shows significant transition between employment status across time. MMLR models were carried out to explore the potential factors related to the employment/unemployment transitions. After coding changes in employment status between waves to different transitions (-1 = transition to unemployment; 0 = no change in employment status; 1 = transition to employment), any related factors were put into

the model. After dropping all the non-significant variables ( $p > 0.05$ ) step by step, five variables were found significant in the final model (age, urbanicity, importance of work for parents, guidance/coaching, time) using *transition to unemployment* as reference level.

Conclusions: Despite consistent overall levels of structured daily activities across time, employment status changed for participants across waves. While analysis is ongoing, current results suggest that age, urbanicity, importance of work for parents, guidance/coaching and time are predictors of employment status over time.

#### **515.029** (Virtual Poster) Sensory Sensitivity and Sexual Motivation in Autistic Adults

**A. B. Choi<sup>1</sup>**, **N. Nadwodny<sup>1</sup>**, **D. Thakkar<sup>1</sup>**, **D. W. Pantalone<sup>2</sup>** and **S. Faja<sup>1</sup>**, (1)Boston Children's Hospital, Boston, MA, (2)Psychology, University of Massachusetts Boston, Boston, MA

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##### Background:

Many autistic people are interested in romantic and sexual relationships. One potentially critical factor influencing motivations for dating and sex is sensory sensitivity, which is common in individuals with autism spectrum disorder (ASD). A growing number of qualitative studies have described how sensory features potentially affect romantic and sexual experiences and interests of autistic individuals (Gray et al., 2021; Lewis et al., 2020). However, we could identify no studies examining whether, and to what extent sensory sensitivity relates to sexual motivation and self-efficacy in romantic relationships of autistic individuals.

##### Objectives:

Using a quantitative approach, this work aims to determine whether and to what extent sensory features of ASD are related to sexual motivation and self-efficacy in romantic relationships of autistic adults.

##### Methods:

Data were collected as part in an ongoing study to examine motivation, knowledge, and behavior concerning dating experiences and sexual health of adults with ASD (age: 18-26 years). Sensory sensitivity was measured using the Glasgow Sensory Questionnaire (GSQ), which has seven subscales: visual, auditory, gustatory, olfactory, tactile, vestibular, and proprioceptive (Robertson & Simmons, 2013). Sexual motivation for dyadic and solitary activities was assessed based on the Sexual Desire Inventory (Spector et al., 1998). Relationship self-efficacy was measured using the Self-efficacy in Romantic Relationships (Riggio et al., 2011). For this preliminary data analysis, data were included from 14 participants (8 male, 6 female) who completed all three questionnaires.

##### Results:

Pearson correlations indicated that the total sensory score on the GSQ was significantly, negatively correlated with dyadic sexual desire ( $r = -.585$ ,  $p = .028$ ), but not solitary sexual desire. To determine whether any GSQ specific subscales were driving the significant correlation with dyadic sexual desire, we ran separate Pearson correlations for each GSQ subscale. Results showed that the sensory scores on the tactile and gustatory subscales were significantly, negatively correlated with dyadic sexual desire (tactile:  $r = -.695$ ,  $p = .006$ ; gustatory:  $r = -.728$ ,  $p = .003$ ). In addition, the total sensory score was negatively, yet non-significantly, related to self-efficacy in romantic relationships ( $r = -.38$ ,  $p = .16$ ).

##### Conclusions:

These results suggest that autistic adults, who experience higher frequencies of difficulties to sensory stimuli, report lower desire for dyadic sexual activities and potentially lower self-efficacy in romantic relationships. With more data to be collected in our ongoing study, findings of this work have the potential to add to the growing evidence suggesting that ASD-specific features (e.g., sensory sensitivity) affect sexual motivation and self-efficacy in adults with ASD. By uncovering what contributes to sexual motivation in autistic individuals, we can better identify ways to support autistic people to have fulfilling sexual relationships and healthy sexual behaviors.

#### **515.030** (Virtual Poster) We Need Less of That and More of This: Autistic Researchers on Autism Research

**S. C. Jones**, Australian Catholic University, Melbourne, VIC, Australia

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##### Background:

Autism research continues to expand exponentially; Google Scholar shows more than 60,000 papers were published in 2020, compared to 37,000 in 2010 and less than 8,000 in 2000. As autism awareness and research proliferates, the role of autistic people in autism research has evolved from a position of subjection, to participation, into collaboration. Despite these advances, the majority of autism research is conceptualized and conducted by non-autistic researchers.

##### Objectives:

The aim of this study was to explore autistic academics' perspectives on autism research, including their views on what constitutes potentially beneficial and/or harmful research. In addition, this study sought to investigate and collate ideas for future research agendas from autistic academics.

#### Methods:

This qualitative study involved autistic adults working in academia (n=29); including nine who had completed, and 11 who were completing, a doctorate. Participants completed a written reflection on autism research and data were entered into NVivo, coded and analysed inductively, identifying and grouping themes.

#### Results:

Autistic academics identified autism research aiming to establish the 'cause of' or 'cure for' autism as the most likely to be harmful, positioning autism as a fundamental flaw in the human genome that needs to be isolated and eradicated. Research attempting to 'fix' or 'train' autistic people to think or act like the neuro-majority was perceived as having more potential to do harm than good. Other approaches viewed as potentially harmful were research that positions autism as a deficit, pathologizing and stigmatizing autistic characteristics; and research that is non-participatory and does not take into account the perspectives and needs of autistic people.

Autistic academics highlighted autism research that seeks to improve the lives of autistic individuals regardless of age, through the identification of appropriate supports, as being the most beneficial.

This was followed by an appreciation for genuine participatory research that involves autistic people from inception to dissemination. Other topics of interest were addressing stereotypes and misperceptions, highlighting the strengths of autistic people, and managing common co-occurring conditions.

Areas of autism research noted as not inherently good or bad, but over-researched in comparison to other areas, included genetics, animal models and cognitive autism theories. Participants' suggestions regarding research areas that remain largely unexplored – and specific topics that could form part of an autism research agenda – will be outlined during the presentation.

#### Conclusions:

If autism research is striving to meaningfully improve autistic people's lives, non-autistic autism researchers must engage and collaborate with the autistic community to gauge their needs and priorities. Research questions posed by autistic academics are more likely to yield results that are valuable to autistic individuals, their families and wider communities. Autistic academics offer insights that integrate their lived experience and understanding of research methods. Developing a research agenda with 'real-world benefits' for autistic people is more likely to be successful if researchers establish ongoing collaborative relationships with autistic academics.

## Animal Models

### PANEL — ANIMAL MODELS

#### 218 - Sleepless in the Spectrum: Insight from Animal Models

**Panel Chair:** Lucia Peixoto, *Sleep and Performance Research Center, Washington State University, Spokane, WA*

**218.001** (Panel) Shank3 Modulates Sleep across Postnatal Development

**L. Peixoto**, *Sleep and Performance Research Center, Washington State University, Spokane, WA*

Background: Sleep problems are prevalent in Autism Spectrum Disorder (ASD), can be observed before diagnosis, and are associated with increased restricted and repetitive behaviors. Therefore, sleep abnormalities may be a core feature of the disorder. Given the conserved nature of mammalian sleep, mouse models provide a unique opportunity to understand sleep in ASD. Previously we showed that adult mice with a truncation in the high-confidence ASD gene *Shank3* (*Shank3<sup>ac</sup>*) recapitulate the clinical ASD sleep phenotype and are the only mouse model shown to recapitulate problems falling asleep frequently observed in ASD individuals. Sleep is important for brain development and its amount and regulation change considerably during the postnatal period. Nonetheless, sleep ontogenesis in ASD remains unexplored.

Objectives: The objective of this study was to use the *Shank3<sup>ac</sup>* mouse model to characterize, for the first time, the developmental trajectory of sleep from the early post-weaning period into adulthood.

Methods: In this study we used intra-cortical longitudinal electro-encephalographic (EEG) and electro-myographic (EMG) recordings to define changes in sleep amount, states, quality and response to sleep loss from weaning to young adulthood in an ASD mouse model.

**Results:** We show that Shank3<sup>ac</sup> mice sleep less overall throughout their lifespan and have increased rapid eye movement (REM) sleep early in life despite significantly reduced non-rapid eye movement (NREM) sleep. Mutants have abnormal responses to increased sleep pressure (sleepiness) that emerge during a specific developmental period. We show that the ability to fall asleep quickly in response to being sleepy develops normally between 24 and 30 days in mice (transition between 70% and 80 of maximal brain volume, 10-16 months in a human infant). Shank3<sup>ac</sup> mice are unable to achieve this developmental milestone and maintain an immature response to sleep loss regardless of age. This phenomenon seems independent of homeostatic NREM sleep slow-wave dynamics. Shank3<sup>ac</sup> mice also develop a progressive deterioration of NREM sleep spectral power (quality) starting at postnatal day 30.

**Conclusions:** Overall, our study recapitulates both preclinical models and clinical studies showing that reduced sleep is consistently associated with ASD and may be a core symptom of the disorder. Our study also suggests that problems falling asleep may reflect abnormal post-natal development of sleep and arousal mechanisms that could be amenable to early intervention.

<https://www.biorxiv.org/content/10.1101/2021.03.10.434728v2>

**218.002 (Panel) Translational Studies into Sleep Disturbance in Neurodevelopmental Disorders – of Mechanisms and Treatment Strategies**  
*M. Coll-Tané<sup>1</sup>, L. V. van Renssen<sup>1</sup>, N. N. Gong<sup>2</sup>, B. van Reijmersdal<sup>1</sup>, S. J. Belfer<sup>2</sup>, E. C. Kurtz-Nelson<sup>3</sup>, C. M. Hudac<sup>4</sup>, T. Nowakowski<sup>5</sup>, R. K. Earl<sup>1</sup>, S. Pillen<sup>6</sup>, E. E. Eichler<sup>7</sup>, M. S. Kayser<sup>7</sup>, T. Kleefstra<sup>1</sup> and A. Schenck<sup>1</sup>*, (1)Radboud university medical center, Nijmegen, Netherlands, (2)Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)Center for Youth Development and Intervention, Department of Psychology, University of Alabama, Seattle, AL, (5)University of California San Francisco, San Francisco, CA, (6)Kempenhaghe, Heeze, Netherlands, (7)Department of Genome Sciences, University of Washington, Seattle, WA

**Background:** Sleep disturbances in autism and related neurodevelopmental disorders are common and adversely affect quality of life in patients and families, yet the underlying mechanisms are understudied.

**Objectives:** Our research aims to establish a translational pipeline to characterize sleep defects in these disorders, dissect their origin, and identify treatment approaches.

**Methods:** We quantitatively assess sleep in individuals with neurodevelopmental syndromes and their preclinical models. To maximize our efficiency, we take advantage of the fruitfly *Drosophila* as a model organism.

**Results:** In a recent study, we found that individuals with mutations in *CHD8*, among the highest-confidence autism risk genes, or in *CHD7* suffer from disturbed sleep maintenance. These defects are recapitulated in *Drosophila* mutants affecting *kismet*, the sole *CHD8/CHD7* orthologue. We show that Kismet is required in glia, but not neurons, for early developmental and adult sleep architecture. This role localizes to subperineurial glia constituting the blood-brain barrier. Moreover, we show that glial loss of Kismet leads to hyperserotonemia, a well-established but genetically unsolved autism endophenotype. Using a number of pharmacological, thermogenetic and genetic approaches, we demonstrate that increased serotonin levels during development underlie Kismet's sleep problems. Importantly, we find that Kismet-related sleep defects, despite their developmental origin, can be reversed in adulthood by a behavioral regime resembling human sleep restriction therapy, the first line treatment for insomnia. I will present our ongoing efforts to translate our findings back to individuals with mutations in *CHD8* and *CHD7* and to move on to the next disorders.

**Conclusions:** This study provided fundamental insights into glial regulation of sleep and proposed a causal mechanistic link between the CHD8/CHD7/Kismet family, the blood-brain barrier glia, developmental hyperserotonemia, and autism-associated sleep disturbances. It provided proof of principle for the utility of our translational pipeline and a potentially widely applicable strategy to improve sleep in neurodevelopmental disorders.

**218.003 (Panel) Circadian Mechanisms As Bidirectional Modulators of Neurodevelopmental Disorders**  
*J. O. Lipton, Neurology, Boston Children's Hospital, Boston, MA*

**Background:** Dysfunction of sleep and circadian rhythms are among the most common manifestations of autism spectrum disorders like the Tuberous Sclerosis Complex but are poorly understood at the mechanistic level.

**Objectives:** To probe the mechanistic interactions between ASD and the circadian timekeeping, we have used animal and cellular models of the neurodevelopmental disorder (NDD) Tuberous Sclerosis Complex (TSC) to investigate fundamental biochemical, cell biological, and neurobiological connections between the mechanistic target of rapamycin (mTOR) signaling pathway and the circadian clock.

**Methods:** We used mouse and cellular models of TSC, cell biology, biochemistry, neurobiology, physiology, electron microscopy, and animal behavior

**Results:** TSC results from the unbridled activity of the mTOR signaling pathway, a crucial cellular arbiter of growth, stress responses, and metabolism. TSC models demonstrated abnormal circadian timekeeping at both cellular and behavioral levels. We attributed this finding to a biochemical dysregulation of the circadian clock protein BMAL1, an essential component of the timekeeping mechanism. Modulation of BMAL1 was capable of rescuing abnormal circadian behavior and other TSC-related phenotypes suggesting that the circadian clock is an important

downstream component of the TSC disease pathway. We will present our ongoing work linking BMAL1 to TSC-dependent protein synthesis in mammalian neurons and synaptic function

**Conclusions:** Our goal is to show how investigation of circadian timekeeping in models of a human NDD has disclosed fundamental bidirectional interactions between ASD-related mechanisms and biological timekeeping thereby nominating unexpected avenues toward mitigating NDDs.

**218.004 (Panel) Translational Modulation By Isrib Alleviates Synaptic and Behavioral Phenotypes in Fragile X Syndrome**

**P. Mourrain**, *Stanford University, Palo Alto, CA*

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**Background:** Fragile X syndrome (FXS) is caused by the functional loss of Fragile X mental retardation protein (FMRP), a translational regulator that binds the transcripts of many proteins involved in synaptic function and plasticity. Abnormal synaptic density and wiring are common defects observed across animal models of FXS, including drosophila, zebrafish, mice and rats. These synaptic phenotypes are observed early during development when sleep dominates and has a critical role on protein biosynthesis, synaptic connectivity, and normalization, suggesting an aggravating/causal role for sleep disruptions in the etiology of FXS.

**Objectives:** Dysregulated protein synthesis is a central effect of FMRP loss and to date direct translational modulation has not been leveraged in the treatment of FXS. Thus, we examined the effect of the novel small molecule translational modulator ISRIB in treating synaptic and behavioral symptoms of FXS.

**Methods:** Using a combination of innovative population-level single synapse analysis, *in vivo* two photon microscopy and behavioral analysis, we revealed a new mechanism for the appearance of dense and immature dendritic spines in human FXS patients and *Fmr1* knockout (KO) mice.

**Results:** Our data suggest that FMRP loss at the synapse dysregulates synaptic translational programs such that spines are disproportionately stabilized through increased PSD-95 expression but prevented from maturing through reduced synaptic accumulation of glutamate receptors. The translational modulator ISRIB rescues this molecular and synaptic deficit in FXS, which results in improved social behavior in *Fmr1* KO mice.

**Conclusions:** These findings highlight the novel therapeutic potential of targeting core translational mechanisms linking cellular and behavioral phenotypes in FXS and neurodevelopmental disorders more broadly. We debate these results in the context of sleep intervention to alleviate synaptic and behavioral deficits in genetic and idiopathic autism spectrum disorder.

**218.005 (Panel) Sleep in Dravet Syndrome: Insights from Preclinical Models**

**H. de la Iglesia**, *University of Washington, Seattle, WA*

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**Background:**

Dravet syndrome (DS) is an intractable epilepsy associated with autism spectrum disorder and caused by heterozygous loss-of-function mutations in the *SCN1A* gene coding for the Nav1.1 sodium channel, which is the primary voltage-gated sodium channel in GABAergic neurons throughout the brain. Clinical evidence suggests that daily sleep timing is disrupted in DS patients, but the neural basis for the sleep phenotype remains unknown.

**Objectives:**

Using the deletion of the *Scn1a* gene in mice, both in a global and a region-specific strategy, our first objective is to identify the neural basis of comorbidities of DS, including disordered sleep.

Because of the severe disruption of circadian rhythmicity in the global *Scn1a*<sup>-/-</sup> mice, a second objective of our work is to assess the effect of environmental changes that improve circadian rhythmicity on symptomatology of DS.

**Methods:**

We have used two transgenic mouse models for all our studies. First, a global *Scn1a*<sup>-/-</sup> mouse that represents a genocopy of DS and presents virtually all symptoms of the disease. Second, an *SCN1A*<sup>fl/fl</sup> mouse that we use to target the hetero- or homozygous mutation to different brain regions either through genetic crosses with Cre mouse lines or through injections of Cre-expressing viruses.

**Results:**

Our results have shown that the sleep disorder comorbidity in DS mouse emerges from deficits in both the circadian and homeostatic regulation of sleep. Furthermore, mice in which *Scn1a*<sup>-/-</sup> mutation is targeted to the forebrain but spares the suprachiasmatic nucleus—the site of a master circadian clock—exhibit the full repertoire of epileptic and autistic symptoms but relatively normal circadian rhythms. Complementary approaches that target the *Scn1a* deletion specifically to the suprachiasmatic nucleus fail to emulate the full array of circadian deficits observed in global *Scn1a*<sup>-/-</sup> mouse.

We have also shown that changes in the 24-h temporal structure of the environment, specifically an ambient temperature cycle superimposed to the light-dark cycle, improve circadian rhythmicity of *Scn1a*<sup>+/-</sup> mice. We are currently assessing if this treatment also leads to improvement on the core symptoms of DS, namely epilepsy and deficits in social behavior.

#### Conclusions:

Our studies show that the DS mouse represents a powerful model to understand the neural basis of different symptoms of the disease. Specifically, they demonstrate that the sleep disorder comorbidity in DS may be generated by decreased Nav1.1 channel activity in sleep regulatory centers, and not merely by seizure-related neural damage or sleep disruption. Together, our studies suggest that the sleep disorder phenotype could be treated independently, and in turn lead to improvement in core symptoms of DS.

## PANEL — ANIMAL MODELS

### 220 - Translational Models for Autism Spectrum Disorders (ASD) and Neurodevelopmental Disorders (NDDs)

**Panel Chair:** Jill Silverman, *Department of Psychiatry and Behavioral Sciences, UC Davis MIND Institute, Sacramento, CA*

**220.001 (Panel)** Neural Circuitry of Social Play: Involvement of Oxytocin and Vasopressin

**A. Veenema**, *Michigan State University, E Lansing, MI*

**Background:** Playing with peers in children and young animals is essential for the development of lifelong social competence and social skills. Children with autism spectrum disorder (ASD) have difficulties with this social play which contributes to their lifelong social dysfunction. ASD is more prevalent in males than in females, suggesting sex differences in the etiology of ASD.

**Objectives:** Developing effective means to restore social play in ASD children is expected to improve their lifelong social functioning, but this requires understanding of the neural basis of social play and potential sex differences herein.

**Methods:** In this talk I will discuss the neurobiological mechanisms driving social play behavior with specific emphasis on the involvement of the neuropeptides vasopressin and oxytocin.

**Results:** Our research demonstrates that vasopressin originating in the medial amygdala and bed nucleus of the stria terminalis and acting on vasopressin 1a receptors in the lateral septum and ventral pallidum has opposing effects on the expression of social play behavior in male and female juvenile rats. We further demonstrated that oxytocin originating in the paraventricular nucleus and acting on oxytocin receptors in the nucleus accumbens facilitates social play behavior in both sexes, but it more potent in males than in females.

**Conclusions:** These findings may have implications for the sex-specific use of therapeutic drugs targeting the vasopressin and/or oxytocin systems in aiming to improve social play engagement in ASD children.

**220.002 (Panel)** Advancing Research in Gastrointestinal Dysfunction in People with Neurodevelopmental Disorders

**M. Gareau**, *University of California Davis, Davis, CA*

**Background:** The role of the microbiota-gut-brain (MGB) axis in maintaining overall health and well-being is now well established. Host-microbe interactions are paramount for maintaining normal physiology, including the brain and behavior. Stress, bacterial infection, and inflammation all detrimentally impact host-microbe interactions in the gastrointestinal (GI) tract causing gut dysbiosis and pathophysiology. Cognitive deficits occur in (1) germ-free (GF) conditions (2) following oral antibiotic (Abx) administration or (3) after infection with enteric bacterial pathogens, suggesting a critical role for the gut microbiota in regulating behavior. Nevertheless, mechanisms by which gut microbes communicate with the brain, impacting a wide variety of behaviors are poorly understood. Since colonization by the gut microbiota begins at birth, and maturation of the GI tract and brain development continue during neonatal life, identifying pathways of establishment of communication between these organs during development is critical to maintaining health across the lifespan. GI complications in children and adults with neurodevelopmental disorders (NDDs) have drawn attention to gaps in understanding their causes and treatment. GI dysfunction is particularly common in individuals with autism spectrum disorder (ASD), Phelan-McDermid and Rett syndromes. GI disorders in these conditions can include GI malformations present at birth (such as pyloric stenosis or Hirschsprung disease) but also functional issues such as feeding problems, gastro-esophageal reflux disease (GERD), cyclic vomiting, delayed gastric emptying, diarrhea, bloating, and constipation leading to incontinence, and stool impaction. These GI issues may be associated with severe nutritional deficiencies, weight loss, failure to thrive and lack of seizure control. Unfortunately, mechanisms to accurately diagnose GI conditions in specific rare genetic NDDs are limited, and tailored treatments to address them are nonexistent, since clinical trials are rare, to date.

**Objectives:** Describe GI pathophysiology and behavioral impacts following dysbiosis of the gut microbiota in neonatal mice and identifying mechanisms of gut-brain communication.

**Methods:** Neonatal mouse models of gut dysbiosis including infection with an enteric bacterial pathogen and antibiotic administration. Ussing chambers are used to assess GI physiology and 16S sequencing of the gut microbiota is used to determine dysbiosis.



**Results:** Infection with a bacterial pathogen and administration of antibiotics in neonatal mice both result in significant dysbiosis of the gut microbiota, which persists into adulthood and is coupled with altered GI physiology and behavioral impairments including cognitive deficits.

**Conclusions:** Disruption of colonization of the gut microbiota in neonatal life can lead to persistent impairments in gut-brain communication into adulthood in mice, although precise mechanisms of action need to be determined in future studies. Identification of these mechanisms would allow better treatment of GI symptoms in NDD patients and may improve behavioral impairments.

**220.003 (Panel)** Development of a Rhesus Monkey Model of Naturally Occurring Social Impairment  
**K. J. Parker, Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA**

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**Background:** Autism spectrum disorder (ASD) is a poorly understood brain disorder of early childhood onset. There are no laboratory-based diagnostic tests to detect ASD, nor are there any disease-modifying medications that effectively treat ASD's core behavioral symptoms. Scientific progress in identifying robust ASD biomarkers and therapeutic targets has been impeded, in part, by overreliance on model organisms that fundamentally lack the sophisticated social and cognitive abilities essential for modeling ASD. We therefore saw significant value in studying naturally low-social rhesus monkeys to model human social impairment, taking advantage of a large outdoor-housed colony for behavioral screening, biomarker identification, and pharmacological testing.

**Objectives:** This talk will describe key criteria for developing a valid animal model and will discuss behavioral, biomarker, and pharmacological findings from low-social rhesus monkeys and people with ASD.

**Methods:** We optimized an ASD screening tool to facilitate rapid identification of socially impaired rhesus monkeys, performed targeted biomarker discovery for low sociality, and tested the efficacy of a medication to improve social cognition abilities in low-social rhesus monkeys. We next used this preclinical information to evaluate putative biomarkers in three ASD case-control cohorts, and performed a pharmacological treatment trial in children with ASD.

**Results:** Careful development and validation of our animal model, combined with a strong commitment to evaluating the translational utility of our preclinical findings directly in people with ASD, yielded a robust neurochemical marker (cerebrospinal fluid vasopressin concentration) of trans-primate social impairment and a medication (intranasal vasopressin) that improved social abilities in low-social monkeys and in a small pediatric ASD cohort.

**Conclusions:** This unique translational research approach has enabled us to move fluidly and bidirectionally across preclinical and clinical research components, to deliver advances in ASD detection and treatment, in a manner not readily achievable with existing animal models. Findings from this research program suggest that vasopressin concentration may be useful for detecting ASD (either alone or in combination with other neurochemical measurements), and that intranasal vasopressin may hold promise for treating ASD's core features.

**220.004 (Panel)** Reconsidering Animal Models Used to Study Autism Spectrum Disorder: Optimizing for Successful Translation  
**J. L. Silverman, Department of Psychiatry and Behavioral Sciences, UC Davis MIND Institute, Sacramento, CA**

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**Background:** Findings from a workshop held by the Autism Science Foundation on Neurodevelopmental disorders (NDDs), including autism spectrum disorder (ASD) and intellectual disability (ID) will be disseminated by Dr. Silverman. Our workshop goal was to highlight strengths and weaknesses in current behavioral approaches to animal modeling of ASD, since with no established biological markers, diagnoses are still solely defined by behavioral criteria. Thus, preclinical *in vivo* animal models of NDDs must be optimally utilized.

**Objectives:** To identify the maximal utility of construct and/or face validity. To provide recommendations for phenotyping animal models. To offer guidelines on how *in vivo* models should be used and reported reliably and rigorously while acknowledging their limitations.

**Methods:** We utilized a tailored literature review and summary of discussion over a two-day workshop and highlighted areas on which the experts agreed.

**Results:** We concluded by recommending minimal criteria for reporting in manuscripts going forward. Dr. Silverman will also discuss examples of behavioral and biomarker assessments that meet these more stringent criteria, recommended from the workshop, being applied in her laboratory using a variety of genetic mouse and rat models of NDDs. Tasks include fine grained assessments of motor skills, various cognitive touchscreen assays with and without co-occurring EEG signatures. EEG and whole-body plethysmography to measure brain seizures, sleep stages and signatures, apneas and respiration during sleep.

**Conclusions:** We ask that attention be paid to minimum reporting requirements. These include: type and description of behavioral test used, sample sizes, statistical tests, utilization of more than one measure of core behaviors, reporting of background strains, and, above all, constant collaboration with behavioral neuroscientists, who are trained not only to design but also to help interpret the results and suggest further experiments before premature publication. We also agreed on the above sample outcomes as translatable between preclinical models and human studies, making these indices extremely useful in a clinical trial.

**401.001** (Poster) Chronic Effects of Manipulating Dietary Tryptophan on Social Preferences and Central Serotonin Neurotransmission in Male Mice  
**G. G. Gould**, *Cellular & Integrative Physiology, The University of Texas Health Science Center at San Antonio, San Antonio, TX*

**Background:** Social interaction deficits are a prominent core symptom of autism spectrum disorders (ASD). Few pharmacological interventions effectively ameliorate these deficits for the majority of affected individuals. Clinical and basic research indicates serotonin (5-HT) system dysfunction, including excessively high or low 5-HT availability in brain, may contribute to the etiology of some forms of autism and underlie social deficits. This led to the hypothesis that altering dietary tryptophan (Trp), the essential amino acid precursor of 5-HT, could improve sociability by modulating serotonergic tone. In a prior acute study, 24 h of enhanced dietary Trp increased social interaction preferences of adult male BTBR T<sup>+</sup>/Itpr3<sup>+</sup>/J (BTBR) mice. To clarify how dietary Trp influences brain 5-HT and sociability chronically, in this study adult male mouse dietary Trp was manipulated in three inbred strains with different social preferences for a month to show behavioral and brain 5-HT<sub>1B</sub> receptor and 5-HT transporter (SERT) effects.

**Objectives:** To establish chronic modulatory effects of dietary Trp content on social preferences and on serotonin transporter (SERT) and brain 5-HT<sub>1B</sub> receptor (R) expression via quantitative autoradiography.

**Methods:** Eight litters each of BTBR, 129S1/SvImJ (129S) and C57BL6/J (C57) were bred for this study. To control for litter effects and reduce cage-mate fighting, at weaning littermate males were placed in different cages so litters were spread across three treatment groups with 8-9 mice per group. Sample size was determined by a-priori Power analysis. At 64 weeks old mice were administered open source purified custom diets (Research Diets, New Brunswick, NJ) containing either 0 g/kg Trp (Trp depleted), 2.1 g/kg Trp (control) or 12.6 g/kg Trp (1% Trp supplement) for 28 days. Mice were weighed and diets refreshed weekly. Social interaction and novelty preference was measured six at a time in three chamber test arenas under low (16 lx) red light with novel 129S males used as strangers for BTBR and C57 tests and novel BTBR used as strangers for 129S tests. Mice were euthanized after tests and blood and brain were collected for serum corticosterone and oxytocin measurements by enzyme-linked immunosorbent assays, and cortical 5-HT levels, SERT and 5-HT<sub>1B</sub>R density measurements by autoradiography. Data were analyzed for each strain by analysis of variance and Sidak's post-hoc tests.

**Results:** In BTBR mice typically lacking social interaction preference, Trp depleted diet improved social interaction preference ( $F(2, 22) = 5.6, P = 0.01$ ) relative to control diet. No other Trp diet-induced changes in social interaction preference occurred in socially deficient 129S mice ( $F(2, 27) = 2.0, P = 0.16$ ) or in gregarious C57 mice ( $F(2, 27) = 2.0, P = 0.16$ ). TRP-depleted mice lost weight, despite high to normal food consumption. Serum corticosterone and oxytocin, and 5-HT<sub>1B</sub>R density in frontal cortex were higher in Trp depleted BTBR, while SERT density was 20% reduced versus BTBR controls.

**Conclusions:** While no chronic diet treatments worsened social behaviors, only Trp depletion was able to improve BTBR social interaction preference. This corresponded with increased serum hormones, 5-HT<sub>1B</sub> expression and global reduction in brain SERT and body weight.

**401.002** (Poster) Distinct Patterns of Cerebellar-Cerebral Structural Correlation Differences Are Present in ASD Mouse Model Clusters  
**F. Morgado<sup>1</sup>, C. Hammill<sup>1</sup>, J. Ellegood<sup>2</sup> and J. P. Lerch<sup>1</sup>**, (1)University of Toronto, Toronto, ON, Canada, (2)The Hospital for Sick Children, Toronto, ON, Canada, (3)Mouse Imaging Centre, The Hospital for Sick Children, Toronto, ON, Canada, (4)Wellcome Centre for Integrative Neuroimaging (WIN), University of Oxford, Oxford, ON, United Kingdom

**Background:**

The cerebellum is a locus of regulation for motor, vestibular, and cognitive processes. Multiple genes strongly associated with autism spectrum disorder (ASD) have elevated expression in the cerebellum (Menashe et al 2013; Wilsey et al. 2013). Mouse models allow us to probe the structural and functional effects of mutations in these ASD-associated genes. For instance, changes in regional brain volume correlations in mutant (MUT) mice relative to wild-type (WT) controls can provide insight into underlying brain connectivity differences spurred by mutations (Yee et al. 2018). Given the polygenic nature of ASD's etiology, comparing structural correlation differences between ASD mouse models may provide key insights into which ensembles of genes may be responsible for certain brain connectivity differences in ASD.

**Objectives:**

To characterize cerebellar-cerebral structural correlation differences in a wide range of ASD mouse models and determine which models are phenotypically similar.

**Methods:**

4563 mice were imaged on a 7-Tesla MRI scanner with a T2-weighted sequence. After excluding non-ASD models, models without publication permission, and scans that failed imaging registration quality control, 2115 mice remained (758 female, 81 models). A 40um isotropic atlas with 52 cerebellar and cerebral structures (Steadman et al. 2014) was registered to the scans using ANTS (Avants et al., 2010). Sex and brain volume were regressed out of normalized volumes. Study-wise differences in WT mice were also regressed against volumes, and the fitted parameters were used

to calculate residual volumes across all mice. Pearson correlation matrices were calculated separately for each model's MUT and WT mice, and MUT-WT correlation differences were calculated using Fisher's transformation and degrees-of-freedom correction.

Using protein expression data from the Allen Brain Institute, mouse models were clustered together if normalized expression in the cerebellum was at least two-fold greater than in other regions. A second cluster was derived for enrichment in the cerebrum. "Negative control" clusters of models with low cerebellar or cerebral protein expression were also analyzed. Regions were tested for enrichment among statistically significant correlation differences (False Discovery Rate-corrected  $P < 0.05$ ) using Fisher's Exact Test. To investigate broader patterns, analysis was repeated at a coarser parcellation (anterior, posterior, or flocculonodular cerebellar lobe, and sensorimotor or supramodal cerebrum).

#### Results:

Across mouse model clusters, mutant mice exhibited reduced cerebellar-cerebral volume correlations relative to wild-types (Figure 1A). Figures 1B and 1C show the negative-log probability of each brain region contributing by chance to more  $P_{FDR} < 0.05$  correlation differences than observed. In the ABI cerebellum enrichment cluster (Nhs (-/-), Chd7 (+/-), Nexmif (-/-)), most significant correlation differences involved the posterior cerebellum ( $P_{Fisher} = 4.11 \times 10^{-4}$ ) and supramodal cerebrum ( $P_{Fisher} = 0.012$ ). Lobule VII, Crus 2, prelimbic cortex, agranular insula, and the frontal pole regions were over-represented in significant correlation differences ( $P_{Fisher} < 0.05$ ). In the cerebrum enrichment cluster, vermis X ( $P_{Fisher} = 4.01 \times 10^{-8}$ ) and right primary sensory cortex ( $P_{Fisher} = 0.045$ ) were over-represented.  $P_{Fisher} > 0.10$  for all regions in the negative control clusters.

#### Conclusions:

Mutations in ASD-associated genes expressed locally in the cerebellum induce cerebellar-cerebral structural correlation differences, particularly between the posterior cerebellum and supramodal isocortex.

#### **401.003 (Poster)** Early Life Antibiotic Exposure Alters Postnatal Neurogenesis in 16p11.2 Neurodevelopmental Disorder Mice

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**Background:** Neurodevelopmental disorders (NDDs) affect the lives of >17% of children and caregivers in the United States and result from the combination of genetic risk variants and exposure to environmental factors. The clinical heterogeneity of NDDs suggests that environmental factors may act on certain genetic susceptibilities, making a Gene x Environment model warranted. A recently identified environmental factor that appears to be linked to increased NDD risk is exposure to cephalosporin antibiotics during the first 2 years of life. Extensive evidence indicates that antibiotic exposure decreases gut bacterial diversity (antibiotic-induced dysbiosis) which may consequently alter adult brain structure and behavior. However, little is known about its effects on developmental neurogenesis, which has been implicated in human genetic, postmortem, and animal model studies as a point of convergence in NDD pathogenesis.

**Objectives:** Our studies use a novel Gene x Environment model to determine how exposure to cephalosporin, a commonly used antibiotic in childhood, alters postnatal neurogenesis in the genetically vulnerable 16p11.2 microdeletion (16pDel) mouse. This mouse models one of the most frequently observed CNVs that accounts for ~1% ASD and also results in other NDD phenotypes.

**Methods:** To model early human life antibiotic exposure, wildtype (WT) and 16pDel littermates were exposed to water (control) or to cefdinir, from postnatal (P) days 5-9 and sacrificed on P13 for analyses. Our preliminary studies examined the cerebellum and hippocampus, two regions that undergo postnatal neurogenesis throughout the first year of human life and are implicated in NDDs.

**Results:** Using immunoblot analysis, we found sex- and genotype-dependent effects of cefdinir exposure on cerebellar neuronal differentiation and hippocampal neurogenesis. Cefdinir-exposed WT mice had a 50% reduction in levels of hippocampal intermediate precursor marker, Tbr2, compared to controls. In genetically vulnerable 16pDel mice, cefdinir-exposed males had decreased hippocampal Cyclin E (mitosis marker) and increased doublecortin (differentiation marker) compared to controls, while cefdinir-exposed females had reduced levels of cerebellar doublecortin compared to controls. Thus, cefdinir effects were dependent on sex and genotype.

**Conclusions:** These results collectively suggest that early life exposure to a cephalosporin alters postnatal neurogenesis in WT and genetically vulnerable 16pDel mice. Ongoing work will assess effects on the microbial community. Ongoing work will assess effects on microbial community composition and function, neurodevelopmental gene expression, and behavioral outcomes related to NDDs.

#### **401.004 (Poster)** Effect of Neonatal Status Epilepticus in Microglial Activation and Complement Pathway.

**D. Santana Coelho, D. Narvaiz, S. Chilukuri and J. N. Lugo, Psychology and Neuroscience, Baylor University, Waco, TX**

**Background:** The developing brain is uniquely susceptible to seizures. Studies have demonstrated that seizures during the early postnatal period can have deleterious consequences to brain development leading to behavioral outcomes such as deficits in communication and increased anxiety. Additionally, status epilepticus in early life is a risk factor for autism spectrum disorder. However, the mechanisms by which neonatal seizures

disrupt neurodevelopment are unclear. Microglia are resident brain immune cells that respond to insults and exhibit important roles in development such as synapse pruning, which is a process that is altered in developmental disorders such as autism.

**Objectives:** Considering the detrimental roles of microglia during development, we aimed to assess microglial response to status epilepticus and the potential effect that these seizures can have in pruning by altering the complement system pathway.

**Methods:** To investigate the temporal response of microglia to status epilepticus, we treated mice with 2 mg/kg kainic acid at postnatal day 10. Following seizures, hippocampal microglia activation was assessed at 1, 2, 3, 4, and 5 days, two weeks and 1 month post seizures. Additionally, we measure the expression of complement proteins to identify a possible mechanism by which synaptic pruning could be altered in these mice. Analysis of microglial activation was done using flow cytometry to quantify MHCII+ myeloid cells and complement system proteins expression was measured using qPCR.

**Results:** Preliminary data demonstrated that microglia activation was significantly increased by status epilepticus and this activation is higher at 1 and 2 days post status epilepticus

**Conclusions:** Our characterization of microglial response suggests that the first 48 hours after status epilepticus can be a critical window where the use of therapeutic interventions might prevent the deleterious consequences that status epilepticus during early life can have on neurodevelopment.

#### **401.005 (Poster) Genetic Mouse Models of Autism Spectrum Disorder Present Subtle Heterogeneous Cardiac Abnormalities**

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**Background:** Autism Spectrum Disorder (ASD) and Congenital Heart Disease (CHD) are strongly linked on a functional and genetic level. Most work has been focused on the neurodevelopmental abnormalities in CHD, whereas the investigation of cardiac abnormalities (CHD or not) in ASD has been more limited.

**Objectives:** In this work we investigate the prevalence of cardiac comorbidities relative to genetic contributors of ASD.

**Methods:** Using high frequency ultrasound imaging, we screened 9 mouse models with ASD-related genetic alterations (*Arid1b*<sup>+/Δ</sup>, *Chd8*<sup>+/Δ</sup>, 16p11.2 (deletion), *Sgsh*<sup>+/Δ</sup>, *Sgsh*<sup>+/Δ</sup>, *Shank3* Dexon 4-9<sup>+/Δ</sup>, *Shank3* Dexon 4-9<sup>+/Δ</sup>, *Fmr1*<sup>+/Δ</sup>, *Vps13b*<sup>+/Δ</sup>), along with pooled wild-type littermates (WT). Using a standardised imaging protocol, the cardiac morphological and functional parameters measured were thickness and thickening of the left-ventricular (LV) anterior and posterior walls, LV chamber diameter, LV fractional shortening, heart rate (HR), aorta diameter (AoD), LV stroke volume and cardiac output.

**Results:** Small-scale alterations in cardiac structure and function were found in the mutant groups compared to WT. When mutant groups were compared to each other, a greater number of significant differences was observed than when mutant groups were compared to WT controls. Mutant groups differed primarily in measures of structure (LV chamber diameter and anterior wall thickness, HR, AoD), while when compared to WT controls, they differed in both structure and function (LV anterior wall thickness and thickening, LV chamber diameter and fractional shortening, HR). The mutant groups with most differences to WT controls are 16p11.2 (deletion), *Fmr1*<sup>+/Δ</sup>, *Arid1b*<sup>+/Δ</sup>. Among mutant groups, the groups differing most from the others were 16p11.2 (deletion), *Sgsh*<sup>+/Δ</sup>, *Fmr1*<sup>+/Δ</sup>. Our results recapitulate the clinical findings associated with each genetic mutation and broadly with ASD, to the extent that a direct comparison is possible. Additionally, our protocol was verified as an effective screening protocol capturing various dimensions of cardiac function.

**Conclusions:** The characteristic heterogeneity of ASD was recapitulated in the cardiac phenotype of ASD-models. However, determining whether certain mutant groups differ in morphological or functional measures (as a general category) can offer insight regarding common underlying mechanisms. Clinically, knowledge of cardiac abnormalities in ASD can be essential as even non-lethal cardiac abnormalities can impact normal development.

#### **401.006 (Poster) Microglial Mutation Affects Auditory and Somatosensory Perceptions**

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**Background:** Deficits in microglial cell (MGC) signaling are thought to be an underlying cause of autism as MGCs are responsible for pruning an initial excess of connections during early critical periods of development. Fractalkine signaling (CX3CL1-CX3CR1) appears to be of particular importance in the shaping of several unimodal systems. Preliminary data from our lab suggests similar mechanisms influence the refinement of multisensory maps in the inferior colliculus, a midbrain structure known to mediate startle responses.

**Objectives:** The present study measures responsiveness to auditory and somatosensory stimuli in control and fractalkine signaling mutants to assess behavioral effects of unrefined multisensory midbrain networks.

**Methods:** Forty-two mice (WT, hetero-, and homozygous CX3CR1-GFP mutants) were tested twice. Each test included 172 measurements of an acoustic-startle response with and without various auditory and somatosensory pre-pulses. The dependent variable was pre-pulse inhibition, PPI, a reflexive response where startle is less if preceded by a non-startling stimulus. One of two auditory pre-pulses (70 dB SPL broad-band noises, 10 or 20 ms in duration) or twelve somatosensory pre-pulses (240, 360, 480 Hz, at two intensity levels, and 10 or 20 ms long) were presented alone or in multimodal combinations. These pre-pulses were presented (or not, for controls) 200 ms before the startle-eliciting stimulus (SES): 15 ms of 110 dB SPL broadband noise. Root-mean-square voltage (Vrms) from the accelerometer was measured over 100 ms following the onset of the SES. The accompanying figure shows the testing apparatus and various voltages (stimuli and response) for a multimodal trial.

**Results:** First, homozygous mutant and male mice were more responsive ( $>PPI$ ) to the unimodal auditory and somatosensory pre-pulses. Second, homozygous mutant mice had more disparate responses to some vibrations compared to the sounds produced by those vibrations. Third, responses of wild-type and heterozygous mice to the multimodal stimuli equaled the sum of their responses to unimodal stimuli, while responses of homozygous mutant mice to multimodal pre-pulses were significantly less than the sum of their responses to unimodal stimuli.

**Conclusions:** Perturbations of MGC-neuronal crosstalk affect the salience of cues that influence unconditioned startle responses in several ways relevant to underlying neural mechanisms for autism (and likely ADHD and PTSD). First, mutant mice had greater PPI to unimodal pre-pulses. This increased responsiveness from the compromised fractalkine signaling is relevant to increased defensive reactions to unanticipated noises and touches in ASD and PTSD. Second, mutant mice responded differently to some vibrations compared to the sounds those vibrations produced, suggesting that altered MGC functioning impairs an ability to ignore extraneous details and respond to 'the big picture'. This is relevant to models of autism, as children on the spectrum often 'miss the forest for the trees'. Third, mutants' responses to simultaneous auditory and somatosensory pre-pulses were less than the sum of responses to each modality alone. This again is relevant to models of autism; the 'whole' being perceived as less than its individual pieces. These results show the value of multimodal psychophysics in MGC mutants as a way to explore underlying causes of multiple perceptual disorders.

#### **401.007 (Poster) Phenotyping Mouse Models of Angelman Syndrome with Multidimensional Behavioral Analysis**

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**Background:** Angelman syndrome (AS) is a single-gene neurodevelopmental disorder caused by loss of function mutations in the maternal copy of the paternally imprinted UBE3A gene. Individuals with AS have a multifaceted behavioral phenotype consisting of deficits in motor function, epilepsy, cognitive impairments, sleep abnormalities, as well as other comorbidities.

**Objectives:** Effectively modeling this behavioral profile and measuring behavioral improvement will be crucial for the success of ongoing and future clinical trials. Foundational studies have defined an array of robust and reliable behavioral phenotypes in the AS mouse model. However, no single behavioral test is able to fully capture the complex nature of AS - in mice, or in children.

**Methods:** Here, we use a multidimensional analysis approach comprised of principal component analysis (PCA) and k-means clustering to quantify the combined performance across eight behavioral domains in a mouse model of AS (Ube3a m-/p+).

**Results:** Multidimensional analysis can successfully predict the genotype of mice based on their behavioral profile with approximately 95% accuracy, and typically achieves  $>90\%$  accuracy with an "n" of ~10 to 15 mice per genotype. We confirmed that multidimensional analysis has the necessary sensitivity to detect behavioral improvement following treatment to increase Ube3a expression in Ube3am-/p+ mice.

**Conclusions:** This approach can be applied to related neurodevelopmental disorders, and may be particularly valuable for disorders where individual behavioral tests are less reliable than in AS and a combinatorial approach is required to determine a phenotype.

#### **401.008 (Poster) Quantifying the Developmental Trajectory of Autism Associated Brain Overgrowth Using Magnetic Resonance and 3D Cellular Resolution Imaging**

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**Background:**

Disruptions in embryonic brain development can manifest as altered postnatal brain structure and function, leading to neuropsychiatric illness. One such disruption is mutation in *Chromodomain helicase DNA binding protein 8 (Chd8)*; a gene that encodes an ATP-dependent chromatin remodeler. Heterozygous *Chd8* loss of function mutations result in macrocephaly in both humans and mouse models, and autism in humans. However, how *Chd8* haploinsufficiency impacts brain structure across cortical development is unknown. Importantly, previous work demonstrated that increases in brain volume are observed across several brain regions including the cortex, requiring a whole brain imaging approach to study the mutation's effects.

## Objectives:

We employ magnetic resonance imaging (MRI), tissue clearing technology, and light-sheet microscopy to acquire MRI and 3D cellular resolution images in intact whole brains from a mouse model with a single heterozygous point mutation in *Chd8* leading to truncated protein. Our goal is to quantify neural progenitors and neuronal cell-types within annotated areas of the developing neocortex in both WT and *Chd8*<sup>-/-</sup> mice to determine the cell types that drive this ASD associated cortical hyper-expansion.

## Methods:

Four pairs of mouse postnatal day 4(P4) littermate brains were perfused, harvested and fixed overnight with 4% paraformaldehyde. The brains were then incubated in 3% gadolinium for 23 days to improve contrast in MRI. Following the incubation, the brains were then imaged on a 9.4T MRI scanner at 60µm×60µm×60µm. Additionally, we generated 3D cellular high resolution (0.75µm×0.75µm×4µm) images from 6 littermate pairs at P4 labeled with upper- (*Brm2*) and lower- (*Ctip2*) layer neuronal markers following tissue clearing using the iDISCO+ protocol (Renier et al., 2016). Using NuMorph, a suite of image analysis tools developed in our lab, we have registered one of these images to the Allen Developing Brain Atlas and quantified all the nuclei in the cortex.

## Results:

From our MRI analysis, we found increased cortical volume in *Chd8*<sup>-/-</sup> mice (~10%) relative to WT littermate controls in both males and females, replicating previous work. Additionally, we quantified all the nuclei in the cortex using NuMorph from one of the 3D cellular resolution images and detected about 13.8 million cortical nuclei comprised of 21% each of upper- and lower-layer neurons. These results suggest that roughly about 42% of all cells in the cortex of P4 mouse brain may be excitatory neurons. Ongoing experiments will permit comparison to an age-matched WT littermate control.

## Conclusions:

These results demonstrate cortical volume increases in *Chd8*<sup>-/-</sup> mouse brains. Moving forward, we aim to perform similar analyses for 9 biological replicates per sex and per genotype at P4 and other early developmental timepoints to elucidate the cellular basis and spatial localization of brain overgrowth in our mouse model, leading to a better understanding of how genetic variation can affect cortical development and alter risk for neurodevelopmental disorders.

### 401.009 (Poster) Shared and Distinct Effects of Autism-Associated Tbr1 Mutations on Cortical Development

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Background: Over 50 pathogenic or likely pathogenic variants affecting *TBR1* have been identified in patients with neurodevelopmental disorders (NDDs) such as autism. As a transcription factor, TBR1 directly regulates the expression of other high-confidence autism risk genes in the developing cerebral cortex. While mouse genetic studies have established *Tbr1* as essential for cortical development, their interpretation in the context of NDDs is somewhat limited. Most studies used homozygous *Tbr1* knock-out mice, while human *TBR1* patients are heterozygous for mutations ranging in type (e.g. missense, nonsense, frameshift) and location within the gene. Thus, *TBR1* patient mutations may cause distinct functional effects ranging from haploinsufficiency, *de novo* gain-of-function, or dominant-negatives. Little is currently known about how patient-specific mutations alter TBR1 function and downstream cortical development *in vivo*.

Objectives: We aim to identify the shared and distinct effects of patient-specific *TBR1* mutations on TBR1 function and mammalian cortical development, focusing on an early-truncating frameshift mutation (p.A136PfsX80) and a missense mutation in the T-box DNA-binding domain (p.K228E).

Methods: Using CRISPR/Cas9, we generated patient mutant mouse lines *Tbr1*<sup>A136PfsX80</sup> and *Tbr1*<sup>K228E</sup> and compared them to a published *Tbr1* knock-out line (*Tbr1*<sup>ko</sup>). All experiments were conducted on mixed sex cohorts and compared heterozygous and homozygous mutants to wild-type littermate controls. We assessed *Tbr1* expression in neonatal and adult mice using Western blot, quantitative PCR, and immunohistochemistry (IHC) (n=3 mice/genotype). We also examined brain morphology using IHC markers and DiI axon labeling (n=3-7 mice/genotype). Groups were statistically compared using unpaired t-tests (two groups) or one-way ANOVA with Tukey's multiple comparisons test (three groups).

Results: We identified p.A136PfsX80 as a loss-of-function *Tbr1* mutation, as TBR1 protein was completely absent from homozygous mutant cortex and reduced by ~40% in heterozygotes. Furthermore, *Tbr1*<sup>A136PfsX80</sup> homozygotes phenocopied the developmental defects previously observed in *Tbr1*<sup>ko</sup> homozygotes. In contrast, homozygous p.K228E mutation caused a ~3.5-fold upregulation of *Tbr1* transcript, and a ~5-fold increase and misexpression of TBR1 protein throughout the cortical layers. In *Tbr1*<sup>K228E</sup> heterozygotes, TBR1 was upregulated by ~2-fold but distributed normally in deep-layer cortex. Despite this upregulation, the p.K228E mutation caused severe cortical defects when homozygosed and failed to genetically complement the *Tbr1*<sup>ko</sup> allele in a complementation cross, indicating limited protein functionality. Nonetheless, p.K228E retained sufficient activity to prevent the substantial cortical apoptosis seen in perinatal *Tbr1*<sup>ko</sup> homozygotes. Common phenotypes present in heterozygotes of all three mutant lines were downregulation of deep-layer cortical marker CTIP2 in adults and reduction of the anterior commissure, suggesting shared defects in cortical neuronal identity maintenance and interhemispheric axon development.

Conclusions: *Tbr1* p.A136PfsX80 is a loss-of-function mutation *in vivo*, suggesting that *TBR1* haploinsufficiency underlies NDDs in patients carrying early-truncating *TBR1* mutations. In contrast, p.K228E may act as a strong hypomorph and/or dominant-negative, as *in vitro* studies suggest the mutant protein can homodimerize with wild-type TBR1. Moreover, upregulation of *Tbr1* transcript in *Tbr1*<sup>K228E</sup> mutants suggests that TBR1 may normally repress its own expression. Further characterization of these mutations, including shared and distinct transcriptional effects, will identify a core TBR1-regulated pathway that may be targeted therapeutically for *TBR1*-related disorders.

**401.010 (Poster)** Utilizing Vagus Nerve Stimulation to Reverse Maladaptive Plasticity in the Inferior Colliculus in a Rat Autism Model  
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## Background:

Individuals with autism often exhibit delayed and weak neural responses to sounds. Prenatal exposure to valproic acid (VPA) alters the development of both subcortical and cortical auditory areas in both humans and animal models. These neural changes have been observed in VPA-exposed rats, which display significantly delayed and weak responses to sound in the auditory cortex. Recent studies in VPA exposed animals have also observed brainstem anatomical alterations, specifically the early processing areas for auditory pathways such as the superior olivary complex and the inferior colliculus. Therefore, developing a method to improve these neural deficits throughout the auditory pathway is needed. We have developed a new approach to drive robust, specific plasticity that substantially enhances recovery after neurological damage. This strategy uses brief bursts of vagus nerve stimulation (VNS) paired with a sound presentation.

## Objectives:

The aims of this study are to 1) document differences in the multi-unit inferior colliculus (IC) response to sounds in VPA exposed rats in comparison to saline exposed control rats, and 2) investigate the ability of vagus nerve stimulation (VNS) paired with speech sounds to reverse the maladaptive plasticity in the inferior colliculus in VPA exposed rats. In these experiments, we test the hypothesis that VNS paired with the speech sound 'dad', 300 times per day for 20 days, will reverse maladaptive plasticity and restore neural responses to sounds in VPA-exposed rats.

## Methods:

The experimental groups included: 1) control rats who were prenatally exposed to saline, 2) VPA-exposed rats who did not undergo therapy, and 3) VPA-exposed rats who underwent VNS-sound pairing therapy. Following the last day of VNS-sound pairing, neural recordings in response to tones, speech sounds, and noise burst trains were collected from the inferior colliculus in each of the experimental groups. Statistical analysis was completed using MATLAB software and SPSS version 27.

## Results:

Our results suggest that VPA animals displayed weaker responses to speech sounds in the IC, and VNS-sound pairing significantly enhanced the IC response strength in VPA-exposed rats ( $F(2, 599) = 6.344, p < 0.01$ ). Interestingly, in response to tones, no significant differences were observed in response rate across the three experimental groups ( $F(2, 315) = 0.1, p = 0.91$ ).

## Conclusions:

VPA animals responded weaker to speech sounds compared to the control animals in the IC. This strengthening effect of VNS was not specific to the paired sound, and was also strengthened in novel speech sounds differing in initial consonant or vowel. This indicates that the VNS-paired plasticity was not specific to paired sound but generalizes to broadband sounds that are acoustically similar to the paired sound. Insights derived from this study may influence the development of new behavioral and sensory techniques to treat communication impairments that result in part from a degraded neural representation of sounds.

**401.011 (Poster)** microRNA As a Potential Biomarker in Autism: Prenatal Stress and SERT Gene Interaction Model  
**T. Woo<sup>1</sup>**, C. King<sup>2</sup>, C. Bloomer<sup>3</sup>, N. Kibiryeva<sup>4</sup>, Z. Talebizadeh<sup>5</sup> and D. Q. Beversdorf<sup>6</sup>, (1)Interdisciplinary Neuroscience Program, University of Missouri, Columbia, MO, (2)Biological Science, University of Missouri, Columbia, MO, (3)University of Kansas Medical Center, Kansas City, KS, (4)Children's Mercy Hospital, Kansas City, MO, (5)Children's Mercy Hospital, Kansas City, MO, (6)Department of Radiology, Neurology, and Psychological Sciences, University of Missouri, Columbia, MO

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Background: Prenatal stress is critical in neurodevelopment and many studies suggest it increases risk for autism spectrum disorder (ASD), particularly in those genetically susceptible to stress. In animal models, we demonstrated that aberrant social behavior was observed in offspring of heterozygous serotonin transporter knock-out (SERT-het) mice exposed to stress during pregnancy, and restricted social interaction was associated with epigenetic changes in the embryonic brains. Two independent clinical studies have shown that the higher incidence of ASD in prenatally stress-exposed mothers is associated with maternal presence of the SERT short-allele (deletion in promoter region). Recently, we have reported differential expression (DE) of microRNAs (miRNAs) in blood samples of prenatally stress-exposed mothers carrying the SERT short allele who have children with ASD, which may serve as a potential blood biomarker of the gene x environment (G x E) interaction in ASD.

Objectives: To further investigate the role of miRNAs as a potential biomarker during pregnancy in this G x E interaction model.

Methods: We profiled the miRNA expression in blood from dams in the mouse model of SERT-het/stress dams at embryonic day 21 (E21) and postnatal day 60 (PD60) and compared with that of wild-type mice at the same time window.

Results: More than three thousand mature miRNAs were examined, and the ANOVA analysis detected several DE miRNAs. However, there were no common DE miRNAs between E21 and PD60, which suggested a transition in miRNA profiles in SERT-het/stress dams after delivery. One of the upregulated miRNAs at PD60 (miR-149-3p) and E21 (miR-762) were also found in the DE miRNAs of human samples from our previous study.

Conclusions: These miRNAs could be biomarker candidates for G x E interactions in ASD, and are highly dynamic over time. Our study provides evidence for epigenetic alterations associated with the gene x environmental interaction which we hope will lead to better understanding of the causes and treatments of ASD, resulting from prenatal stress exposure in genetically stress susceptible individuals.

## VIRTUAL POSTER SESSION — ANIMAL MODELS

### 501 - Animal Models --- (V)

#### **501.001** (Virtual Poster) Microbial Dysbiosis and Increased Gut Permeability in a *Cntnap2* Knock-out Rat Model of Autism

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and restricted, repetitive behaviors. Although pathophysiology of ASD is multifactorial, mutations in *CNTNAP2* have been implicated in the genetic etiology of autism. *CNTNAP2* is a gene within the neurexin family which codes for Contactin-associated protein-like 2 (CASPR2). Neurexins plays a crucial role in the development of the nervous system, synapse formation and cell adhesion properties. Previous studies have shown that *Cntnap2* knock-out (KO) rats exhibit ASD associated behavior abnormalities and can serve as a powerful tool to understand the mechanisms underlying autism. Besides behavior abnormalities, gastrointestinal (GI) complications are a common co-morbidity observed in individuals with ASD. It has been proposed that this association regarding behavior abnormalities and GI complications is related to the concept of the gut-brain axis, which suggests a bidirectional communication between the brain and the gut microbiota. There is a need to characterize the gut microbiota and GI abnormalities utilizing preclinical animal models such as *Cntnap2* KO rats that will pave the way to develop novel treatment modalities for ASD.

Objectives: As *Cntnap2* KO rats provide a preclinical model of ASD with strong face and predictive validity, the objective of the present study was to characterize gut microbiome profile of *Cntnap2* KO and wild-type (WT) littermate rats by 16S rRNA sequencing. In addition, we investigated GI parameters such as gut motility and permeability as indicators of gut function.

Methods: Heterozygous breeders of *Cntnap2* KO rats were obtained from Envigo company. The model contains a five base pair deletion in exon six of the *Cntnap2* gene, created using the zinc finger nuclease target site CAGCATTTCGCACC|aatgga|GAGTTTGACTACCTG. All experimental animals were obtained from heterozygous crossings. Both male and female rats were used in each experiment. Gut microbiota of *Cntnap2* KO and WT littermate control rats was characterized using 16s RNA sequencing followed by determination of alpha and beta microbial diversity. Gastrointestinal transit time was determined using the nonabsorbable red dye Carmine red whereas gut permeability was determined using FITC-dextran assay.

Results: We observed gut dysbiosis and distinct microbial composition in *Cntnap2* KO rats compared to WT littermate control rats. There was a significant difference in gut microbial beta diversity in terms of Bray-Curtis and unweighted UniFrac distances in *Cntnap2* KO and WT littermate control animals. In addition, there was decreased GI motility and increased gut permeability in *Cntnap2* KO animals compared to WT littermate control rats.

Conclusions: The gut dysbiosis observed in *Cntnap2* KO is in agreement with the findings observed in individuals with ASD. Thus, this model provides a tool to explore the role of gut dysbiosis and microbiota-gut-brain axis in predisposition to ASD. Our new findings of gut dysbiosis in *Cntnap2* KO will provide opportunities to develop novel therapeutic strategies based on restoration of gut microbiome.

#### **501.002** (Virtual Poster) Understanding the Development of ASD Trajectory in Offspring Following Exposure to Maternal and Postnatal Immune Activation Using a Rat Model

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Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by three core features, repetitive behavior, impaired social interactions, and difficulty with communication. Increasing evidence suggests that maternal immune activation (MIA) ("single hit") resulting from maternal viral infection may be involved in predisposition to ASD in the offspring. This is a worldwide concern, especially during this pandemic of COVID-19. In addition, studies have shown that offspring exposed to MIA may be more susceptible to gram negative bacterial infections during birth leading to postnatal immune activation (PIA) ("double hit"). However, it is not known when the offspring exposed to MIA and PIA start exhibiting the core symptoms of ASD. There is a need to understand the trajectory of ASD development in offspring following exposure to MIA and PIA using animal models that will provide opportunities for early intervention and hence better clinical outcomes.



**Objectives:** The objective of this study was to determine when the offspring exposed to MIA and PIA start exhibiting the core symptoms of ASD. We also determined whether the effects of MIA and PIA in exhibiting behavioral abnormalities are limited to juvenile stage or they have long lasting effects till the adult stage.

**Methods:** The animals were divided into five groups as shown in Table 1. MIA was induced in pregnant dams using intraperitoneal injection of double-stranded RNA polyinosinic-polycytidylic acid [poly(I:C)] (20mg/kg) at embryonic day 12.5 (E12.5). PIA was induced by giving oral gavage of lipopolysaccharide (LPS) (10 mg/kg) on postnatal day 9. Animals in all groups were subjected to behavior tests such as juvenile play during ages from postnatal day 21 to day 30. In addition, the animals were subjected to a comprehensive battery of behavior tests during adult stage upto six months. These behavior tests include three-chamber test, locomotor and repetitive/stereotypic-like activity, open-field, marble burying and determination of sensory stimuli response using prepulse inhibition and acoustic startle reflex.

**Table 1: Experimental animal groups**

| Group | Pregnant Dam (Mother) | Offspring            |
|-------|-----------------------|----------------------|
| 1     | No treatment (Naïve)  | No treatment (Naïve) |
| 2     | Vehicle (PBS)         | Vehicle (PBS)        |
| 3     | MIA                   | No treatment         |
| 4     | No treatment          | LPS (PIA)            |
| 5     | MIA                   | LPS (PIA)            |

**Results:** The offspring exposed to MIA or PIA alone exhibited behavioral abnormalities that were further exacerbated following exposure to MIA and PIA together compared to control group. The behavior abnormalities were observed as early as during juvenile stage that continued till the adult stage.

**Conclusions:** The result of the present study suggests that MIA or PIA have long lasting effects on the developmental trajectory of offspring. In addition, the findings are highly relevant in the current situation of pandemic given that COVID-19 will lead to MIA or PIA and potentially affect the neurological functioning of future children. Our findings provide novel insights regarding the effect of MIA and PIA in predisposition to ASD and will pave the way for development of novel preventive and therapeutic modalities.

**501.003 (Virtual Poster)** Effects of a Gut-Selective Integrin-Targeted Therapy in a Mouse Model for Autism Spectrum Disorders  
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*Background:*

Inflammatory and immune changes are recognized as pivotal mechanisms in ASD, particularly the ones involving the microbiota-mucosal immune response development. Few data are so far available concerning the primary contribution of mucosal immune dysfunction to behavioral and neuroinflammatory profiles in ASD mouse models.

*Objectives:*

To clarify the role of gut mucosal immunity on behavioral and neuroinflammatory profile in ASD, we used the early-life immune activation (EIA) mouse model. As double-hit model, it includes both prenatal (Poly I:C, mimicking a gestational viral infection) and postnatal (LPS mimicking a bacterial infection) immune challenges

*Methods:*

In male C57BL6/J EIA adult offspring we evaluated the effects of a two-week ip treatment with a monoclonal antibody (DATK-32) directed against the integrin alpha4 beta7 (anti- $\alpha 4 \beta 7$  Ab), responsible for lymphocyte trafficking in the gut mucosa. The anti-  $\alpha 4 \beta 7$  Ab causes a selective blockade of gut-experienced lymphocyte traffic to intestinal lamina propria. The effects of the treatment are assessed on EIA behavioral and neuroinflammatory profile, and immune-inflammatory changes.

*Results:*

The integrin targeted treatment counteracts selected EIA changes in anxiety and exploratory profiles (detected in the open field and marble burying tests), but did not significantly affect the social deficits shown by EIA male mice in the three-chamber tests (both social responsiveness and social novelty). EIA behavioral effects are associated with a proinflammatory phenotype in the hippocampus of male offspring, as reflected by a significant increase in the mRNA expression of the proinflammatory cytokine IL-6 and a concomitant reduction of microglia-associated protective genes such as arginase-1, TGF- $\beta$ 1 and CD-68. Treatment with anti- $\alpha 4 \beta 7$  Ab in EIA mice re-established the expression of arginase-1, CD-68 and TGF- $\beta$ 1, whereas it did not modify IL-6 mRNA.

Cytofluorimetric analyses of lymphocytes isolated from gut associated lymphoid tissue show in EIA mice increased percentage of IL-17+ or IFN-g+ lymphocytes in Mesenteric Lymph Nodes (MLN) or colonic lamina propria, respectively. Treatment with anti- $\alpha$ 4 $\beta$ 7 Ab was associated with percentage of IL-17+ and IFN-g+ lymphocytes comparable to control mice (saline +Isotype Ab).

#### Conclusions:

Treatment with anti- $\alpha$ 4 $\beta$ 7 Ab counteracts some of the behavioral abnormalities in the EIA mouse model of ASD. We suggest that preclinical interventions on gut mucosal immune-system could have beneficial effects on selected ASD neurobehavioral features.

**501.004 (Virtual Poster)** Vorinostat, a Histone Deacetylase Inhibitor, Ameliorates the Sociability and Cognitive Memory in an Ash1L-Deletion-Induced ASD/ID Mouse Model

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#### Background:

ASH1L is an epigenetic factor that facilitates gene expression through modifying chromatin. Previous genetic studies reported that *ASH1L* is a high ASD risk gene. Our recent study used a mouse model to demonstrate that loss of *ASH1L* in the mouse brain was sufficient to cause core autistic-like behaviors and impaired cognitive memory, confirming that the disruptive *ASH1L* mutations are the causative drivers leading to ASD/ID genesis.

#### Objectives:

Since histone acetylation and *ASH1L*-mediated histone modification have synergistic effects in facilitate gene expression, in this study we examined whether vorinostat (SAHA), a histone deacetylase inhibitor (HDACi), could ameliorate the ASD/ID-like behavioral and cognitive memory deficits in the *Ash1L*-deletion-induced (*Ash1L*-Nes-cKO) ASD/ID mouse model.

#### Methods:

Low dose of SAHA (5mg/kg/day) was administrated to the *Ash1L*-Nes-cKO from postnatal day 5 to 60. Three-chamber tests, novel object recognition (NOR) tests, and open field assays were used to assess the sociability, social novelty, recognition memory, and anxiety-like behaviors of *Ash1L*-Nes-cKO mice.

#### Results:

The behavioral tests showed that low dose of SAHA administration for 50 days largely enhanced the discrimination index of sociability ( $p = 0.0412$ ) as well as reduced the hair grooming episodes ( $t = 3.733$ ,  $df = 18$ ,  $p = 0.0015$ ) and time ( $t = 3.20$ ,  $df = 18$ ,  $p = 0.005$ ) in the *Ash1L*-Nes-cKO mice, suggesting that SAHA treatment ameliorated the core ASD-like deficits in sociability and repetitive behaviors. Furthermore, the NOR tests revealed that the SAHA treatment significantly increased the discrimination index for the novel object ( $p < 0.0001$ ), suggesting that SAHA treatment ameliorated the cognitive memory. However, the SAHA treatment did not show positive effects to ameliorate postnatal growth retardation, anxiety-like behaviors, and paw clasping in the *Ash1L*-Nes-cKO mice. Blood biochemical analysis and peripheral blood cell counting showed that the mice treated with SAHA had normal liver and renal functions as well as normal blood cell counts, suggesting that the low dose of SAHA did not induce severe side effects and was well tolerated by animals.

#### Conclusions:

Our current study provides experimental evidence to show that the postnatal administration of low-dose SAHA significantly ameliorates the sociability, repetitive behaviors, and cognitive memory in the *Ash1L*-deletion-induced ASD/ID mouse model, indicating that SAHA is a promising reagent for the pharmacological treatment of core ASD/ID behavioral deficits caused by disruptive *ASH1L* mutations.

## Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG)

### PANEL — BRAIN FUNCTION (FMRI, FCMRI, MRS, EEG, ERP, MEG)

#### 202 - Pupillometry As a Neuroimaging Tool during Naturalistic Behavior – New Avenues for Biomarker Research, Etiological Mechanisms, and Prognostic Risk Assessment

**Panel Chair: Nico Bast**, Autism Research and Intervention Center of Excellence Frankfurt, Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, University Hospital Frankfurt, Goethe University, Frankfurt, Germany

**202.001 (Panel)** Attentional Strengths and Weaknesses in Autism Spectrum Disorder: The Role of the Locus Coeruleus – Norepinephrine System

**Background:** Infants at elevated risk for autism spectrum disorder (ASD), as well as children, adolescents, and adults diagnosed with ASD excel at visual search compared to their typically developing (TD) peers. Paradoxically, slowed attentional disengagement has also been found across the lifespan in those at risk for, or diagnosed with, ASD. However, whether these two paradoxical states co-exist within the same individuals and the neurofunctional mechanism(s) associated with these strengths and weaknesses remains to be determined.

**Objectives:** To examine the relationship between enhanced visual search and impaired disengagement, and assess the role that the locus coeruleus – norepinephrine (LC-NE) system, as indexed by pupil diameter, plays in the manifestation of atypical attentional processes.

**Methods:** Participants were 28 children with ASD and 30 age- and non-verbal IQ-matched TD children. The study consisted of separate visual search, gap-overlap, and resting eye-tracking paradigms. For the visual search paradigm, participants were instructed to find the target (vertical line) embedded within an array of tilted (10°) distractor lines. The target was present on 50% of trials, and displayed within set sizes of 18, 24, and 36 items. In the gap-overlap task, participants were instructed to fixate on a central crosshair and then move their eyes to a peripheral target once it appeared. Each trial began with a crosshair presented alone. Next, a target could appear with either the crosshair remaining on the screen (overlap) or 200ms after the crosshair disappeared (gap). For the resting eye-tracking, participants were instructed to relax, remain still, and to look at the central crosshair. Saccadic latency and pupil diameter were monitored using an EyeLink 1000 Plus eye-tracking system.

**Results:** For the visual search paradigm, groups did not differ significantly for RT or accuracy. However, there was a significant interaction between group and target presence; while the groups were equivalent for target present (ASD=1541ms; TD=1525ms), there was an ASD advantage in the target-absent condition (ASD=2323ms; TD=2928ms). Children with ASD showed faster, albeit a non-significant difference in, search efficiency (ASD=12ms/item; TD=20ms/item). For the gap-overlap paradigm, groups did not differ on saccadic RT. Gap effect scores (overlap – gap) were marginally larger for children with ASD ( $p<.1$ ; ASD=66ms; TD=34ms); step effect scores (overlap – baseline) were significantly larger in ASD ( $p<.05$ ). Resting pupil diameter was significantly larger in the ASD group ( $p<.05$ ). Correlations between gap effect and search efficiency measures showed that, for the ASD group (but not the TD group), slower disengagement was associated with better search efficiency, and that larger pupil size was related to slower disengagement and more efficient visual search ( $ps<.05$ ).

**Conclusions:** Similar to previous reports, children with ASD exhibited a target-absent search advantage and slower attentional disengagement. For the ASD group, greater search efficiency was associated with slower attentional disengagement. Importantly, increased tonic activation of the LC-NE system (i.e., larger resting pupil size) was associated with greater search efficiency and poorer attentional disengagement. The present findings suggest attentional strengths and weaknesses co-occur in individuals with ASD, and may be linked to atypical activation of the LC-NE system.

## **202.002 (Panel) Sensory Salience Processing and Associated Pupillary Responses Modulate Attenuated Social Attention in Autism Spectrum Disorder**

**N. Bast, Autism Research and Intervention Center of Excellence Frankfurt, Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, University Hospital Frankfurt, Goethe University, Frankfurt, Germany**

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**Background:** Visual exploration is defined by an interactive evaluation of sensory salience (stimulus-driven) and semantic content (goal-directed). Attenuated social attention is a key marker of autism spectrum disorder (ASD) that has been explained by an altered processing of semantic content like attenuated social motivation. In contrast, neuroimaging findings emphasized altered sensory processing of salience. The Locus-Coeruleus Norepinephrine (LC-NE) system has been established as a neurophysiological modulator of sensory processing. Recent findings revealed altered LC-NE functioning in ASD, which indicates altered sensory processing as an underlying mechanism of altered social attention.

**Objectives:** We aim to investigate sensory salience processing with LC-NE functioning as neurophysiological modulator as a predictor of social attention during naturalistic visual exploration.

**Methods:** We assessed a sample of heterogenous individuals (AIMS-2-TRIALS study) with ASD and neurotypical development (TD:  $n = 164$ , ASD:  $n = 164$ ) that were matched in age ( $m/SD = 16.3/5.8$  years, range = 6–30 years), IQ ( $m/SD = 103/17$ , range = 60–140), and sex distribution (female:  $n = 95$ , male:  $n = 233$ ). During eye tracking, participants watched a series of movie scenes that either depicted humans or did not depict humans. Eye tracking data contained pupillary response information as an index of LC-NE phasic activity. We further applied computer vision algorithms to extract physical and motion salience information of the movie scenes (see figure). This sensory salience information was related to corresponding gaze behavior and pupillary responses to retrieve estimates of gazes on and reactivity to sensory salience, which were then applied as predictors of social attention as measured by gazes on eye regions (definition of areas-of-interest). We applied linear mixed models that controlled for data quality, comorbid psychopathology, and scene duration by a polynomial effect of time. Significant and standardized effects are presented as marginalized coefficients ( $\beta$ ) or contrasts ( $\Delta M$ ) with 95% confidence intervals.

**Results:** Across groups, higher pupillary responses were associated with lower gazes on sensory salience during early phases ( $\beta = -0.04 [-0.05, -0.02]$ ) and higher gazes on sensory salience during intermediate phases of the movie scenes ( $\beta = 0.05 [0.03, 0.07]$ ). In ASD compared to TD, pupillary responses were lower during human movie scenes ( $\Delta M = -0.09 [-0.15, -0.02]$ ) and higher during non-human movie scenes ( $\Delta M = 0.07 [0.02, 0.14]$ ). Importantly, we found lower social attention in ASD ( $\beta = -0.08 [-0.15, -0.02]$ ) that was moderated by gazes on and reactivity to sensory salience. In ASD, lower pupillary responses predicted lower social attention ( $\beta = -0.04 [-0.06, -0.02]$ ).

In a secondary analysis, the pupillary response signal across scenes was decomposed into an early response component (PR1) and a late pupillary response component (PR2). Across groups, PR1 was negatively associated with social attention ( $\beta = -0.04 [-0.05, -0.01]$ ), while PR2 was positively associated with social attention ( $\beta = 0.01 [0.00, 0.03]$ ).

**Conclusions:** We provide the first empirical support of altered sensory processing in ASD during naturalistic visual exploration. Different LC-NE phasic activity is emphasized as a basic neurophysiological mechanism in ASD that contributes to attenuated social attention and altered sensory salience processing.

#### **202.003 (Panel) Pupil Size and Pupillary Light Reflex in Early Infancy: Heritability and Associations with Polygenic Liability for Neuropsychiatric Conditions**

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**Background:** The pupillary light reflex (PLR, a sudden constriction response to retinal or attended stimulus luminance serving to regulate the amount of light reaching the retina) and the baseline pupil diameter are measures based on pupil tracking that reflect physiological responses linked to specific neural circuits (both parasympathetic function and sympathetic activity linked to the locus coeruleus-norepinephrine system) that have been implicated as atypical in some psychiatric and neurodevelopmental conditions, particularly autism and schizophrenia.

**Objectives:** We investigated the contribution of genetic and environmental factors to individual differences in early life baseline pupil size and the PLR, and whether there were shared or distinct genetic etiologies between these measures. We also tested its associations with common genetic variants associated with neurodevelopmental (autism spectrum disorder and attention deficit hyperactivity disorder) and mental health (bipolar disorder, major depressive disorder, and schizophrenia) conditions using genome-wide polygenic scores (GPSs).

**Methods:** Our study included 510 infant twins assessed at 5 months of age (281 monozygotic and 229 dizygotic pairs) in the lab, using a Tobii TX300 eye-tracker to record pupil size over 12 PLR trials interspersed with other audio-visual tasks. Zygosity and GPSs were estimated based on DNA samples. The analysis plan for this study was pre-registered in OSF (<https://osf.io/5kzh2>).

**Results:** Univariate twin modelling showed high heritability at 5 months for both pupil size ( $h^2 = .64$ , CI: .54-.72) and constriction in response to light ( $h^2 = .62$ , CI: .51 to .70), and bivariate twin modelling indicated substantial independence between the genetic factors influencing each ( $r_G = .38$ ). When analyzing genome-wide polygenic scores, we found a statistically significant positive association between infant tonic pupil size and the GPS for schizophrenia ( $\beta = .15$ ,  $p = .024$ ). There was no significant association with the GPS for autism ( $p > .25$ ) or any other GPSs, and no associations between constriction response and the GPSs.

**Conclusions:** This study shows that individual differences in some measures based on pupillometry are highly heritable in early infancy, although substantially independent in their genetic etiologies. It also provides initial evidence that pupil size may share some links with common genetic variants linked to schizophrenia. It illustrates how genetically-informed studies of infants may help us understand early physiological responses associated with psychiatric disorders which emerge much later in life.

#### **202.004 (Panel) Capturing the Pupillary Light Reflex As Part of Medical Appointments in a Neurodevelopmental Clinic Using Automated Pupillometry**

**V. Troiani<sup>1</sup>, A. DiCriscio<sup>1</sup>, S. Dickey<sup>2</sup> and A. Beck<sup>2</sup>,** (1)Geisinger Autism & Developmental Medicine Institute, Lewisburg, PA, (2)Geisinger, Lewisburg, PA

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**Background:**

We and others have previously found that the pupillary light reflex (PLR) and pupil response captured using infrared eye tracking are atypical in autism spectrum disorder (ASD) and individual differences in pupil responses are associated with core diagnostic traits of ASD. However, widespread assessment of the PLR in clinical settings has been limited using infrared eye trackers, which can be expensive, require time consuming calibration for each participant, and domain-specific knowledge for data analysis and export. The PLR can also be captured using hand-held pupillometers, such as the NeuroOptics NPi 200 pupillometer. The NPi 200 is a validated, hand-held optical scanner that captures pupil reactivity and pupil size (see Figure, Part A). The device captures and records a PLR waveform (pupillogram), which can be output for analysis, along with summary metrics, including a normalized pupil response estimate (NPi), pupil size, constriction and dilation velocity, amongst others (See Figure, Part B). The device allows for standardized data capture in clinical settings, but to date, has primarily been used in critical care settings, rather than within the context of neurodevelopment.

**Objectives:** The purpose of this study was to evaluate a process to capture automated pupillometry within a clinical setting to assess the feasibility of using hand-held pupillometers in populations with neurodevelopmental concerns and a wide range of ability and functioning, including ASD. We also aim to confirm reliability of PLR capture with the NPi 200 across timepoints. Future analyses will compare PLR metrics from successful captures in children with and without ASD.

## Methods:

We developed a process that included 1) generating and monitoring a clinical appointment list, 2) using existing electronic health record data to identify eligible participants, 3) calling participants to gauge interest in research participation as an add-on to their clinical appointment, and 4) rapid PLR assessment using the NeuroOptics NPi 200 pupillometer. In a subset of participants, we captured data at 2 timepoints to confirm reliability of the PLR.

## Results:

To date, we have assessed N=60 children (study ongoing), with successful capture completed on N=46 children (n=36 of 46 with a clinical diagnosis of ASD; n=10 with other neurodevelopmental diagnoses). Age of participants currently ranges from 3 to 17, FSIQ from 42 to 144, and SRS Total T-score ranging from 53 to 91. Preliminary results indicate that internal consistency of measures across multiple timepoints is high (Cronbach's alpha ranging from 0.86 to 0.98; Figure, part C). When the target pediatric sample is reached, we will perform planned analyses to determine specificity and sensitivity of the PLR metrics to discriminating between ASD and other neurodevelopmental diagnoses.

## Conclusions:

These results indicate that hand-held, automated pupillometers, such as the NeuroOptics NPi 200, can be used for successful capture (77% success rate) of PLR in children with a large range of ability and functioning. Thus, hand-held pupillometers show promise for use in neurodevelopmental populations as part of furthering our understanding of PLR differences in ASD, presymptomatic detection, identifying clinically meaningful subgroups with differing severity or treatment response, and monitoring treatment efficacy.

## PANEL — BRAIN FUNCTION (FMRI, FCMRI, MRS, EEG, ERP, MEG)

### 228 - Investigating the Excitatory/Inhibitory Imbalance Hypothesis in Autism - a Multidisciplinary Approach

**Panel Chair: Nicolaas Puts,** *Russell H. Morgan Department of Radiology and Radiological Science, Institute of Psychiatry, Psychology & Neuroscience, King's College London, UK, Baltimore, MD, United Kingdom*

**Discussant: Nicolaas Puts,** *Russell H. Morgan Department of Radiology and Radiological Science, Institute of Psychiatry, Psychology & Neuroscience, King's College London, UK, Baltimore, MD, United Kingdom, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, Russell H. Morgan Department of Radiology and Radiological Science, Institute of Psychiatry, Psychology & Neuroscience, King's College London, UK, Baltimore, MD, United Kingdom, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom*

**228.001 (Panel)** Aberrant Acoustic and Tactile Sensory Sensitivity and Integration at Specific Developmental Stages in the *Cntnap2* and *Nrxn1* Mouse Models for Autism Spectrum Disorders

**I. W. Riemersma,** *R. Havekes and M. Kas, University of Groningen, Groningen, Netherlands*

## Background:

Sensory information processing is key for normal functioning in daily life. Sensory abnormalities are a frequent feature of neurodevelopmental disorders (NDD). In autism spectrum disorders (ASD) sensory abnormalities are reported in up to 90% of patients. Moreover, these symptoms are reported as early as 6 months of age while diagnosis generally takes place at 3 years of age or later. This suggests that deficits in sensory processing could underlie other symptoms found in NDD.

## Objectives:

It is unclear which biological mechanisms underlie these sensory symptoms and when during development these changes could contribute to a behavioural phenotype. Therefore, the aim of this research was to perform a longitudinal screening of the behavioural sensory phenotype in genetic mouse models of NDD.

## Methods:

We assessed acoustic and peripheral tactile sensory sensitivity by measuring startle responses to single auditory and tactile stimuli. In addition, prepulse inhibition (PPI) of paired auditory and auditory-tactile stimuli was measured to assess sensory gating. These tests were performed in two genetic models associated with NDD: *Nrxn1*<sup>-/-</sup> and *Cntnap2*<sup>-/-</sup> mutant mice with their respective WT littermates serving as controls. This multi-model approach was used with the aim of finding convergence in possible underlying biological mechanisms of NDD. In addition, sensory phenotypes were monitored at three different developmental timepoints (TP1 6-8 weeks, TP2 12-14 weeks and TP3 18-20 weeks) with the goal of identifying possible sensitive time windows. Significance was ascertained by repeated measures ANOVA with corrections for multiple comparisons.

## Results:

A significant main effect of genotype and a genotype x sound level interaction was found for acoustic sensory sensitivity in both the *Nrxn1* and *Cntnap2* mice (*Nrxn1*: p=0.0013; *Cntnap2* p=0.0371, interaction: *Nrxn1*: p=0.0095 *Cntnap2* p=0.0013). Both gene knockout models showed a decrease in acoustic sensitivity for higher dB acoustic pulses (110-120dB). In addition, the *Cntnap2*<sup>-/-</sup> mice showed decreased peripheral tactile

sensitivity. Moreover, for the acoustic and tactile-acoustic sensory gating a main effect of both age and genotype was found for both mouse models (Age  $p < 0.001$ , acoustic *Cntnap2*:  $p < 0.001$ ; *Nrxn1*  $p = 0.0133$ , tactile-acoustic *Cntnap2*  $p = 0.0018$ ; *Nrxn1* n.d.). *Nrxn1*<sup>-/-</sup> and *Cntnap2*<sup>-/-</sup> mice showed increased levels of PPI indicating aberrant sensory gating. Interestingly, the decreased acoustic sensitivity and increased sensory gating effects were not yet visible during the first timepoint at 6-8 weeks. Conversely, peripheral tactile hyposensitivity in the *Cntnap2* was most prominent at the earliest timepoint at 6-8 weeks.

#### Conclusions:

Here, we show that tactile and acoustic sensory sensitivity and gating is affected in two mouse models for NDD, specifically at later developmental stages (early and late adulthood), but not yet during early adolescence. Interestingly, the peripheral tactile phenotype was specifically clear at the first time point, while the central acoustic sensory phenotypes were most apparent at later stages. To further determine the origin of the behavioural deficits observed in these mice, our next step is to identify changes in brain markers related to sensory processing during these time points. Ultimately to further unravel underlying biological mechanisms as well as identifying optimal developmental time windows for new therapeutic strategies for NDD.

**228.002 (Panel)** Variance in Motor Functioning in Autistic Children Is Explained By Low-Level Tactile Perception and Brain GABA Levels  
**J. L. He<sup>1</sup>**, G. Oeltzschner<sup>2</sup>, E. Wodka<sup>3</sup>, R. A. Edden<sup>4</sup>, S. H. Mostofsky<sup>3</sup> and N. A. Puts<sup>1</sup>, (1)Department of Forensic and Neurodevelopmental Sciences, Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, UK, King's College London, London, United Kingdom, (2)Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, MD, (3)Center for Autism and Related Disorder, Kennedy Krieger Institute, Baltimore, MD, (4)Russell H. Morgan Department of Radiology and Radiological Science, Institute of Psychiatry, Psychology & Neuroscience, King's College London, UK, Baltimore, MD, United Kingdom

**Background:** Altered sensory processing and motor functioning are some of the earliest signs of autism. While the sensory and motor signs of autism have been studied and reported on separately, few studies have investigated how these sensory and motor signs might co-occur in autism. This is perhaps surprising since the development of motor competency is well-known to depend on sensory functioning. Moreover, with increasing evidence of altered excitatory-inhibitory (E-I) balance in cortical and thalamic brain regions, and an important role of E-I in sensorimotor integration, it is of interest whether motor competency in autism is also explained by differences in GABA and glutamate levels.

**Objectives:** We explored associations between low-level tactile perception and motor functioning in autistic children and typically developing controls (TDC), 8-12 years of age. We also conducted exploratory analyses to see whether and how brain GABA and glutamate levels in relevant brain regions contribute to tactile perception and overall motor functioning.

**Methods:** 144 autistic children ( $M_{Age} = 10.39$ ,  $SD_{Age} = 1.35$ ) and 216 neurotypical controls ( $M_{Age} = 10.17$ ,  $SD_{Age} = 1.23$ ) participated in this study. Low-level tactile perception was assessed using a well-established vibrotactile psychophysical battery. Two-alternative force choice staircasing procedures were used to estimate each participant's tactile detection, discrimination and temporal order judgement thresholds. Motor functioning was assessed using the Movement Assessment Battery for Children – Second Edition (MABC-2) and the Physical and Neurological Examination of Subtle Signs (PANESS). A subset of children ( $N_{ASD} = 44$ ,  $N_{TDC} = 58$ ) also underwent edited magnetic resonance spectroscopy (MRS), where GABA+ (GABA + macromolecules) and Glx (glutamate + glutamine) levels of the primary sensorimotor cortex (SM1) and thalamus (Thal) were quantified (~27 ml voxels, 10 min acquisition (320 transients)). Data were analysed using Gannet and metabolite levels expressed as tissue-corrected water-scaled estimates. Due to different acquisition phases with slightly different parameters, data shown are shown as residuals.

**Results:** When collapsing across groups, both static detection and temporal order judgement thresholds were associated with MABC-2 total percentile ranking ( $R = 0.38$ ,  $p < 0.001$ ) and PANESS total ( $R = 0.33$ ,  $p < 0.001$ ) scores. These associations also held at the group-level. See Fig. 1. SM1 GABA+ levels were associated with MABC Total Percentile Rank scores in autism ( $R = 0.54$ ,  $p = 0.002$ ) but not TDCs ( $R = 0.23$ ,  $p = 0.15$ ). See Fig. 2.

**Conclusions:** Our results suggest that low-level tactile perception is associated with motor functioning in both autistic and non-autistic children. Children who were better able to detect and judge the temporal order of tactile stimuli were also those who had higher overall motor functioning. Additionally, the results suggest that motor functioning is associated with SM1 GABA+ levels in autism, a finding that is broadly consistent with the suggestion that motor functioning may be associated with excitatory-inhibitory balance. A limitation of these findings is that they are cross-sectional. Future investigations through a longitudinal design beginning in early childhood would help us better understand how tactile perception (and perception in other domains) relates, and potentially contributes, to motor functioning.

**228.003 (Panel)** Reduced Inhibition of Stimulus Temporal Segregation Associated with Sensory Hyperresponsiveness in ASD  
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#### Background:

Individuals with autism spectrum disorder (ASD) often exhibit sensory hyperresponsiveness. Ide et al. (2019) reported individuals with ASD and severe sensory hyperresponsiveness exhibited finer temporal resolution in the temporal order judgment task (TOJ). Our fMRI study on an ASD patient with sensory hyperresponsiveness and ultra-high temporal resolution of TOJ revealed the neural circuit related to the excessive performance (Ide et al., 2020). Using MR spectroscopy, we also demonstrated that individuals with ASD and reduced gamma-aminobutyric acid (GABA) in the part of the circuit for TOJ exhibited increased sensory hyperresponsiveness (Umesawa et al., 2020). Stimulus temporal resolution in TOJ often does not differ from neurotypical controls (Ide et al., 2019), but we have reported the specific condition that task-irrelevant visual stimulus preceding

target stimuli for performing TOJ enhanced the temporal resolution in ASDs (Chakrabarty et al., 2021). We hypothesized that GABA-related E/I imbalance in the neural circuits which regulates stimulus temporal resolution may relate to sensory hyperresponsiveness.

#### Objectives:

We sought to determine whether individual sensory hyperresponsiveness associates with the regulation of temporal resolution (TR) in visual TOJ with multiple task-irrelevant stimuli encouraging perceptual integration. We examined how impairment of TR relates to sensory hyperresponsiveness in adults with ASD.

#### Methods:

Participants observed 4 successive sets of the left and right stimuli of C-shaped line segments. One out of the 4 sets were formed by asynchronous stimuli (target) while the others involved synchronous stimuli (distractors). Twenty-two ASD and 19 typically developed (TD) participants reported which stimulus (L/R) of the target set was presented later. Participants performed the task with observing the two stimuli configured to encourage perceptual grouping or those without that configuration. Such grouping condition with C-shaped line segments might impair TR (just noticeable difference) in TOJ task (Nicol and Shore, 2007). We also evaluated individual sensory hyperresponsiveness by using the Adolescent/Adult Sensory Profile (Brown et al., 2001; Dunn, 1997).

#### Results:

In line with the previous study, the configuration for perceptual grouping worsened the TR of the target set without preceding distractors in ASD and TD groups. Comparisons of the finest TR of all the sets for each participant revealed no difference between ASD and TD groups, but the ASD group showed significant improvement of TR. Reduced effect of the perceptual grouping on the finest TR was associated with enhancement of sensory hyperactivity (Sensory Sensitivity + Sensation Avoiding score) in ASD group.

#### Conclusions:

The present data suggested the reduced inhibitory function for over-processing of successive stimuli resulting in heightened TR of individuals with ASD. We speculate that spatial integration of stimuli may reduce mental loads induced by overflow of sensory information, and its dysfunction would lead to sensory hyperresponsiveness. Further study is necessary to reveal whether neural E/I imbalance affects such regulatory function or temporal processing itself.

#### **228.004 (Panel) Identifying EEG Markers of Excitation and Inhibition in the Living Human Brain**

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#### Background:

Efficient brain function depends on coordinated Excitatory (E) glutamate and Inhibitory (I) GABA signalling. E-I regulation is thought to be altered in autism. However, in living humans, investigation of E-I is constrained by methods which lack temporal resolution (Magnetic Resonance Spectroscopy) or are invasive (Positron Emission Tomography). In contrast, electroencephalography (EEG) has good temporal resolution and is safe.

#### Objectives:

We tested the hypothesis that EEG markers extracted from an auditory oddball paradigm are sensitive to E-I modulation with the GABAB receptor agonist arbaclofen; and whether E-I responsivity (to a pharmacological challenge) is altered in autism. Two types of EEG markers which may capture different aspects of E-I were considered: task-dependent (including event-related potentials (ERPs) and event-related spectral perturbation (ERSP)) response to auditory signals and task-independent (aperiodic 1/f).

#### Methods:

EEG data was available from 66 adults with (n = 38) and without autism (n = 28). Repetitive standard tones (1066 trials) were interrupted with intermittent deviant tones that differed from the standard in terms of frequency (78 trials), duration (78 trials) or both (78 trials). Data were collected following a single dose of either placebo, low (15mg) dose or high (30mg) dose arbaclofen. The order of administration was randomized and double-blind. We looked at latency and amplitude in two ERPs: the P3a (elicited by novelty) and the mismatch negativity (MMN; elicited by the auditory odd-ball paradigm). We then used ERSP analysis to measure dynamic, time-locked changes to theta. Finally, we looked at the aperiodic 1/f exponent which quantifies the arrhythmic activity contained in the power spectrum. Here, spectral densities were extracted from epochs of four standard tones only, and parameterised to quantify aperiodic activity separate from periodic.

#### Results:

ERP: Across groups, there was a significant drug effect on P3a latency to frequency deviants ( $p=0.01$ ); P3a latency after 30mg of arbaclofen was longer than the placebo condition. There was also a significant drug-group interaction ( $p=0.04$ ) in P3a latency to combined deviants: Arbaclofen reduced P3a latency in the non-autistic group ( $p=0.001$ ) only. Arbaclofen had no effect on P3a amplitude, nor MMN amplitude or latency ( $p>0.05$ ). ERSP: There was a significant drug-group interaction in theta power to combined deviants ( $p=0.002$ ): Arbaclofen depressed theta band perturbation

in the autistic group ( $p < 0.001$ ) only.

Aperiodic 1/f: Across groups, there was a significant effect of drug- Aperiodic exponents after 30mg of arbaclofen were larger than those at placebo. There was no significant effect of group ( $p = 0.082$ ) and no significant drug-group interaction ( $p = 0.194$ ).

#### Conclusions:

We provide direct evidence that EEG markers extracted from an auditory oddball paradigm are sensitive to GABAergic drug challenge. Arbaclofen altered task-dependent brain signalling, but the response profile was different in people with and without autism. Arbaclofen also altered task independent E-I signalling, but response was similar in both groups. We discuss how these findings may further knowledge of sensory processing in autism. We consider whether individual responses to pharmacological challenge could help identify individuals who may (or may not) be responsive to this intervention in a clinical setting.

## ORAL SESSION - 3A — BRAIN FUNCTION (FMRI, FCMRI, MRS, EEG, ERP, MEG)

### 303 - Neurodevelopmental Processes Associated with Sensory Functions in ASD

#### 303.001 (Oral) Atypical Integration of Sensory-to-Transmodal Functional Systems Mediates Symptom Severity in Autism

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**Background:** Autism spectrum disorder is characterized by co-occurring deficits in low-level sensory processing and high-order social cognition. Despite evidence that suggest cascading effects of sensory abnormalities on the development of high-order transmodal functional systems, only few studies have investigated biological substrates underlying atypical interactions across the cortical hierarchy and how it is associated with ASD symptoms.

**Objectives:** To assess the functional organisation of sensory and motor areas, and their relationship with subcortical and high-order transmodal systems.

**Methods:** We applied connectopic mapping on primary sensory/motor areas, along with targeted seed-based intrinsic functional connectivity (iFC) analyses in a multi-site resting-state fMRI dataset of 107 ASD and 113 neurotypical controls (NT). The connectopic map represents how the functional connectivity between the targeted sensory/motor area and the rest of neocortex vary topographically within the given ROI. We first investigated group differences in these connectopic maps and then further projected the vertex-wise correlations of the gradient clusters showing group differences onto the neocortex to examine differences in whole brain connectivity. For the seed-based connectivity analysis, individual iFC matrices were constructed by correlating the functional time-series across predefined parcels within a hierarchically stratified brain system: (i) within sensory/motor areas, (ii) between sensory/motor and subcortical areas, and (iii) within high-order transmodal areas.

**Results:** We observed robust evidence of atypical functional gradient profiles in primary sensory/motor regions and disrupted macroscale cortical hierarchies that underlie phenotypic symptoms in ASD. Specifically, connectopic mapping showed topological gradient abnormalities (i.e., excessively more segregated iFC) in the motor and visual areas, the former of which was associated with restricted and repetitive behaviors, one of the key symptoms of ASD. Different patterns of cortical projections from regions showing gradient abnormalities indicate an overall atypical functional organization in ASD. Notably, the atypical motor gradient showed stronger connectivity with other low-level sensory areas (i.e., visual and auditory) as well as high-order transmodal areas such as the medial prefrontal cortex in ASD compared to NT. Meanwhile, cortical projections from the peripheral visual gradient to the angular gyrus and orbitofrontal cortex were comparably weaker in ASD (**Figs A, B**). Seed-based iFC analyses revealed mosaic patterns of abnormalities: hypoconnectivity within the low-level and high-order functional networks but hyperconnectivity between subcortical and primary sensory/motor regions. Moreover, the proportion of hypoconnectivity in high-order functional networks tends to increase along the cortical hierarchy, suggesting a less integrated high-order system in ASD (**Figs C, D**). Finally, a series of mediation analyses showed that the association between low-level sensory/motor iFCs and clinical symptoms of ASD was mediated by high-order transmodal systems, suggesting pathogenic functional interactions along the cortical hierarchy (**Fig E**).

**Conclusions:** Together with that the findings were largely replicated in an independent dataset; our results collectively suggest the critical role of atypical integration of sensory-to-high-order systems in the complex ASD symptomatology.

#### 303.002 (Oral) Atypicalities in Salience Network Connectivity at 9 Months Relate to Sensory Sensitivity in Infants with a Family History of Autism

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**Background:** Individuals with Autism Spectrum Disorder (ASD) show atypical connectivity in the Salience Network (SN; Uddin et al., 2013), a functional brain network involved in orienting attention to relevant stimuli (Uddin 2015). In particular, in youth with ASD, sensory over-responsivity



(SOR) is related to hyperconnectivity between the SN and sensory cortices (Green et al., 2016), suggesting that SOR may arise from over-attribution of salience to extraneous sensory stimuli. Previous work in our group has demonstrated differences in SN connectivity with sensorimotor and social regions in infants at high vs. low familial risk for ASD by 6 weeks of age (Tsang et al., 2021). However, it remains unknown whether aberrant SN connectivity persists later in development and how it may relate to early atypical sensory reactivity.

**Objectives:** This study aimed to further characterize early atypicalities in SN connectivity and their relationship to sensory reactivity in infants at high familial risk for ASD.

**Methods:** Sixty-six 9-month-old infants underwent an 8-minute resting-state fMRI scan during natural sleep on a 3T MRI scanner. Participants with an older sibling with an ASD diagnosis were deemed to be at high risk (HR, n=45) for ASD, whereas infants with no familial history of ASD were deemed to be at low risk (LR, n=21). The fMRI data were preprocessed and analyzed with FSL using ICA-AROMA to remove signal components attributable to motion. The right anterior insula – the hub of the salience network – was used in seed-based analyses of SN connectivity across the whole brain. Infants' sensory sensitivity was assessed via parental reports on the Infant Sensory Profile (ISP) at 6 months of age, and the Infant-Toddler Social and Emotional Assessment (ITSEA) at 12 months of age. These sensory sensitivity scores were used as regressors in whole-brain analyses to examine how sensory processing atypicalities related to SN connectivity. Here, we report on regression results involving sensory assessment measure within the HR sample. Since the majority of HR infants are expected to not receive an ASD diagnosis (Ozonoff et al., 2011), subsequent analyses will stratify the entire sample by diagnostic outcome to test for group differences in SN connectivity.

**Results:** Within the HR group, heightened sensory sensitivity on the ISP at 6 months of age was significantly correlated with stronger connectivity between the hub of the SN and bilateral primary auditory and somatosensory cortices, thalamus, and amygdala. Interestingly, greater SN connectivity with left somatosensory and auditory cortices, thalamus, and amygdala at 9 months was also predictive of higher sensory sensitivity scores on the ITSEA at 12 months of age.

**Conclusions:** In HR infants, increased SN connectivity with sensory cortices and subcortical regions was related to heightened sensory sensitivity across the first year of life. These results corroborate and extend our prior findings in 6-week-old infants at high risk for ASD (Tsang et al., 2021). As early as 9 months, prior to autism diagnosis, infants already demonstrate hyperconnectivity in the SN that relates to early sensory sensitivity, which may have downstream effects on later development of core autism symptoms.

### **303.003 (Oral) Resting-State Functional Connectivity of the Sensorimotor Cerebellum in ASD**

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**Background:** The cerebellum is involved in sensorimotor processing and continues to develop through adolescence (Bernard et al. 2015). In youth with autism spectrum disorder (ASD), the cerebellum shows structural and functional atypicalities (Rogers et al., 2013; Khan et al., 2015). Many individuals with ASD have sensory processing differences (Leekam et al. 2007), however, there is limited research on how the sensorimotor cerebellum is functionally connected in the typically developing (TD) brain and how the connectivity is different in ASD vs. TD youth. Furthermore, while subparts of the sensorimotor cerebellum are thought to be associated with different aspects of sensory processing, there is little research on their distinct connectivity patterns.

**Objectives:** To examine resting-state functional connectivity (rsFC) with Lobules I-IV and Lobules V-VI of the sensorimotor cerebellum in TD compared to ASD youth.

**Methods:** We collected functional magnetic resonance imaging (fMRI) data to examine rsFC in 54ASD (16F,38M) and 45TD (12F,33M) children and adolescents (age 8-18). Participants were age- and sex-matched. IQ was significantly different between groups and was included as a covariate in analyses. A whole-brain connectivity analysis was conducted using two sensorimotor cerebellar regions-of-interest (ROIs): lobules I-IV (associated specifically with sensorimotor processing) and lobules V-VI (associated with sensorimotor, visual, and auditory processing) (Khan et al. 2015; Leggio and Olivito, 2018). Results were thresholded at  $z > 2.3$  and cluster corrected for multiple comparisons at  $p > 0.05$ .

**Results:** In examining rsFC across groups and lobules, we found that the sensorimotor cerebellum is functionally connected with a wide-range of regions associated with sensorimotor processing (e.g. precentral gyrus, postcentral gyrus, lingual gyrus, thalamus), as well as the limbic system (i.e. hippocampus, amygdala, cingulate gyrus), basal ganglia (i.e., pallidum) and higher-order cognitive function (e.g. precuneus, temporal pole). Lobules I-IV and V-VI showed distinct connectivity with regions associated with the mesolimbic and limbic systems; and with regions related to sensory and emotion processing, respectively.

The ASD group had higher connectivity than the TD group between Lobules I-IV and visual regions, precuneus, brainstem and cerebellum (Figure 1), and reduced connectivity with auditory-language cortical regions and posterior cingulate gyrus. Lobules V-VI showed similarly increased connectivity with the brainstem and within the cerebellum in ASD, and reduced connectivity with inferior frontal gyrus and precentral gyrus, regions known to play a role in social and motor function, respectively.

**Conclusions:** The sensorimotor cerebellum is functionally connected with brain regions including the basal ganglia, limbic and higher-order cognitive systems as well as sensorimotor areas at rest. In the ASD group, both Lobules I-IV and V-VI show elevated short-range rsFC characterized by connectivity within the cerebellum and with the brainstem. Lobules I-IV showed atypically increased connectivity with visual regions and decreased connectivity with regions associated with higher-order language, social, and regulatory functions. Lobules V-VI showed decreased connectivity with

regions related to motor and social function in the ASD group. Overall, these findings suggest that atypical cerebellar connectivity may play a role in increased sensory reactivity and decreased language, social, and regulatory skills often seen in ASD.

**303.004 (Oral) Relationship between GABA, Glutamate and Social and Sensory Processing in Children with Autism Spectrum Disorder**

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**Background:** Theories of altered inhibitory/excitatory signaling in autism spectrum disorder (ASD) suggest that gamma amino butyric acid (GABA) and glutamate (Glu) abnormalities may underlie social and sensory challenges in ASD.

**Objectives:** The present study investigated GABA and Glu concentrations in the amygdala and cerebellum, brain regions implicated in ASD, and related them to individual differences in social and sensory processing. We hypothesize that a greater imbalance of the GABA/Glu ratio in the amygdala will be related to olfactory performance and social impairment.

**Methods:** Age- and sex- matched children with ASD (n=51), a clinical control group with sensory abnormalities (SAs) but not ASD (SA;n=50), and children with typical development (TD;n=50) were enrolled. Single-voxel MRS data were acquired from the left amygdala and right cerebellum at two echo times (TE=30 and 80ms) using a MEGA-PRESS pulse sequence (TR 2000, 2048 complex time points, spectral width 2000 Hz, 32 averages, voxel size 30x30x30mm). A similar sequence, with a modification for GABA-editing, was acquired from the same voxel locations (TR/TE 2000/68ms). All participants were assessed using the Social Responsiveness Scale-2 (SRS-2), Autism Diagnostic Interview-Revised (ADI-R), and Autism Diagnostic Observation Scale (ADOS). Individual sensory processing profiles were characterized using the Child Sensory Profile-2 (CSP-2). Odor identification and detection thresholds were evaluated using the University of Pennsylvania Smell Identification Test (UPSIT) and two odorants via Sniffin' Sticks Threshold Test (phenylethyl alcohol, vanillin), respectively.

**Results:** Significantly increased cerebellar Glu levels were observed in ASD compared to TD ( $p<.05$ ). No other significant group differences for GABA or Glu levels were observed in either region of interest. Children with ASD and SAs had more difficulty with odor detection and odor identification than TD children, but did not perform significantly different from each other. Additionally, there were no significant group differences between children with ASD and SAs on parent-reported sensory processing measures (CSP-2). The ASD group demonstrated a negative correlation between the ratio of amygdalar GABA/Glu and vanillin odor detection ( $r=-.519$ ,  $p<.01$ ), while the SA group exhibited a positive correlation between cerebellar GABA/Glu and vanillin odor detection ( $r=.532$ ,  $p<.01$ ). Lastly, a greater imbalance of cerebellar GABA/Glu was correlated with increased social impairment in the ASD group measured using the ADOS-2 Social Affect Calibrated Severity Score ( $r=-.443$ ,  $p<.05$ ).

**Conclusions:** Our results provide insight into ASD-specific relationships between neurotransmission and odor identification and detection impairments. Despite limited phenotypic differences between children with ASD and SA across all measures of sensory processing, behavioral and parent-reported sensory challenges were related to GABA and Glu levels in the amygdala in the ASD group, while these same measures were related to cerebellar GABA and Glu in the SA group. Further, the relationship between a greater imbalance in the ratio of cerebellar GABA/Glu and social impairment appears specific to individuals with ASD. Our findings provide preliminary evidence that an imbalance in excitatory and inhibitory neurotransmission is associated with some clinical features of ASD. These neural markers may also aid in parsing out disorder-specific neurochemical and sensory profiles and subtypes of ASD.

**ORAL SESSION - 9A — BRAIN FUNCTION (FMRI, FCMRI, MRS, EEG, ERP, MEG)**

**315 - Functional Brain Network Variation Across Autism and Related Neurodevelopmental Disorders**

**315.001 (Oral) Cerebellar Functional Connectivity Profiles Are Shared Among Children with Autism Spectrum Disorder and Other Neurodevelopmental Disorders**

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**Background:**

The cerebellum plays an integral role in regulating cognitive and affective processes, and its deregulation can lead to behavioural differences (Limperopoulos et al. 2009). For instance, perinatal cerebellar injury bears one of the highest increased likelihoods for development of autism spectrum disorder (ASD) among non-genetic causes (Wang et al. 2014). Symptoms due to cerebellar injury can also reflect behaviours relevant to other neurodevelopmental disorders (NDDs), like attention-deficit hyperactivity disorder (ADHD) (Makris et al. 2015) and obsessive-compulsive disorder (OCD) (Sha et al. 2020).

Investigating shared features of cerebellar functional connectivity (FC) between ASD, other NDDs, and typically developing (TD) children can provide insight into which patterns of cerebellar dysfunction in ASD or ASD subgroups are shared with NDDs.

#### Objectives:

To characterize the extent to which behaviour-correlating patterns of cerebellar FC in ASD are shared among typically developing (TD) children and those with diagnoses of ADHD and OCD.

#### Methods:

913 participants were recruited through the Province of Ontario Neurodevelopmental Disorders Network. 422 passed imaging quality control and had complete scores on the behavioural measurements for attentional problems, social communication, and obsessive-compulsive traits (Figure 1) (142 ADHD, 129 ASD, 86 TD, 45 OCD; 73% male; age =  $12.3 \pm 3.1$  (mean  $\pm$  standard deviation)). Resting-state functional MRI data were collected using T2\*-weighted echo planar imaging with one of two 3-Tesla Siemens scanners. Viewing condition was a movie (pre-upgrade) or Inscapes (post-upgrade) and included as a confounder in the analyses. Pre-processing was performed using FMRIPREP; scans were excluded if framewise displacement  $>0.5\text{mm}$  or DVARS  $>0.5\%$  in more than 1/3 of volumes.

Signal was averaged over regions-of-interest (ROIs) from the Yeo and Buckner et al. functional atlases (2011). FC was quantified per participant using partial correlation matrices from the ROI-averaged signals. Canonical correlation analysis (CCA) was performed to identify maximally correlated components (canonical variates (CV)) of the behavioural and FC data. CVs were probed for statistical stability and significance via bootstrap resampling and multivariate analysis of variance.

#### Results:

$P_{\text{Permutation}} < 0.05$  for the first two CVs (Figure 1). CV-1 (“attentional/social deficit” CV) loading values strongly correlated with CBCL Attentional Problems score and SCQ score, which bore coefficients opposite in sign to TOCS score. CV-2 (“obsessive-compulsive CV”) loading values trended with TOCS score, which had the largest coefficient (Figure 1). White stars denote  $|z| > 1.6$ , where  $z$  is the ratio of coefficient to standard error measured from bootstrap resampling (this heuristically indicates a stable coefficient).

Figure 2 illustrates stable cerebellar-cerebral FC. For the “attention/social deficit” CV,  $|z| > 1.6$  was observed for FC between lobules VI/VII/VIII to right-lateralized dorsal attention, control, and limbic networks. For the “obsessive-compulsive” CV, FC between bilateral posterior cerebellar lobe to bilateral dorsal attention, control, and visual network ROIs bore stable coefficients.

ASD children had large negative CV-1 loadings and comprised 52% of participants below the 5<sup>th</sup> percentile of loading values. TD children were observed to have low loading values across both CVs.

#### Conclusions:

ASD shares features of cerebellar-cerebral FC, largely involving the posterior cerebellum, with ADHD and OCD along orthogonal attentional/social communication deficit and obsessive-compulsive components of behaviour.

**315.002 (Oral)** Using Optimal Classification Trees to Disentangle the Overlap between Autism Spectrum Disorder and Schizophrenia  
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Background: Significant genotypic and phenotypic overlap between Autism Spectrum Disorder (ASD) and Schizophrenia (SZ) has been widely documented. This can hinder accurate diagnosis. Neural excitation/inhibition (E/I) ratio, a parameter indicating the contribution of excitatory and inhibitory synaptic activity, has shown to be impaired in both ASD and SZ, yet no study to date has directly compared E/I ratio between SZ and ASD thus the degree of its overlap and differentiation between the groups is not known. To this extent, E/I can be quantified using the Hurst exponent. Additionally, machine learning approaches can aid in increasing the accuracy of differential diagnosis.

Objectives: We had two main objectives: (1) to quantify group differences in the E/I ratio between HC, ASD and SZ, and (2) to assess the discriminant ability of the E/I ratio, both alone and combined with phenotypic measures, in distinguishing between ASD and SZ.

Methods: We collected resting state fMRI (rsfMRI) data from 55 healthy controls/HC (mean age  $24 \pm 3.73$ ; 29 females), 30 ASD (mean age  $22 \pm 3.74$ ; 5 females), and 39 SZ (mean age  $26 \pm 3.58$ ; 8 females) as well as phenotypic data from both patient groups: the Positive and Negative Syndrome Scale (PANSS), the Autism Diagnostic Observation Schedule module 4 (ADOS-T), the Bermond-Vorst Alexithymia Questionnaire (BVAQ), the Empathizing Quotient (EQ), and the Intelligence Quotient (IQ) based on the Wechsler Adult Intelligence Scale (WAIS-III). We ran independent component analysis (ICA) with Neuromark templates on the rsfMRI data to identify 53 components. On the resulting 53 time-courses

from each participant we subsequently computed the Hurst exponent, an indicator of the E/I ratio. Finally, using Optimal Classification Trees (OCT), we ran a classification analysis on the two clinical groups using five incremental feature sets (i.e., models): (1) PANSS and ADOS only; (2) PANSS; ADOS, BVAQ, EQ and IQ; (3) Hurst only; (4) Hurst plus PANSS and ADOS; (5) Hurst plus PANSS; ADOS, BVAQ, EQ and IQ.

Results: Using ANCOVAs, we observed significant group differences in Hurst exponent of the cerebellum and the Sensorimotor, Visual and Cognitive Control networks ( $F > 3.0$ ,  $p < .05$ ). In all of these areas, there was a persistent decrease in E/I ratio in ASD and SZ compared to HC, with SZ showing the lowest values. OCT analyses showed a consistent increase in classification accuracy over the five models: (1) 50%; (2) 64%; (3) 78%; (4) 78%; and (5) 85%.

Conclusions: Our analyses demonstrated that incorporating the E/I ratio alongside phenotypic data results in the best accuracy when disentangling the overlap between ASD and SZ. Using standardized measures and analysis methods will allow expanding these results to new samples, further clarifying the documented heterogeneity in both SZ and ASD.

### **315.003** (Oral) Challenging Diagnostic Boundaries in ASD, ADHD and OCD Using fMRI Resting-State Networks

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Background: Autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), and obsessive-compulsive disorder (OCD) are neurodevelopmental conditions that have distinct behaviour-based diagnostic criteria. However, the behavioural manifestations are highly heterogeneous within disorder and overlap across disorder, supporting trans-diagnostic approaches to studying these conditions. Topographical differences in the brain's functional connectome, particularly differences in the integration and segregation between resting-state networks, have frequently been described in these conditions compared to typically developing (TD) individuals, and there is increasing evidence that these differences are shared across conditions.

Objectives: The objective of this study is to use functional magnetic resonance imaging (fMRI)-derived measures of connectome topography to identify data-driven subgroups. These subgroups may map to underlying biological mechanisms and may better differentiate on their clinical and cognitive characteristics than the current diagnostic labels.

Methods: fMRI resting-state data were acquired on 612 participants (173-ADHD, 250-ASD, 123-TD, 66-OCD; 438-males, 174-females) between 4-19 years of age through the Province of Ontario Neurodevelopmental Disorders (POND) network. Functional connectomes were constructed using parcels that were categorized into eight resting-state networks (visual, somatomotor, dorsal attention, ventral attention/salience, limbic, frontoparietal control, default, and subcortical). Distance matrices were constructed that quantified the dissimilarity of pairs of participants on the integration and segregation of these networks. Similarity Network Fusion was used to fuse the distance matrices from which subgroups were identified using spectral clustering to obtain a solution for a particular set of parameters. This procedure was performed across a wide range of parameters, retaining solutions that were stable across the parameter space. A participant co-assignment matrix was constructed that quantified the probability that pairs of participants were clustered in the same subgroup across the retained solutions, and hierarchical clustering was performed to identify subgroups. To remain agnostic to the number of subgroups identified from the co-assignment matrix, hierarchical clustering was performed to identify subgroups across a range of number of clusters.

Results: The Davies-Bouldin index pointed to four being the optimal number of clusters, and the proportion of each diagnoses did not differ between the clusters. The first cluster was characterized by decreases in IQ and adaptive functioning as well as increases in repetitive behaviours; this contrasted with a second cluster with relatively high performance in these behavioural domains. The third cluster was distinguished by increased repetitive behaviours and obsessive-compulsive traits. Finally, the fourth cluster was comprised of two subgroups that emerged from the hierarchical clustering that differed in their attention abilities. Segregation of the default mode network and integration of the visual, dorsal attention, and subcortical networks were the most significant contributors in determining the subgroups. While the first subgroup demonstrated decreased segregation of the default mode yet increased integration of the visual, dorsal attention, and subcortical networks compared to the remaining subgroups, the third subgroup demonstrated the opposite pattern of segregation and integration, with the remaining subgroups falling in between.

Conclusions: Measures of the brain's functional segregation and integration can be used to identify subgroups of children and adolescents with neurodevelopmental conditions that reflect behavioural differences that span diagnostic boundaries.

### **315.004** (Oral) Neural Correlates of Face Processing in Children with Autism, Fragile X Syndrome, Unaffected Siblings of Children with Autism, and Typical Development

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**Background:** Atypical neural responses to face stimuli have been well-documented in children with autism spectrum disorder (ASD). However, much of this research excludes additional participant groups that are also impacted by varying degrees of ASD symptoms. In the current study, we investigated neural correlates of social information processing among children with ASD, as well as children with fragile X syndrome (FXS) and unaffected siblings of children with ASD (ASIBs). FXS is single gene disorder often characterized by intellectual impairment. Approximately 60% of preschoolers with FXS also meet diagnostic criteria for ASD (Roberts et al., 2020). Additionally, ASIBs are often impacted by the broader autism phenotype, in which they display higher rates of subclinical ASD symptoms than observed in the general population (e.g., Ozonoff et al., 2014).

**Objectives:** To examine differences in neural responses to social and non-social stimuli in heterogeneous groups of participants impacted by ASD, including children with ASD, children with FXS, and unaffected ASIBs.

**Methods:** Participants included children with ASD ( $N = 36$ , 35 males, age  $M = 5.6$  years), children with FXS ( $N = 19$ , 13 males, age  $M = 6.2$  years), and non-ASD younger siblings of children with ASD ( $N = 23$ , 16 males, age  $M = 5.5$  years). A group of children with typical development were also included ( $N = 28$ , 23 males, age  $M = 5.2$  years). Event-related potentials (ERPs) were measured in response to photographs of upright and inverted faces and houses. A behavioral support protocol was utilized to promote successful data collection (Guy, Black, et al., 2021). The P1, indicative of stimulus orienting, and N170, reflecting specialized face processing, ERP components were examined.

**Results:** There was a difference in the amount of useable data collected across groups: ASD (trials  $M = 159$ ), FXS (trials  $M = 127$ ), ASIB (trials  $M = 221$ ), TD (trials  $M = 206$ ). As presented in Figure 1, there was a main effect of group on P1 amplitude,  $F(3, 6696) = 37.00, p < .01, \eta^2 = .02$ . As presented in Figure 2, there were main effects of stimulus type,  $F(1, 159) = 6.26, p = .01, \eta^2 = .03$ , and group,  $F(3, 6675) = 90.35, p < .01, \eta^2 = .04$ , on N170 amplitude.

**Conclusions:** Neural responses to face and house stimuli differed across groups at both the P1 and N170 components. Children with FXS demonstrated the greatest amplitude P1 and N170 responses, possibly reflecting hyper-responsivity to the stimuli. The ASIB and TD groups showed similar patterns of responses across both ERP components. Participants in the ASD group showed statistically similar P1 amplitude responses to TD and ASIB participants, however, their N170 amplitude responses were decreased relative to other participant groups. While this may be indicative of atypical face processing in ASD, all groups showed evidence of specialized face processing, based on the main effect of stimulus type at the N170. The results of the current study indicate that heterogeneous participant groups impacted by ASD demonstrate unique patterns of neural responses to visual stimuli.

## POSTER SESSION — BRAIN FUNCTION (fMRI, fCMRI, MRS, EEG, ERP, MEG)

### 416 - Brain Function (fMRI, fCMRI, MRS, EEG, ERP, MEG)

#### 416.040 (Poster) Evaluation of EEG Biomarkers for Angelman Syndrome during Overnight Sleep

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**Background:** Angelman syndrome (AS) is a neurodevelopmental disorder caused by loss of function mutations in the *UBE3A* gene. AS is characterized by intellectual disability, impaired speech and motor skills, epilepsy, and impaired sleep. Multiple treatment strategies to re-express functional *UBE3A* were successful in rodent models of AS and have now moved to early stage clinical trials in children.

**Objectives:** Developing reliable and objective AS biomarkers is essential to guide the design and execution of current and future clinical trials. Our prior work quantified short clinical EEGs to define promising biomarkers for AS. Here, we asked whether overnight sleep is better suited to detect AS EEG biomarkers.

**Methods:** We retrospectively analyzed EEGs from twelve overnight sleep studies from individuals with AS with age and sex-matched Down syndrome and neurotypical controls, focusing on low-frequency (2-4 Hz) delta rhythms and sleep spindles.

**Results:** Delta EEG rhythms were increased in AS during all stages of overnight sleep, but overnight sleep did not provide additional benefit over wake in the ability to detect increased delta. Abnormal sleep spindles were not reliably detected in AS during overnight sleep, suggesting that delta rhythms represent a more reliable EEG biomarker.

**Conclusions:**

Overall, we conclude that periods of wakefulness are sufficient, and perhaps ideal, to quantify delta EEG rhythms for use as AS biomarkers.

#### 416.041 (Poster) Age-Related Changes in Insular Cortical Functional Connectivity in Autism Spectrum Disorder

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**Background:** Insular function is implicated in generally all cognitive processes such as social cognition, attention, speech, language, and executive function (Uddin et al., 2017). This multifaceted cortical region can be further divided into at least three functional subdivisions: a dorsal anterior, ventral anterior, and posterior insula (Deen et al., 2011). Altered functional connectivity of the insular cortices has been demonstrated in autism spectrum disorder (ASD; Nomi et al., 2019) and is linked with several behavioral characteristics of ASD (Green et al., 2016; Neufeld et al., 2018; Uddin et al., 2013). However, little is known regarding insular functional connectivity (FC) changes across development and into adulthood in ASD.

**Objectives:** To characterize age-related differences in insular subdivision FC strength between individuals with ASD and typically developing (TD) individuals from childhood to middle age.

**Methods:** Using a large multi-site resting-state fMRI dataset from the Autism Brain Imaging Data Exchange (ABIDE; 9 sites; 758 participants; TD: N = 405 (mean age: 15 years); ASD: N = 353 (mean age: 15 years); Age: 5-50 years), we investigated age-related differences in insular FC strength between individuals with ASD and TD individuals. The right (R) and left (L) ventral anterior (vAI), dorsal anterior (dAI), and posterior insula (PI) were identified as regions of interest (ROIs; Deen et al., 2011; **Figure 1**). Individual time courses were extracted and averaged across insula voxels for each subdivision. Time courses were correlated with every other cerebral voxel to identify FC strength between insular subdivisions and other brain regions. Linear regression models were used to identify age x group (ASD, TD) interactions of insula functional connectivity strength.

**Results:** An age x group (ASD, TD) interaction revealed that younger individuals with ASD had weaker functional connections with the cerebellum, lateral occipital cortex, and temporal fusiform cortex than typical individuals but older individuals with ASD had stronger functional connections with these same brain areas compared to typical individuals (voxel (uncorrected),  $p < .001$ ; cluster (corrected),  $p < .05$ ; **Figure 2**). Specifically, age-related functional connections that changed with age were observed between the R dAI and the cerebellum and lateral occipital cortex (**Figure 2A and 2B**); the L dAI and the L cerebellum (**Figure 2C**); the R PI and the temporal fusiform cortex (**Figure 2D**); and the L PI and the temporal occipital fusiform cortex, lingual gyrus, and L cerebellum (**Figure 2E and 2F**).

**Conclusions:** In all insula subdivisions examined, the general trend was that functional connectivity with the whole-brain increased with age in ASD and decreased with age in TD. The findings suggest individuals with ASD undergo altered age-related FC with the insula and cerebellum, occipital cortex, and temporal cortex, potentially underlying disturbed sensory integration processing commonly experienced in ASD.

**416.042 (Poster)** Association between the Visual Evoked Potential and autistic symptoms in children with and without Tuberous Sclerosis Complex  
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**Background:** Tuberous Sclerosis Complex (TSC) results from mutations in *TSC1* or *TSC2* genes. This leads to increased activation of the mammalian target of rapamycin (mTOR) pathway, which in turn causes benign hamartomas in the brain and also impacts neuronal connectivity and function. Approximately 50% of individuals with TSC meet criteria for Autism Spectrum Disorder (ASD). The neural mechanisms underlying ASD in individuals with TSC remain unknown, despite the known underlying gene and resulting disruptions in neuronal pathways. The Visual Evoked Potential (VEP) is a robust neural response to basic visual stimuli. It reflects integrity of lower-level visual pathways and synaptic efficiency, and atypicalities in basic sensory circuitry (e.g., visual processing) could perturb higher-order complex functions (e.g., social cognition) that rely upon it. The VEP can be measured in infants easily using a reversing checkerboard stimulus and EEG. Varcin et al. (2016) found the 12-month VEP was remarkably intact in a pilot sample of infants with TSC, though individual differences likely exist given findings in 'idiopathic' ASD of the altered P100 component of the VEP. We now present data from 12, 18, 24, and 36 months describing the VEP and autism severity in individuals with and without TSC.

**Objectives:** assess the development of the VEP and its relationship to autism severity in individuals with and without TSC.

**Methods:** Pattern reversal VEP and ADOS-2 data were collected at 12, 18, 24, and 36 months from children with TSC and a comparison sample of typically developing children (Table 1). Most data were cross-sectional, though some children participated at multiple time points. We processed VEP data using the HAPPE pipeline (Gabard-Durham et al., 2018) and visually inspected each waveform for drift and evidence of noise (multiple peaks, no prominent peaks, or severe perturbations to morphology or latency). We conducted multiple regressions to predict ADOS-2 calibrated severity score (CSS) with N1 amplitude, P1 amplitude, and TSC case status, while controlling for sex and number of trials. P-values were adjusted for multiple comparisons using the False Discovery Rate.

**Results:** P1 amplitude was significantly increased in infants with TSC compared to typically developing infants at 12 and 18 months ( $p$ 's  $< 0.05$ ), but not 24 and 36 months. No between-group differences were observed in N1 amplitude at any age. With regard to autism severity, no significant relationship emerged between VEP components and ADOS-2 CSS. Future work will include ASD diagnostic data as well as Mullen Visual Reception and Fine Motor raw scores.

**Conclusions:** The VEP appears atypical in younger infants with TSC but normalizes by two years. Interestingly, this pattern appears to be driven by stability in TSC P1 amplitudes across ages, while the sample without TSC shows increasing P1 amplitude. Analysis of available longitudinal data may elucidate whether this pattern of different developmental trajectories holds at the individual level. The absent relationship between ADOS-2 CSS and VEP amplitude suggests that basic visual processing may remain intact, and social atypicalities may be due instead to perturbations in higher

order neural processes.

**416.043 (Poster)** Attentional Influences on Neural Processing of Biological Motion in Typically Developing Children and Those on the Autism Spectrum

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**Background:** Biological motion imparts rich information related to the movement, actions, intentions and affective state of others, which can provide foundational support for various aspects of social cognition and behavior. Given that atypical social communication and cognition are hallmark symptoms of autism spectrum disorder (ASD), many have theorized that a potential source of this deficit may lie in dysfunctional neural mechanisms of biological motion processing. Indeed, synthesis of existing literature provides some support for biological motion processing deficits in autism spectrum disorder, although high study heterogeneity and inconsistent findings complicate interpretation.

**Objectives:** Here, we attempted to reconcile some of this residual controversy by investigating a possible modulating role for attention in biological motion processing in ASD.

**Methods:** We employed high-density electroencephalographic (EEG) recordings while participants observed point-light displays of upright, inverted and scrambled biological motion under two task conditions to explore spatiotemporal dynamics of intentional and unintentional biological motion processing in children and adolescents with ASD (n=27), comparing them to a control cohort of neurotypical (NT) participants (n=35). In the unattended task condition, participants passively viewed the point-light displays and indicated whether they observed a red or green color change in one of the dots. Next, in the attended condition participants indicated whether the point light displays depicted biological (upright or inverted) or non-biological (scrambled) motion.

**Results:** Behaviorally, ASD participants were able to discriminate biological motion with similar accuracy to NT controls (Unattended:  $d'_{ASD}=1.26\pm.78$ ;  $d'_{NT}=1.53\pm.74$ ; Attended:  $d'_{ASD}=1.05\pm.76$ ;  $d'_{NT}=1.44\pm.77$ ). However, electrophysiologic investigation revealed reduced automatic selective processing of upright biologic vs. scrambled motion stimuli in ASD relative to NT individuals in the P1, N1, and P2 components, which was ameliorated when task demands required explicit attention to biological motion. Additionally, we observed distinctive patterns of covariance between visual potentials evoked by biological motion and functional social ability, such that Vineland Adaptive Behavior Scale-Socialization domain scores were differentially associated with biological motion processing in the N1 ( $F(1,18)=9.343$ ,  $R^2=.342$ ,  $p<.007$ ) and P2 ( $F(1,18)=6.601$ ,  $R^2=.223$ ,  $p<.017$ ) periods in the ASD and NT groups, respectively.

**Conclusions:** Together, these data suggest that individuals with ASD are able to discriminate, with explicit attention, biological from non-biological motion but demonstrate diminished automatic neural specificity for biological motion processing, which may have cascading implications for the development of higher order social cognition.

**416.044 (Poster)** Distinct Habituation Patterns of Auditory Social Attention Associated with Disruptive SCN2A and GRIN2B Mutations

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**Background:** Upwards of 30% of autistic individuals carry a *de novo* copy number or single nucleotide variant associated with ASD (Iossifov et al., 2014), including individuals with a genetic disruption to either *SCN2A* (loss of genetic function, specifically) or *GRIN2B* (Pan et al., 2015; Sanders et al., 2018). Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder with heterogeneity across levels of the genotype and phenotype (Lord et al., 2020) associated with sensory information overload and sensory sensitivities (Wilson et al., 2019). Habituation is the mechanism by which sensory information is filtered at the neural level, and it represents a fundamental, evolutionarily conserved form of learning. Atypical habituation patterns are reported in ASD (Hudac et al., 2018; Vivanti et al., 2018), and may underlie cognitive and behavior hallmarks of both ASD. We anticipate that novelty habituation may be a translational biomarker for preclinical drug screening, objective clinical classification, and stratification of human cohorts.

**Objectives:** Our objective is to examine neural attention responses to nonsocial (e.g., tones) and social information (e.g., speech) in youth with disruptive mutations to *SCN2A* and *GRIN2B*.

**Methods:** Over 40 youth (aged 2-22 years) with a known disruptive mutation to *SCN2A* and *GRIN2B* enrolled in the BioGENE study completed mobile electroencephalography (EEG) at off-site locations (participant's home, local hotel room). Preliminary analyses include 14 *SCN2A* and 4 *GRIN2B* youth aged 2-19 years. Two passive auditory oddball EEG experiments measured attention and speed of habituation to (1) nonsocial information (Hudac et al., 2018) and (2) consonant-vowel speech information. Here, we focus on the within-category response differentiation of the P3a (100-350ms). Linear mixed-effects analyses with random effects [R lme() package] tested experiment differences (nonsocial vs social) in condition (i.e., deviant noises vs. frequent/repeated tone or speech) and habituation (i.e., the reduction rate of N1 amplitude).

**Results:** Both *SCN2A* and *GRIN2B* groups exhibited a P3a effect (novel relative to frequent sounds) for both experiments,  $F's>3.71$ ,  $p's<.011$ , however, larger P3a effects were observed for *GRIN2B* ( $p<.001$ ) relative to *SCN2A* ( $p=.06$ ). In addition, the *GRIN2B* group was sensitive to experimental context with larger P3a effects for nonsocial relative to social sounds,  $F(1,512)=10.11$ ,  $p=.002$ . Lastly, a trend indicates potential habituation differences between groups,  $p=.07$ .

**Conclusions:** Group differences in auditory attention may implicate distinct underlying mechanisms of ASD for SCN2A and GRIN2B. For one, the GRIN2B differentiated between social and nonsocial sounds, albeit with an atypical pattern than one may expect from a neurotypical population. Further work to understand individual difference factors associated with auditory attention, such as sex, age, cognition, and ASD severity, will be helpful in clarifying the specificity of this potential biomarker.

**416.045 (Poster)** EEG Frequency Tagging Evidence of Intact Social Interaction Recognition in Adults with Autism

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**Background:** To explain the social deficiencies in autism, a large amount of research has been conducted on the neural correlates of social stimuli processing. This research typically uses simple stimuli such as a single agent or body parts such as eyes, faces or hands. Although these simple stimuli provide great experimental control, there is a trade-off with ecological validity. That is, simple social stimuli have the disadvantage of not resembling the complexity of what we encounter in our daily social lives, and as such, the situations people with autism experience difficulties in. This might be the reason why these studies found mixed results so far. Perhaps, anomalies only occur when processing more complex social stimuli that require complex cognitive processes. A particularly relevant process in this respect is the recognition of third-party social interactions, as it is both highly relevant in social life and requires advanced processing. In a previous study, we used EEG frequency tagging to investigate how neurotypical individuals infer social interaction from contextual information. The results revealed increased neural responses over lateral posterior electrodes to social scenes depicting a social interaction than to social scenes not depicting a social interaction.

**Objectives:** To further our understanding of social interaction difficulties in autism, we compared social interaction recognition in adults with and without autism using EEG frequency tagging. We expected to replicate the enhanced response to social interaction scenes in the control group. Importantly, we also expected this effect to be diminished in the autism group.

**Methods:** We administered the EEG frequency tagging task to 24 adults with autism<sup>1</sup>, and a gender- and age-matched group without any diagnoses ( $n = 22$ ). The task included four types of stimuli: images that depict rich social scenes with social interaction, images that depict rich social scenes with no social interaction, and the scrambled versions of both image types (See figure 1). The study design and analyses for this study were pre-registered.

**Results:** Contrary to our expectations, a repeated measures ANOVA revealed an enhanced response to social scenes with social interaction compared to social scenes without social interaction in *both* groups, with no difference between them.

**Conclusions:** We found an enhanced response to social scenes with social interaction, replicating our previous findings. However, this effect was not diminished in adults with autism. This suggests that the process of inferring social interaction from context using static images is not anomalous in adults with autism, and cannot explain the social difficulties adults with autism experience.

<sup>1</sup>We are aware of the ongoing person-first versus identity-first debate. We acknowledge and respect different preferences for language used to refer to a person with a diagnosis of autism spectrum disorder. Our choice of person-first language was based on the preference of our Dutch-speaking autism group.

**416.046 (Poster)** Functional Analyses of Biological Motion Perception in ASD

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**Background:** Biological motion perception supports successful social function as it allows us to identify social conspecifics in our environments. Because social perception is thought to be different in ASD, biological motion perception has been the topic of much eye-tracking and neuroimaging research, with studies indicating reduced attention or reduced activation to biologically relevant information in ASD. However, there is limited understanding of the neural time course of biological motion perception in ASD. This early activity likely reflects mechanisms guiding how eye-movements are deployed in the environment and represents a meaningful inflection point for understanding differences in social attention.

**Objectives:** Our goals were to (1) use novel functional data analytic methods to characterize brain response to biological motion in participants with ASD and (2) assess whether brain activity to biological motion differed between participants with ASD and a neurotypical (NT) comparison sample.

**Methods:** Data were collected as part of the Autism Biomarkers Consortium for Clinical Trials (ABC-CT); a multisite, naturalistic study of 6-11 year-old children with ASD and NT. Clinical characterization was thorough and included measures of cognitive ability (Differential Ability Scales — DAS-II), ASD symptomology (Autism Diagnostic Observation Schedule — ADOS) and adaptive behavior, (Vineland Adaptive Behavior Scales — VABS3). ERP data were collected (ASD  $n=213$ ; NT  $n=113$ ) using a high-density electrode montage while participants viewed one-second segments of point light animations depicting either humans walking (biological motion) or phase scrambled comparison stimuli (scrambled motion).



Segmented and averaged ERPs for all participants were then processed to estimate principle ERPs (pERP)s. pERPs are a set of maximally independent basis functions, or waveform shapes, shared among all participants, which represent the time courses of distinct sources of neural activity. Subsequent analyses were conducted on individual pERP scores, which represent the activation of a specific neural source for a given participant and experimental condition.

**Results:** Six pERPs were sufficient to explain >80% of the variance in the sample. Of these six, two pERPs showed significantly different activation between biological and scrambled motion at occipitotemporal sites. The first pERP was most prominent at ~200ms ( $t = 4.1$ ,  $p < .05$ ) whereas the second spanned the entire time course ( $t = 2.5$ ,  $p < .05$ ). These pERPs indicated that scrambled motion, relative to biological motion, elicited greater neural activity across all participants. However, an interaction with diagnostic group revealed that NT individuals, relative to ASD, showed increased differentiation between biological and scrambled motion at the pERP impacting activity in the 200ms range ( $t = 2.3$ ,  $p < .05$ ).

**Conclusions:** These data show that biological motion is differentiated from non-biological motion in brain as early as <300ms. This time course is commensurate with facilitating the deployment of eye-movements to socially relevant information in the environment. Individuals with ASD showed reduced neural specialization in this early time range. This finding suggests that reports of reduced attention to biological motion in ASD may be evident in the first milliseconds of perception. Ongoing analyses evaluate whether these patterns of neural activity can explain heterogeneity in clinical presentation or patterns of attention to social information.

#### **416.047 (Poster)** Infant/Toddler Trajectories of Amygdala Development Are Associated with Later ASD Diagnosis and School-Age Anxiety in a Familial High-Risk for ASD Sample

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**Background:** Children with autism spectrum disorder (ASD) are at an increased risk for other co-occurring behavioral and mental health problems, including anxiety disorders (Leyfer et al., 2006; Simonoff et al., 2008; Sukhodolsky et al., 2007). Siblings of children with ASD also show increased rates of anxiety, particularly in middle childhood (Shivers, Deisenroth, & Taylor, 2013), making high-risk sibling samples ideally suited to identify precursors of anxiety in ASD. The amygdala is involved in emotion processing and fear regulation (Pine, 2008), and has been implicated in both ASD and anxiety (Amaral, Bauman & Schumann, 2003; Kilgore & Yurgelun-Todd, 2005). No study to date has investigated how amygdala growth in infancy is related to later anxiety symptoms in a sample at high-risk for ASD.

#### **Objectives:**

Examine whether growth trajectories in amygdala volume from 6 to 24 months differ based on later ASD and anxiety outcomes.

#### **Methods:**

This study prospectively examined infants at high- and low-familial-risk (HR, LR) for ASD at 6, 12 and 24 months of age and at one visit during school age (7 to 11 years). Clinical best estimate diagnosis of ASD or no-ASD was made at 24 months. Participants were further classified as having clinically significant symptoms of anxiety or not at school age, based on cutoffs (T-score>65) on the Child Behavior Checklist (CBCL; Achenbach, 1999). This resulted in 4 groups: ASD+anxiety (N=11; 24 developmental samples); ASD only (N=14; 33 developmental samples); Anxiety only (N=19; 45 developmental samples); No ASD or anxiety (N=112; 275 developmental samples). Participants underwent structural MRI scans at 6, 12 and 24 months. Pre-processing included registration to an age-specific multi-atlas, and multi-modality based quantification of amygdala volume. Multi-level models examined trajectories of amygdala volume from 6 to 24 months as predicted by the main effects and interactions between age at imaging, later ASD diagnosis, and school-age anxiety symptoms, controlling for sex and total brain volume at each imaging timepoint.

**Results:** Growth trajectory of the left amygdala in the first 2 years of life was associated with ASD diagnosis ( $t=2.709$ ,  $p=.007$ ) and elevated anxiety symptoms ( $t=4.014$ ,  $p<.001$ ; Figure 1). Both the presence of later ASD diagnosis and anxiety symptoms were associated with increased growth trajectories of amygdala volume over time, but the interaction between the two was not significant. Results were similar in the right amygdala, but left amygdala is presented for ease of interpretation.

**Conclusions:** Amygdala growth differed by presence of later ASD diagnosis and anxiety symptoms, and may serve as an early marker of impaired social and emotional processing. The lack of a significant interaction indicates that the association between early amygdala development and later anxiety symptoms is comparable in children with and without ASD. Understanding early predictors may help identify those most at risk for developing each condition and inform the search for potential intervention targets.

#### **416.048 (Poster)** Late Positive Potential to Emotional Faces in Young Children with Autism: Associations with Sex and Reciprocal Social Interaction

**Background:** Difficulties with emotional face processing have been well-established in the autism spectrum disorder (ASD) literature (Lozier et al., 2014), with electroencephalogram (EEG) research focusing on early-stage perceptual processing using the N170 event-related potential (Kang et al., 2017). The field has begun to examine late positive potential (LPP), which indexes sustained attention to emotional stimuli and elaborative processing at later stages, lending insight into heterogeneity across ASD (Keifer et al., 2019). In autistic adults, ASD symptoms are positively associated with heightened LPP in response to subtler emotional faces, suggesting increased attention due to difficulty with processing (Keifer et al., 2019). Conversely, no significant associations were reported between LPP and ASD symptoms in adolescents (Benning et al., 2016). However, LPP has not yet been examined in younger autistic children. Although sex differences have not been established in ASD, literature in typically-developing (TD) populations suggests larger LPP amplitudes in females than males (Yu et al., 2020; Kato & Takeda, 2017). Examining the effects of ASD symptoms and sex on LPP in this younger developmental period may be an important next step to understanding differences in late-stage emotion processing in ASD.

**Objectives:** We examined the relationship between ASD symptoms and LPP in response to emotional faces in autistic and TD children. We hypothesized that greater ASD symptoms would relate to heightened LPP. We explored potential sex differences in LPP amplitudes.

**Methods:** Eighty participants (N = 45 ASD, 75% male,  $M_{age}=7.94$ ,  $SD_{age}=1.84$ ;  $M_{IQ}=106$ ) participated in this study. Parents completed a measure of autism symptoms (SCQ; Rutter et al., 2003). LPP was indexed from parietal sites during a non-verbal awareness task with cartoon faces with varying emotions. Independent samples *t*-tests were first conducted to examine group differences in LPP, followed by Pearson and point-biserial correlations. Hierarchical linear regressions were conducted to examine the predictive relationships of ASD symptoms or sex on LPP.

**Results:** T-tests revealed no differences in LPP between TD and ASD groups ( $p>.307$ ). However, among ASD children, SCQ Total and Reciprocal Social Interaction subscale were correlated positively with parietal LPP and differed by sex. LPP also differed by sex (Table 1). SCQ predicted heightened LPP above and beyond sex. Upon probing, this effect was more pronounced in the SCQ reciprocal social interaction subscale (Table 2).

**Conclusions:** This is the first study in ASD to examine LPP in childhood. Similar to adults (Keifer et al., 2019), LPP did not differ between ASD and TD children. However, within ASD children, results suggest autistic girls than boys may pay more sustained attention during late-stage emotional processing, similar to TD populations (Yu et al., 2020; Kato & Takeda, 2017). Above and beyond sex, higher levels of ASD symptoms, specifically in the reciprocal social interaction subdomain, may relate to requiring more attentional neural resources to late-stage emotional processing (Keifer et al., 2019). These findings provide insight into developmental trends and specific ASD symptom associations with emotional face processing and can aid in the development of treatments targeting emotional processing in children with ASD.

**416.049 (Poster)** Modulation of the Face-Sensitive N170 Event-Related Potential By Emotional Expression and Visual Attention in Adults with Autism, Schizophrenia, and a Non-Clinical Comparison Group

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**Background:** Compared to non-clinical (NC) samples, individuals with autism (ASD) and schizophrenia (SZ) spectrum disorder exhibit atypical brain responses to faces as quantified by the N170, a face-sensitive event-related potential. Features of the N170, such as amplitude and latency, may also relate to emotional valence and patterns of visual attention to faces. Investigations of how neural processing of faces relates to emotional valence and/or visual attention are needed to elucidate processes underlying social difficulties in ASD and SZ.

**Objectives:** Examine relations among emotional valence, visual attention, and neural response to faces in a transdiagnostic sample of ASD, SZ, and NC individuals.

**Methods:** Participants were adults aged 18-35 years (ASD n=28; SZ n=24; NC n=40) with confirmed diagnoses via standardized tools and expert clinician assessment. A novel gaze-contingent and interactive face processing paradigm with co-registration of electroencephalography and eye tracking was used to examine both neural response and visual attention during face viewing. Participants were presented with a fixation cue followed by a neutral face with a direct gaze. Contingent upon gaze to the eyes of the neutral face, the stimulus changed to either a happy or fearful face. Visual attention was defined as percentage of time looking (%looking) to the face and was logit transformed to accommodate distributional assumptions for statistical analyses. Neural response was approximated by N170 peak amplitude and latency extracted from electrodes over right occipitotemporal scalp. Separate linear mixed effects models were conducted to assess the main and interactive effects of diagnostic group, face valence, and %looking on N170 amplitude and latency. Models included the three-way Diagnosis (ASD, SZ, NC) x Emotion (happy, fearful) x Visual Attention (%looking) interaction and all lower order effects.

**Results:** For N170 amplitude, significant effects included the main effects of Diagnosis [ $F(2, 89)=3.51$ ,  $p=0.03$ ] and Emotion [ $F(2, 89)=7.87$ ,  $p<0.01$ ], and the Diagnosis x Emotion x Visual Attention interaction [ $F(2, 89)=10.84$ ,  $p<0.001$ ]. Irrespective of valence and %looking, ASD exhibited reduced N170 amplitude compared to SZ [ $t(83)=-2.10$ ,  $p=0.04$ ] and NC [ $t(83)=-1.98$ ,  $p=0.05$ ]. Greater amplitude was observed for happy [ $M(SE)=-5.44(0.28)$ ] compared to fearful [ $M(SE)=-4.64(0.29)$ ] faces [ $t(83)=4.78$ ,  $p<0.001$ ]. The significant three-way interaction indicated different relationships between %looking and N170 amplitude based on diagnostic group and valence. Specifically for happy faces, there was a positive

association between %looking and amplitude in NC that was not evident in ASD and SZ. For fearful faces, more %looking was positively associated with N170 amplitude across all groups. With N170 latency as the outcome variable, only the main effect of Emotion [ $F(1, 83)=21.2, p<0.01$ ] was significant: slower latencies were observed in response to fearful faces [difference=10.80ms,  $t(83)=4.83, p<0.001$ ].

**Conclusions:** Findings demonstrate the importance of considering both valence and visual attention to faces to clarify mixed findings regarding atypical neural response to faces reported in the ASD and SZ literatures. Between-group differences in the association between visual attention and neural response in happy but not fearful faces suggests shared aberrations in early perceptual processing of particularly prosocial information in ASD and SZ that may underly reduced social approach and/or downstream social difficulties.

**416.050 (Poster) Neurocomputational Mechanisms of Social Decision-Making Impairments in Autism Spectrum Disorder**

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**Background:**

Autism Spectrum Disorders (ASDs) are characterized by impairments in social functioning as well as repetitive behaviors and restricted interests. Perhaps due to deficits in socioemotional reciprocity, individuals with ASD are thought to show alterations in social decision-making. Despite the multitude of neuroimaging studies investigating social dysfunction in ASD, the neural underpinnings of these social impairments remain poorly understood. Prior research is largely limited by the use of passive paradigms (e.g. face perception, emotion recognition) rather than ecologically-relevant, proactive social tasks more akin to the type of interactions with which people with ASD struggle daily.

**Objectives:**

By utilizing tasks that probe dynamic and naturalistic aspects of social decision-making in combination with 7T functional magnetic resonance imaging (fMRI), this study takes an innovative computational psychiatry approach to understanding the neural underpinnings of social deficits in ASD. We hope that by better characterizing impairments in specific aspects of social interaction, both behaviorally and in the brain, we can gain a fuller understanding of the mechanisms involved and inform the development of future interventions.

**Methods:**

In conjunction with fMRI, ASD participants (n=12; mean age: 25.3, age range: 18.1-35.7; 75% male) completed the ultimatum game, a neuroeconomic task in which they accepted or rejected proposed monetary offers from virtual partners. Participants also completed a choose-your-own-adventure game in which they simulated interactions with virtual characters. In this game, each interaction shifted a given character's position in a behind-the-scenes plot of 'social space' framed by axes of social hierarchy and affiliation. Computational modeling approaches extracted parameters of interest based on the trajectory of decision-making in each task. General linear models with parametrically modulated regressors assessed activity in several brain regions in association with model-derived task behavior.

**Results:**

In the ultimatum game, ASD patients showed higher initial offer expectations ( $p=0.03$ ) and impairments in norm adaptation speeds (the degree of offer expectation adjustment based on observations;  $p<0.001$ ) than have been previously reported in typically-developing (TD) individuals (n=45). Neurally, individuals with ASD did not show the encoding of norm prediction errors (the difference between the expected and actual offers) in the anterior insula that is typically present in TD individuals. In the choose-your-own-adventure game, reduced social consistency (more varied character trajectories) was associated with increased ASD symptoms (ADOS;  $p<0.05$ ). Neurally, individuals with ASD did not show hippocampal encoding of the angles of the vectors drawn between the participant's point of view and the characters' locations in social space (which typically represents intact tracking of relationships) that has been previously described in TD individuals. Within the ASD group, this decreased hippocampal encoding was associated with impaired social affect (ADOS;  $p<0.05$ ) and decreased prosocial motivation (EmQue,  $p<0.05$ ).

**Conclusions:**

Together, these results suggest that individuals with ASD show altered social decision-making and do not utilize neural circuits known to support social decision-making to the same extent as TD individuals. Additionally, the observed alterations in both social behavior and neural encoding of social information were associated with increased ASD symptoms, suggesting these results hold clinical relevance.

**416.051 (Poster) Neurophysiological Correlates of the Sensory Gating Inventory in Adults with Autism Spectrum Disorders**

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**Background:** Adults with autism spectrum disorders (ASD) show significant and persistent sensory symptoms. A common sensory symptom in ASD includes impairments in filtering out redundant sensory information, referred to as sensory gating. The paired-click electroencephalography (EEG) paradigm is widely used to examine neural sensory gating.

**Objectives:** This study examined perceptual abnormalities associated with sensory gating using the self-report Sensory Gating Inventory (SGI) and its relationship to event-related potential (ERP) measures from the paired-click EEG paradigm in young adults with and without ASD.

**Methods:** Twenty-four young adults with ASD (range: 18 – 30 years, Mean: 23.3 years) and 24 age-matched neurotypical adults completed the SGI. The SGI is a 36-item self-report questionnaire of perceptual anomalies related to sensory gating. The questionnaire yields 4 factors: Perceptual Modulation (16 items), Distractibility (8 items), Over-Inclusion (7 items), and Fatigue-Stress Vulnerability (5 items). A higher score indicates greater sensory symptoms. EEG data were recorded during the auditory paired-click paradigm wherein participants heard repeated presentations of 80 pairs of click sounds. Each click was 3 ms in length with a 500 ms stimulus onset asynchrony between clicks and an 8-second inter-trial interval between pairs. The study's primary ERP measures included the P50 and N1 amplitude and latency and difference score (Click 2 – Click 1). Group differences on the SGI and ERP measures were examined using univariate analysis of variance and effect sizes are reported using Cohen's *d*. We used Pearson's correlation to examine the relationship between SGI and ERP measures.

**Results:** Compared to controls, adults with ASD had significantly higher scores on all 4 factors of the SGI, Perceptual Modulation ( $d=1.5, p<.0001$ ), Distractibility ( $d=1.3, p<.0001$ ), Over-Inclusion ( $d=1.5, p<.0001$ ), and Fatigue-Stress Vulnerability ( $d=.71, p=.017$ ), as well as the SGI total score ( $d=1.4, p<.0001$ ). On the paired-click EEG paradigm, there was no significant group difference on P50 and N1 amplitudes of Click 1 or 2, and difference scores. There were no group differences on the P50 latencies of either click. However, the ASD group showed significantly delayed N1 latencies of click 1 ( $d=.90, p=.003$ ) and click 2 ( $d=.73, p=.017$ ) compared to controls. Across all participants, there was a positive relationship between click 2 N1 latency and SGI total score ( $r=.32, p=.034$ ), such that longer N1 latencies were associated with greater perceptual sensory gating anomalies.

**Conclusions:** Our results indicate that young adults with ASD show significant perceptual anomalies related to sensory gating. The SGI may serve as an informative tool to assess sensory and perceptual functioning in adults with ASD. While adults with ASD show robust neural sensory gating at the P50 and N1 components, they show delayed processing of simple auditory sounds. Delayed auditory processing has been proposed as a biomarker for ASD, and our results show that longer N1 latencies are associated with greater behavioral sensory gating deficits. These findings support a growing body of literature investigating the clinical correlates of atypical neurophysiologic responses in adults with ASD.

**416.052 (Poster)** Novel Unsupervised Machine Learning Approaches for Understanding Sleep EEG Brain State Dynamics in Rett Syndrome  
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**Background:**

Brain activity during sleep is highly dynamic. Conventional description of the sleep process in neurotypical subjects relies on manual scoring of the sleep polysomnography (PSG) into 5 stages (Wake, rapid eye movement (REM), and Non-REM 1-3). These stages represent predictable and discrete transitions of state and reflect various combinations of underlying neurotransmitter influences. However, sleep brain state dynamics may be so significantly altered in developmental brain disorders (DBD), such as Rett syndrome, that the conventional PSG approach may provide an inaccurate and incomplete model. Redefining this altered ultradian rhythm offers insight into underlying neuropathology in DBD.

**Objectives:**

Here we used a Hidden Markov Model (HMM) approach to describe brain activity during sleep as continuous transitions between quasi-stable brain states. We compared differences between the inferred states from healthy subjects and the states from Rett syndrome patients. To validate the model, for a given holdout segment of unlabeled EEG signals, the models trained from healthy and Rett groups were used to predict which group the EEG signals were from.

**Methods:** 51 healthy children (age:  $8.3\pm4.7$  years) and 38 Rett syndrome girls (age:  $11.6\pm5.4$  years) participated in the study. For each subject, we obtained 5-channel (Fp1, F7, C4, O1, T4) electroencephalogram (EEG) and a single lead of chin EMG signals. As the model input, we extracted power spectrum from seven frequency bands (in Hz): slow (0.5–1.5) and fast (1.5–4) delta; slow (4–6) and fast (6–8) theta; alpha (8–12); slow (12–14) and fast (14–16) sigma. Additional features were signal root mean squared (RMS) and per-channel sample entropy and the EMG RMS. We then employed multivariate Gaussian HMM to infer the hidden states, including initial states probability, the state first (mean activity) and second order statistics (covariance matrix), and states transition probabilities.

**Results:**

For control group, 20 inferred states described the sleep EEG statistics well. Some states were highly specific to a PSG stage, while some states appeared to reflect within-state microstructure and apparently novel cross-stage states not captured by conventional PSG staging. The transition matrix showed the patterns of switching between states. For the Rett group, the number of inferred states varied between individuals. No states were highly specific to the REM stage. We observed a high probability of transitioning from NREM-associated states to wake-associated states, which rarely occurred in the control group. The leave-one-out validation showed high accuracy rate when predicting whether a subject is from the healthy group (sensitivity: 96%, precision: 91%) or the Rett syndrome group (sensitivity: 87%, precision: 94%).

**Conclusions:**

Altered sleep-state generation and rhythms, as uncovered here in the proposed HMM framework, can help define brain state pathology in Rett syndrome, such as rapid cycling between states, heterogeneities of state architecture within the Rett group, and important differences between the control and Rett groups. This approach holds promise for diagnosis as well as evaluation of treatment efficacy, particularly when treatments aim to alter early developmental neuromodulatory brain state aberrancies in DBDs.

**416.053 (Poster)** Physical Disgust Processing in Children with Autism Spectrum Disorder (ASD) during Observation of Rotten Foods

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**Background:** Proper processing of disgust, a primary emotion, is necessary for (i) perception and labelling of stimuli as harmful, (ii) preparing an adequate avoidant or adaptive response to stimuli, and (iii) regulating stress and behavior produced from the experience of disgust. However, children with autism may display difficulties with identifying potentially noxious stimuli and making appropriate withdrawal responses. Aberrant disgust processing in children with ASD may be linked with these issues and could influence inappropriate behavior, like pica.

**Objectives:** Aims included: i) Identifying neural differences associated with disgust processing in youths with ASD during an fMRI food observation task; ii) Characterizing the factors influencing the neural activity during the fMRI task.

**Methods:** Data from 12 participants with ASD (ages 8-16, mean=12.49 ± 2.48) and 14 TD participants (ages 8-17, mean=11.97 ± 1.86) were analyzed. Assessments included: a) Disgust Sensitivity Questionnaire for Children (DSQ-C); b) Body Perception Questionnaire Very Short Form (BPQ-VSF); and c) Sensory Over-Responsivity Inventory (SenSOR). fMRI data was collected while participants observed pictures of disgusting foods (i.e., rotten foods) presented in a block design and analyzed using a standard preprocessing pipeline on FSL. Whole brain comparisons between groups were completed using FSL's FEAT function controlling for age, sex and IQ. Parameter estimates from spherical ROIs in the left and right anterior insula (AI), were extracted. Spearman's correlations and linear regression were used to assess the association between AI activity when observing disgusting foods with food-related disgust above and beyond associations with interoception and sensory overresponsivity.

**Results:** Whole brain comparisons revealed hypoactivity in the left ventral AI for the ASD group compared to TD when viewing disgusting foods ( $Z > 2.3$ , uncorrected). AI activity across groups was significantly positively correlated with disgust sensitivity (DS;  $R = 0.451$ ,  $p = 0.021$ ) and interoceptive ability (BPQ;  $R = 0.445$ ,  $p = 0.023$ ). Stepwise regression between AI activity and DSQ-C while including BPQ and demographic factors (age, IQ, gender) as covariates, indicated that only DS continued to be significantly associated with insula activity ( $p = 0.014$ ). Within-group analysis revealed that this association was driven by the TD group where the association was also significant ( $R = 0.707$ ,  $p = 0.017$ ). However, in the ASD group, there was no significant association ( $R = 0.176$ ,  $p > 0.05$ ). Using prediction models, we identified that only within the ASD group, insula activity towards disgusting foods is strongly influenced by participant age ( $R = 0.741$ ,  $p = 0.004$ ).

**Conclusions:** Our initial findings of insula hypoactivity in the ASD group during the observation of rotten foods (which elicits physical disgust) supports the hypothesis that poor insula activity associated with disgust processing could be a factor in difficulties with contamination and food-related behavior. We also found that AI activity during this task was driven by DS significantly more than interoception or sensory processing. Additionally, the influential factors within each group differed significantly. Disgust processing is influenced by individual DS only in the TD group. However, for the ASD group, disgust processing in the insula was associated with age, which suggests that proper disgust processing may be influenced by development and learning of appropriate behaviors over time.

**416.054 (Poster)** Resting EEG and Language Development in Young Children with Autism Spectrum Disorder

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**Background:** Autism spectrum disorder (ASD) is characterized by core difficulties in language and communication. Recent electroencephalography (EEG) studies suggest that baseline neural activity may be associated with individual differences in language among young children at-risk for language impairment. For example, Wilkinson and colleagues (2019) found that reduced frontal gamma power is associated with better expressive—but not receptive—language in infant siblings of children with ASD (Wilkinson, 2019). However, it remains unclear whether similar neural mechanisms are linked to language abilities in young children who meet clinical criteria for ASD.

**Objectives:** This study aimed to (a) test whether frontal gamma power differs between young children who meet clinical criteria for ASD and TD peers and (b) whether gamma power is associated with individual differences in expressive or receptive language in ASD.

**Methods:** Participants included 49 young children with ASD and 59 age and sex-matched TD children (ages 22-60 months) recruited from ongoing research studies at Boston University and Boston Children's Hospital. Children sat quietly while watching a screensaver while baseline EEG was recorded using a 128-channel Hydrocel Geodesic Sensor Net. Data were pre-processed through BEAPP-HAPPE pipeline. Log-transformed mean power in the gamma frequency range (30-55 Hz) was computed for each electrode and then averaged over a frontal region of interest. Children also completed the Mullen Scales of Early Learning (MSEL), including measures of expressive language and receptive language skill.

**Results:** We did not find significant differences between ASD and TD in frontal gamma power at rest ( $p > .05$ ). Children with ASD scored significantly lower than TD on both expressive and receptive language subscales of the MSEL (all  $ps < .001$ ). Multiple regression analysis predicting expressive language scores revealed significant interactions between diagnostic group and frontal gamma power [ $t = -2.538$ ,  $p = .013$ ]: lower gamma

power predicted higher expressive language in the ASD group only, controlling for the effects of age and sex. In contrast, neither the main effect of gamma power nor the interaction between gamma power and group significantly predicted receptive language scores in a separate multiple regression model (all  $p > .05$ ).

**Conclusions:** Young children with ASD did not differ from age- and sex-matched TD peers on frontal gamma power, in line with prior studies indicating that group differences in resting state power may be most pronounced in the first year of life. However, reduced gamma was associated with better expressive language skills among autistic children, suggesting unique associations between high frequency neural activity and the ability to express oneself through language in ASD. These findings replicate and extend prior research in infant siblings of autistic children in an independent sample of young children who meet clinical criteria for ASD. Our results implicate high frequency neural synchrony in the gamma band in the development of expressive language in ASD, highlighting a potential target for future interventions to support language skills.

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**416.055 (Poster)** Robust Sex Differences in Functional Brain Organization and Their Dissociable Links to Clinical Symptoms in Autism  
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**Background:**

Autism spectrum disorder (ASD) is a highly heterogeneous neurodevelopmental disorder that affects nearly 1 in 189 females and 1 in 42 males. However, the neurobiological basis of sex differences in ASD is poorly understood, as most studies have neglected females and relied on analytical approaches that are ill-equipped to capture robust neurobiological sex differences.

**Objectives:**

Identify robust and interpretable dynamic brain markers that distinguish between female and male children with ASD and predict clinical symptom severity.

**Methods:**

We leverage multiple brain imaging cohorts (ABIDE, Stanford, CMI-HBN;  $N_{ASD} = 773$ ) and exciting recent advances in explainable artificial intelligence (xAI), to develop a novel multivariate time series deep neural network (stDNN) that extracts informative brain dynamics features that accurately distinguish between female and male children with ASD, and predict clinical symptom severity.

**Results:**

stDNN achieved an accuracy of  $86.0 \pm 1.65\%$  for distinguishing between females and males with ASD from multisite ABIDE/Stanford cohort ( $N_{ASD} = 678$ ). Notably, stDNN also classified data from an independent CMI-HBN cohort ( $N_{ASD} = 95$ ) with an accuracy of  $83.4 \pm 3.67\%$ , without additional training. stDNN trained to distinguish between ASD males and ASD females, however, could not distinguish neurotypical males from neurotypical females, highlighting the uniqueness of ASD-related sex differences. xAI revealed that brain features associated with key nodes of the motor, language, and visuospatial attentional systems, consistently distinguished between females and males with ASD in both cohorts. Furthermore, brain features associated with the primary motor cortex node of the motor system emerged as a robust predictor of the severity of restricted/repetitive behaviors in females but not in males with ASD.

**Conclusions:**

Our findings, replicated across independent cohorts, reveal that the brains of females and males with ASD are functionally organized differently, contributing to their clinical symptoms in distinct ways. Our findings inform the development of more refined sex-specific diagnoses and targeted treatment strategies, and ultimately advance precision psychiatry.

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**416.056 (Poster)** SLEEP Disturbance Is Associated with Anomalous Default and Attention Network Dynamic Functional Connectivity in Children with Autism

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**Background:** Sleep disturbance is highly prevalent among children with ASD compared to typically developing (TD) children. The neural basis for sleep disturbances in ASD is unknown; however, disrupted functional connectivity (FC) both within default mode network (DMN) and between DMN and dorsal attention networks (DAN) have previously been associated with both sleep deprivation in TD adults and ASD diagnosis.

**Objectives:** To examine FC between the DMN and DAN and associations with sleep disruption in children with ASD. Given that ASD is associated with greater variability at behavioral and neurophysiologic levels, we chose to investigate DMN-DAN connectivity using innovative dynamic FC (dFC) methods that not only assess mean (static) FC, but also dynamic FC (i.e., FC variability), which is thought to be an indicator of cognitive processing.

**Methods:** Participants were 98 children with a diagnosis of ASD (80% male, 10.4±1.4 years) and 246 TD children (70% male, 10.3±1.3 years). Parents completed the Children's Sleep Habits Questionnaire (CSHQ) (ASD = 45±8, TD = 39±5;  $p < 0.001$ ) and children completed a resting-state fMRI scan (duration=5-6.5 min). We used group independent component analysis to decompose the aggregate fMRI data into 30 temporally coherent and spatially independent components (ICs). ICs corresponding to the dorsal attention network (DAN; IC-19) and DMN subsystems (ICs 17, 25, 26) were extracted. dFC was examined for all six edges (3 within-DMN and 3 DMN-DAN) using dynamic conditional correlations (DCC). Linear models were fit for each edge, separately for dFC-mean and dFC-variance, with terms for diagnosis (DX) [ASD=1/TD=0], presence of clinical-level of sleep disturbance (CSD = CSHQ score  $\geq 41$ ) or typical sleep (TYP) [CSD=1/TYP=0], DX-by-CSD interaction, and nuisance covariates (age, sex, MRI coil, meanFD). Lastly, to examine dFC prediction of CSHQ total scores, linear regression models were constructed separately for dFC-mean and dFC-variance with terms for DX, DX-by-dFC interaction, and nuisance covariates ( $\alpha=0.05$ ).

**Results:** A chi square analysis of CSHQ responses revealed a significantly higher level of CSD among children with ASD (59%) as compared with TD children (26%) ( $p < 0.001$ ). We observed a main effect of DX on dFC-mean for two within-DMN edges (IC17-IC25 and IC-25-IC26); the ASD group showed weaker dFC-mean for both edges compared with the TD group (both  $t = -2.1$ ,  $p = 0.03$ ); in contrast, there was no effect of DX on DMN-DAN dFC-mean. For dFC-variance, there was a marginally significant DX-by-CSD interaction for an anti-correlated DAN to anterior DMN (aDMN) edge (IC19-IC25;  $p = 0.05$ ); aDMN-DAN dFC-variance was greater in the ASD+CSD vs. TD+CSD group yet was lower in the ASD+TYP vs. TD+TYP (Fig. 1A). Further, the aDMN-DAN DX-by-dFC-variance interaction term was the only significant predictor of total CSHQ score, such that a 0.1 increase in dFC-variance was associated with a 2.83-point increase in total CSHQ score in the ASD group ( $t = 2.79$ ,  $p = 0.005$ ) (Fig. 1B).

**Conclusions:** Our findings suggest that alterations in dorsal attention-default mode network connectivity are associated with greater sleep disturbance in autism. Validation of these brain imaging biomarkers would benefit from additional studies using objective sleep measures (e.g., actigraphy, polysomnography).

#### **416.057 (Poster)** Self- and Other-Related Processing in the Brain: An fMRI Study

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#### **Background:**

Humans have been shown to respond uniquely to stimuli that are self-related, such as their own face or name. Such self-specific effects are thought to be crucial for self-awareness and social functioning, and research suggests that these effects may be diminished in individuals with autism. However, findings are currently mixed, and neural responses to self-related stimuli have rarely been investigated across different stimulus types. As a consequence, it is still debated whether different self-bias effects are supported by one unitary or separate mechanisms, and which aspects of self-processing may be altered in autism.

#### **Objectives:**

The aim of the current study was twofold. Firstly, we wanted to map the typical representational structure of self- and other-related information in the brain, independently of stimulus type (own face or own name), using multi-voxel pattern analysis. Secondly, we wanted to investigate, in a neurotypical sample, whether the found neural activation patterns for self-related stimuli were related to self-reported levels of autism characteristics.

#### **Methods:**

In a Siemens 3T MRI scanner, 36 neurotypical participants were presented with six runs of face images, and six runs displaying first names, in three categories (Self, Close Other, Stranger). As an attention check, they were asked to press a button each time a black cross presented centrally changed color to red. Finally, they filled out the Autism Spectrum Quotient and Social Responsiveness Scale for Adults as measures of self-reported autism characteristics.

#### **Results:**

Representational similarity analyses across faces and names revealed higher similarity in activation patterns for different self-specific stimuli in visual areas of the brain, as well as the basal ganglia and insula. When looking at activation patterns for faces specifically, additional areas in ACC, parietal cortex and right STS were found, with no additional regions for names. The self-specificity metric for none of these regions showed a significant correlation with levels of autistic traits.

#### **Conclusions:**

These results suggest that self-related processing may be supported by stimulus-specific as well as more abstract self-related mechanisms that are independent of stimulus type. Although in this neurotypical group no relation to autism characteristics was found, we are currently planning a follow-up study in a group of adults with and without autism, which will shed further light on the question of which aspects of self-processing might be altered in autism.

#### **416.058 (Poster)** Sex Differences in Neural Response to Faces in Autistic Adults

**Background:** Sex differences in ASD have long been of interest given a notable male bias in prevalence estimates. Sex-specific biological factors may contribute to ASD etiologies and have demonstrable effects on neurodevelopmental trajectories (Walsh et al., 2021). Given that much of what we know about sex differences in ASD is derived from behavioral observation, more investigation is needed to determine the extent to which sex differences in ASD may be related to neural function. The N170 event-related potential is a promising neural marker of social perception in ASD (Kang et al., 2017). Despite this promise, only one study to date has focused specifically on sex differences in the N170 to faces in autistic children (Coffman et al., 2016). In this study, sex differences were observed, with shorter latencies in males and higher amplitudes in females. Neural responses correlated with autism severity in females but not in males. It is not known whether these sex effects are specific to children.

**Objectives:** To evaluate sex differences in N170 response in adults with and without ASD.

**Methods:** The preliminary sample included 32 individuals with ASD (8 female) and 28 typically developing adults (16 female). Data collection is ongoing. EEG was recorded using a Hydrocel 128-channel sensor net, and dependent variables were extracted over right occipitotemporal scalp (T6). Participants viewed upright faces and houses for 1 second. Each stimulus was preceded by a crosshair cueing gaze to the right eye, left eye, center nose, or center mouth regions. Event related potentials were extracted between 120 and 220ms, filtered, artifact rejected, baseline corrected, re-referenced to the whole scalp average, and averaged across trials. N170 amplitude and latency were examined via 2x2x2 repeated measures ANOVA for condition, sex, and diagnosis. Co-registered eye-tracking will support evaluation of associations with gaze in forthcoming analyses.

**Results:** A condition-by-sex interaction emerged for N170 amplitude such that males had more negative amplitudes than females and more negative N170s to faces than houses,  $F(1, 56)=4.55, p<.05$ . In females but not males with ASD, N170 latency to faces was negatively associated with the social motivation subscale of the Social Responsiveness Scale (SRS),  $r=-.85, p<.01$ , as well as the Reading the Mind from the Eyes Task  $r=-.82, p<.05$ . In addition, in females but not males with ASD, marginal correlations emerged between N170 latency and the social communication index of the SRS  $r=-.66, p=.08$  and the Benton Facial Recognition task,  $r=-.65, p=.08$ . There were no main effects for N170 latency.

**Conclusions:** These data add to the growing body of research on sex differences in neural information processing in ASD. In contrast to prior findings in children, males had higher amplitude N170s than females, and no main effects of diagnosis emerged. In females with ASD, shorter N170 latencies were associated with higher self-report ratings of social ASD features and social anxiety but also with better performance on behavioral tasks of facial and emotion recognition. Future work should examine neurodevelopmental trajectories of social perception by sex throughout the lifespan.

#### **416.059 (Poster) Somatosensory Duration Mismatch Negativity in Young Adults with and without Autism Spectrum Disorder**

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**Background:** Both hyper- and hypo-sensitivity to tactile stimuli are commonly reported in people with autism spectrum disorder (ASD), yet little is known about the neurological underpinnings of this atypical tactile sensitivity. Compared to other sensory domains, few studies exist that examine the neurophysiology of tactile perception in ASD. The limited evidence that exists shows mixed results, but all known research has used repetitive, identical stimuli with a predictable intensity or duration. In this experiment we aim to clarify the role of predictability in how the brain responds to tactile stimulation in neurotypical and autistic young adults.

**Objectives:** To measure whether people with and without ASD have different patterns of cortical response to predictable and unpredictable passive somatosensory stimulation.

**Methods:** This study used a somatosensory duration mismatch negativity (MMN) paradigm to assess vibrotactile novelty detection in 17 neurotypical and 3 autistic young adults. ASD diagnoses were confirmed by administration of the Autism Diagnostic Observation Schedule by a trained clinician. The MMN is a specific event-related potential that occurs when a repeated sequence of identical, predictable 'standard' stimuli is interrupted by a novel, unpredictable 'deviant' stimulus that differs from the standard majority. By maintaining one stimulus as the majority of the input (80%), any perceived deviation from the anticipated stimulus results in a distinct, measurable electrophysiological response known as the MMN. In this study, vibrations of standard (100 ms) and deviant (115, 130, 145, and 160 ms) durations were presented while an electroencephalogram (EEG) measured cortical activity. Data collection is ongoing.

**Results:** Difference waves were calculated by subtracting the standard waveform from each respective deviant waveform. The average of the 10 milliseconds surrounding the peak amplitudes of the difference waves as well as the peak latencies of the difference waves were extracted from fronto-central electrodes between 130 and 210 ms after stimulus presentation. The peak difference wave amplitudes did not differ significantly between groups: 115 ms:  $t=.72, p=.53$ ; 130 ms:  $t=.88, p=.44$ ; 145 ms:  $t=.49, p=.67$ ; 160 ms:  $t=.62, p=.57$ . The latency of each peak also did not differ between groups: 115 ms:  $t=1.21, p=.30$ ; 130 ms:  $t=.098, p=.93$ ; 145 ms:  $t=.19, p=.85$ ; 160 ms:  $t=.20, p=.86$ .

**Conclusions:** Additional data collection is needed to properly compare these two groups with appropriate power, but these preliminary results suggest that early low-level processing of novel vibrotactile information does not differ between the two groups. While preliminary, these results suggest that the level and processing speed of cortical activity in response to both predictable and unpredictable somatosensory stimuli is similar between autistic and neurotypical young adults.



**416.060 (Poster)** The Relationship between Visual Evoked Potentials, Sleep, and Autistic Traits As Markers of Excitatory/Inhibitory Imbalance and Gabaergic Functioning in Autism Spectrum Disorder

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**Background:** Balanced excitatory and inhibitory (E/I) activity, driven by glutamatergic and GABAergic input, enables adaptive neural responses optimal for information processing (Foss-Feig et al., 2017). Early waveform peaks (i.e., N1 and P1) generated by visual evoked potentials (VEP) represent early visual processing and reflect glutamatergic and GABAergic activity. In some individuals with autism spectrum disorder (ASD), E/I imbalance in critical neurocircuits leads to less efficient information processing (Sohal & Rubenstein, 2019). Additionally, altered GABAergic function in ASD may contribute to poor sleep due to GABA's role in sleep initiation and maintenance (Deliens & Peigneux, 2019).

**Objectives:** Compare (1) VEP P1 amplitude and latency and (2) sleep in autistic and neurotypical adults to evaluate (3) whether alterations in GABA-mediated processes explain variance in ASD characteristics.

**Methods:** Participants included 35 adults with ASD (29 males; age  $M=26.95\pm5.98$ ; FSIQ  $M=110.46\pm10.98$ ) and 28 neurotypical (NT) adults (12 males; age  $M=27.83\pm4.74$ ; FSIQ  $M=117.57\pm15.37$ ). Participants with ASD met diagnostic criteria via gold-standard assessments, and cognitive ability was assessed using the WASI-II. Self-reported ASD traits and sleep quality were indexed using the Social Responsiveness Scale-2 [SRS-2 total score, Social Communication Index (SCI), and Restricted Interests and Repetitive Behavior (RRB)] and the Pittsburgh Sleep Quality Index (PSQI). Electroencephalography (EEG) was used to record VEP over the occipital cortex (O1, O2, Oz) during a pattern-reversal checkerboard paradigm. N1 and P1 peaks were selected manually via a web hosted peak picker to extract peak amplitude and latency for analyses. Between-group differences in sleep, P1 amplitude and latency, and SRS-2 scores were assessed using independent samples t-tests. Linear regression was used to examine the relationships among these variables.

**Results:** Groups did not differ in P1 amplitude or latency ( $ps>0.05$ ). However, a significant group x P1 amplitude interaction for predicting SRS-2 scores was detected ( $F(3,58)=14.75$ ,  $p<.001$ ) such that increased P1 amplitude was associated with higher levels of ASD traits in the ASD group ( $F(1,29)=4.42$ ,  $p=.044$ ); no relationship between these variables was observed in the NT group ( $F(1,26)=2.46$ ,  $p=.129$ ). Compared to the NT group, adults with ASD endorsed poorer sleep via the PSQI with respect to global sleep quality ( $t(58)=4.26$ ,  $p<.001$ ), sleep efficiency ( $t(59)=2.35$ ,  $p=.022$ ), and sleep disturbance ( $t(40)=3.15$ ,  $p=0.003$ ). Within ASD, increased PSQI global scores were associated with more ASD traits [SRS-2 total scores: ( $r(32)=-.44$ ,  $p=.009$ ); SCI: ( $r(32)=-.46$ ,  $p=.007$ ); RRB: ( $r(32)=-.35$ ,  $p=.041$ )]. No significant relationships were found between PSQI global scores and P1 amplitude in ASD.

**Conclusions:** As expected, adults with ASD reported poorer sleep quality compared to neurotypical adults, which was associated with more ASD traits. Of note, there was no difference in P1 amplitude or latency between diagnostic groups. However, P1 amplitude was positively associated with ASD traits within the ASD group, which indicates differences in early visual processing, an index of E/I balance, may predict ASD features. Though poor sleep in ASD was associated with more autistic traits, no relationship between sleep, P1 amplitude, and ASD traits was found. Future research collecting objective measures of sleep, such as polysomnography or actigraphy, is recommended to further probe these relations.

**416.061 (Poster)** Visual Evoked Potential N1 Amplitude and Latency Differ between Children Diagnosed with Autism, Attention-Deficit/Hyperactivity Disorder, and Autism with Co-Occurring Attention-Deficit/Hyperactivity Disorder

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**Background:** Early visual processing differences, as measured through the visual evoked potential (VEP), have been reported in autistic individuals. Animal research suggests that the VEP reflects cortical excitation/inhibition balance, which has been implicated in the pathophysiology of autism. Furthermore, in autistic children, the VEP correlates with individual differences in social abilities. As such, the VEP represents a potential brain-based biomarker that may reflect both clinical and neurobiological aspects of autism. To date, research on the VEP in autistic children has not explored the impact of co-occurring disorders, such as attention-deficit/hyperactivity disorder (ADHD), despite estimates that 40-60% of autistic children have co-occurring ADHD.

**Objectives:** Compare differences in the VEP between autistic children, children with ADHD, autistic children with co-occurring ADHD, and neurotypical children.

**Methods:** Participants were 131 children ages 3-7 years old from 4 groups: neurotypical (NT;  $N=27$ ), ADHD ( $N=42$ ), autistic ( $N=34$ ), and co-occurring autism and ADHD (Autistic+ADHD;  $N=28$ ). VEP stimuli consisted of two black and white checkerboards that reversed phase. Amplitude and latency of the N1 and P1 peaks were derived. Group differences were tested using general linear models. Covariates (full-scale IQ, age, and sex) impeding the overall model were iteratively removed until best model performance was achieved. Follow-up pair-wise t-tests were corrected for multiple comparisons using the Benjamini-Hochberg correction.

**Results:** Neither P1 amplitude nor latency differed among groups. For N1 amplitude, there was an overall model effect when group, sex, and a group-by-sex interaction term were included in the model (neither IQ nor age significantly contributed to the model). However, group, sex, and their interaction were not independently associated with N1 amplitude. To explore what drove the significant model effect, we conducted separate analyses in male (N=96) and female (N=35) participants. In males, but not females, there was a significant group difference in N1 amplitude ( $F(3)=3.71$ ,  $P=.01$ ). Pair-wise analyses revealed a significantly larger N1 amplitude in autistic compared to ADHD males ( $F(1)=10.55$ ,  $P<.01$ ). This was associated with a large effect ( $d=.86$ ). For N1 latency, there was also a significant group effect when controlling for full-scale IQ (neither age nor sex significantly contribute to the model) in the full sample ( $F(3)=3.00$ ,  $P<.05$ ). Pair-wise analyses revealed that children with ADHD had a significantly faster N1 latency compared to both autistic ( $F(3)=6.56$ ,  $P=.01$ ) and Autistic+ADHD ( $F(3)=6.91$ ,  $P=.01$ ) children.

**Conclusions:** Based on the VEP, among males, autistic children were found to have a larger N1 amplitude compared to children with ADHD. Children with ADHD regardless of sex, however, exhibited a faster N1 latency compared to autistic children with and without co-occurring ADHD. These results suggest that, while the co-occurrence of ADHD does not influence VEP among autistic children, children diagnosed with ADHD versus those with autism appear to have different patterns of VEP. Furthermore, timing and magnitude of the VEP may be sensitive to diagnostic classification but are not influenced by co-occurring ADHD among autistic children.

## VIRTUAL POSTER SESSION — BRAIN FUNCTION (fMRI, fCMRI, MRS, EEG, ERP, MEG)

### 516 - Brain Function (fMRI, fCMRI, MRS, EEG, ERP, MEG) --- (V)

**516.031** (Virtual Poster) Altered Processing of Communication Signals in the Subcortical Auditory Sensory Pathway in Autism  
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**Background:** Human communication requires the fast and accurate processing of sensory signals, such as the voice. Traditionally, it is assumed that the cerebral cortex and limbic structures are specialised in processing speech, vocal identity, and emotional components of the sensory signal. Much less is known about the role of subcortical sensory pathway structures for communication and its impairments. For example, it is to-date unclear at which processing stage voice processing difficulties arise in autism.

**Objectives:** Here, we assessed the functional integrity of auditory pathway nuclei for processing voices in autism.

**Methods:** We tested functioning of the auditory midbrain (inferior colliculus; IC) and thalamus (medial geniculate body; MGB) in three independent functional magnetic resonance imaging (fMRI) experiments in groups of adults with autism and pair-wise matched typically developed controls (matched on age, sex, handedness, and full-scale intelligence quotient (IQ)). We focused on two aspects of voice processing that are impaired in autism: voice identity perception, and recognising speech-in noise. First, participants performed tasks on speaker identity and speech recognition (voice identity recognition experiment,  $n = 16$  per group). Second, both groups passively listened to blocks of vocal and non-vocal sounds (vocal sound experiment,  $n = 16$  per group). In the third experiment participants performed speech recognition tasks on speech that was either presented with or without noise (speech-in-noise recognition experiment,  $n = 17$  per group). All participants had normal hearing (confirmed with pure tone audiometry) and did not take psychotropic medication. All participants in the autism group had previously received a formal clinical diagnosis and underwent additional clinical assessment including the ADOS and ADI-R. For the fMRI analysis we used a general linear model implemented in SPM12. We focused on four regions of interest (left and right IC and left and right MGB).

**Results:** We found reduced blood-oxygenation-level-dependent (BOLD) responses for the autism as compared to typically developed control groups in the IC – the central midbrain structure of the auditory pathway ( $p < .05$  family wise error (FWE) corrected for the four regions of interest). The right IC responded less in the autism as compared to the control group for voice identity, in contrast to speech recognition. The right IC also responded less in the autism as compared to the control group when passively listening to vocal in contrast to non-vocal sounds. Within the control group, the left and right IC responded more when recognising speech-in-noise as compared to when recognising speech without additional noise. In the autism group, this was only the case in the left, but not the right IC. The autism and the control group did not differ significantly in the average amount of head movements (all  $p$  values  $> 0.1$  in all three experiments).

**Conclusions:** Our results show that communication signal processing in autism is associated with reduced subcortical sensory functioning in the midbrain. The results highlight the importance of considering sensory processing alterations in explaining communication difficulties, which are at the core of autism.

**516.032** (Virtual Poster) Auditory Processing Is Substantially Altered in Low-Functioning Children with ASD: ERP Study  
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**Background:** Event-related potential(ERPs) to sounds are atypical in ASD, although results are inconsistent with most studies focused on the latencies of ERP components and very few studies comparing amplitude of ERPs to pure tones and phonemes. Also most previous studies focused on high-functioning ASD children(HFA), leaving a substantial proportion of ASD children, those with poor language skills out of research.

**Objectives:** Our study aims to fill this gap in knowledge.

**Methods:** Children with ASD (18 high- and 18 low-functioning, HFA and LFA) and 18 typically developing peers (TD) (mean age 12, range 6-18 years, mean IQ = 116, 95 and 53 for TD, HFA and LFA, respectively) listened to pure tones (327/367 Hz) and phonemes ("ba"/"da") presented in separate odd-ball sequences (intensity about 75dB and interstimulus interval(ISI) 760-930ms). Concurrently, 64-channels EEG(BiosemiActiveTwo) were registered. After recording EEG data were re-referenced to average reference, epoched -200 to +500 ms post-stimulus latencies, and then separately averaged for the tones and phonemes standard stimuli with artifacts (more than 5 STDs over mean) removed. For the analysis we took peak amplitude of P1, N1, P2 and N2 components measured at fronto-central sites (FC3 and FC4) as well as their polarity-reversed counterparts at temporal-parietal (TP7 and TP8) sites within the following time windows: 60-90ms, 100-130ms, 135-165ms, 245-275ms, respectively. Repeated-measures ANOVA with Stimulus Type(Tone vs Phonemes), Hemisphere(left vs right), Frontality(frontal- central vs temporo-parietal) as within-subject factors and Group(TD, HFA and LFA) as between-subject factor used for statistical inference.

**Results:** LFA group showed more pronounced ERP abnormalities compared to HFA: Significant Group effect for P1 ( $F(2,51)=3.228, p=0.047$ ) was triggered by significant difference only between LFA and TD group with values of HFA lying in between. N1 was, on the contrary, increased in the ASD group with more pronounced difference in the right hemisphere(Group by Hemisphere interaction,  $F(2, 51)=4.724, p=0.013$ ): LFA group differed from TD in both hemispheres, while TD vs HFA difference was significant in the right but not left hemisphere. P2 was attenuated in LFA both in the left and right fronto-central site as compared to TD, but LFA vs HFA difference was insignificant in the latter(post-hoc follow-up of Group by Frontality by Hemisphere interaction:  $F(2,51)=3.426, p=0.040$ ). N2 was smaller in response to Tones also specifically to the LFA group with TD vs HFA not reaching significance in any hemisphere, and LFA vs HFA in the right hemisphere(follow-up of Group by Stimulus Type by Hemisphere interaction,  $F(2,51)=3.299, p=0.045$ ).

**Conclusions:** Neurophysiological response to sounds is substantially affected in ASD with more severe phenotype associated with more pronounced ERPs abnormalities characterized by differential involvement of the right and left hemisphere. These ERPs abnormalities are mostly common in response to tones and phonemes or even specific to more simple stimuli - tones, suggesting general deficits in basic auditory processing.

**516.033 (Virtual Poster)** Brain to Brain Synchrony during Natural Social Interaction of Children with Autism Spectrum Disorder Using fNIRS  
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**Background:**

Deficits in social communication and engagement represent a core symptom of autism spectrum disorder (ASD). As an optical brain monitoring technology, functional Near-Infrared Spectroscopy (fNIRS) provides a measure of cerebral hemodynamics in response to sensory, motor, or cognitive activation. Consistent with neuroergonomics, fNIRS can measure the brain in ecologically valid everyday settings during complex natural tasks. In this project, we investigate prefrontal brain activity, using fNIRS wearable neuroimaging, during toddler's natural social interaction of toddlers. We measure fNIRS brain response to social stimuli and brain to brain coupling of an adult confederate with toddlers with and without ASD.

**Objectives:**

Evaluate brain to brain coupling as a measure of neural synchrony, between toddler and adult confederate pairs while they communicate and play with each other.

**Methods:**

Experimental protocol involves naturalistic communication and gameplay between participant children (age 18-42 months) and our confederate adult. The child was unfamiliar to our confederate adult and hence represented a greater barrier than parent for social interaction. There are two conditions (dyad together and apart), each five-minutes long. In the together condition, the Adult played and interacted with the child participant, doing activities such as reading stories, singing, and playing with toys. In the apart condition, the child and the Adult were still in the same room, but not interacting while their brain activity is monitored. Instead, the child played with their parent while the confederate adult conversed with another person (See Figure 1). Children with ASD and their parents completed the TELE-ASD-PEDS and Childhood Autism Rating Scale (CARS-2) to confirm autism diagnoses. During the sessions, raw light intensities at 16 anterior prefrontal regions sampled continuously 10Hz via wearable fNIRS sensors from both the child and adult. For analysis, data were low-pass filtered at 0.1Hz to eliminate high frequency noise and physiological artifacts such as cardiac and respiration cycles, and converted to oxygenated hemoglobin (HbO) concentration changes by using the Modified Beer Lambert Law. Five minutes long together and apart task segments were extracted, and Spearman's rank correlation coefficients were calculated for all channel pairs for child and adult ( $16 \times 16 = 256$ ) of each dyad.

**Results:**

Preliminary results based on our first two pairs (2 ASD toddlers and 2 adult sessions data) are presented in Figure 2 where correlation of fNIRS HbO time-series channels of Child (x-axis) and Adult (y-axis) were presented as color coded. As expected, the together condition elicited higher correlations between child and adult during joint play, compared to the apart condition in which their activity was more independent.

**Conclusions:**

This fNIRS hyperscanning study explores neural correlates of natural social interaction of children with ASD and a confederate adult. Preliminary results suggest that joint and separate activity impact in neural synchrony can be observed with wearable neuroimaging sensors. We will continue with participant recruitment and data collection in order to compare children with ASD to typically developing children in this paradigm.

**516.034 (Virtual Poster)** Default Mode Network Connectivity Differences in Youth with Autism Spectrum Disorder Compared to Early-Onset Psychosis

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**Background:**

The default mode network (DMN) is one of the most extensively studied brain networks (Whitfield-Gabrieli and Ford, 2021). Neuroimaging studies have found DMN is implicated across various neuropsychiatric disorders characterized by social impairments, notably in autism spectrum disorder (ASD) and early onset psychosis (EOP; Assaf et al., 2010; Kennedy and Adolphs, 2012; Nair et al., 2020). However, few studies have investigated functional dysconnectivity of the DMN and its association to diagnostic and social cognition measures in a group of ASD adolescents and age-matched individuals with EOP to identify any shared or distinct patterns unique to each group.

**Objectives:**

To examine whole-brain functional connectivity of the DMN and its relationship to behavioral correlates in a group of adolescents with ASD and adolescents with EOP, compared to typically developing (TD) adolescents.

**Methods:**

Resting-state functional magnetic resonance data were acquired on a 3T Siemens scanner for 62 adolescents, aged 12-21 years; 25 with ASD, 19 EOP adolescents, and 18 TD controls (Mean age = 16.35; % female = 39%). Data were preprocessed in FSL (Smith, 2004), and ICA-AROMA (Pruim et al., 2015) was used to remove motion confounds. Nuisance regressors (white matter, cerebrospinal fluid) were included to further reduce potential confounds. The DMN seed was derived from a prior study (Lawrence et al., 2019). For between-network connectivity, group analyses were limited to voxels (voxelwise threshold of  $Z > 2.3$  and corrected cluster threshold of  $p < 0.05$ ). Additionally, Pearson's correlations were run to examine the relationship between the DMN connectivity and various behavioral measures. Diagnostic measures include the Autism Diagnostic Observation Schedule, 2<sup>nd</sup> edition (ADOS-2; Lord et al., 2012), Scales for the Assessment of Negative and Positive Symptoms (SANS; SAPS; Andreasen, 1984). The social measures include WebCNP Emotion Recognition Test (Gur et al., 2010), and The Awareness of Social Inference Test (TASIT; McDonald et al., 2003).

**Results:**

The ASD group demonstrated underconnectivity within the precuneus and medial frontal cortex compared to TD; but overconnectivity of the DMN with opercular gyri, bilateral insular cortex, and bilateral superior frontal cortex. ASD also demonstrated overconnectivity of left superior parietal lobule, bilateral insular cortex, and bilateral superior frontal regions compared to EOP. For the ASD group, atypical whole-brain DMN connectivity was associated with higher calibrated severity scores on the ADOS-2. In contrast, whole-brain DMN connectivity was associated with poorer performance on an emotion recognition task in EOP group.

**Conclusions:**

Results suggest distinct whole brain DMN connectivity patterns in the ASD and EOP groups were associated with socioemotional functions. Specifically, ASD group showed underconnectivity in major DMN hubs such as the precuneus, but overconnectivity with extraneous regions such as bilateral insular cortex and superior frontal gyri compared to both TD and EOP groups. Atypical DMN connectivity pattern in the ASD group was associated with higher diagnostic symptom severity scores. Contrastingly, youth with EOP showed associations between DMN connectivity patterns and poorer performance on an emotion recognition task. Collectively, these findings suggest atypical DMN connectivity may be relevant to social impairments observed in each of these neuropsychiatric conditions.

**516.035 (Virtual Poster)** Detection of an Autism EEG Signature through a New Processing Method Based on a Topological Approach

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**Background:**

Many different mathematical approaches have been tested in the last few years to disentangle the EEG data complexity and determine if it is possible to distinguish children with ASD from typically developing children or children with other neuropsychiatric disorders. Each method has advantages and disadvantages, like for example, the large computational time required to achieve the final task.

## Objectives:

We present an alternative pre-processing approach of EEG data based on a novel algorithm applied to raw data to detect topological EEG features. Our assumption is that brain connection abnormalities can be detected through a specific mathematical topological approach, which is able to compare the minimal structure of functional networks beneath scalp electrodes.

## Methods:

This new pre-processing approach of EEG data to detect topological EEG features has been applied to a continuous segment of artifact-free EEG data lasting 10 minutes in ASCII format derived from 50 ASD children and 50 children with other Neuropsychiatric disorders matched for age and male/female ratios whose data were obtained from a clinical archive. Both groups had the same age range (4-10 years) and the same gender distribution (m=39, f=11). None of the subjects were affected by genetic conditions, cerebral malformations, or epilepsy. In the control group, the range of primary diagnoses were ADHD (n=41), mood disorders (n=4), anxiety disorders (n=16), sleep disorders (n=12), ODD (n=6), and TBI (n=5).

Each EEG was manipulated using “Cin-Cin” algorithm, based on an input vector characterized by a linear composition of city-block matrix distances among 19 electrodes. From the resulting triangular matrix of 171 numbers expressing all of the one-by-one distances among the 19 electrodes a minimum spanning tree (MST) is calculated. Electrode identification serial codes sorted according to the decreasing number of links in MST, and the number of links in MST are taken as input vectors for machine learning systems. With this method all the content of an EEG is transformed in 38 numbers which represent the input vectors for machine learning systems

classifiers. The advantage is the simplicity and the small computational time required.

## Results:

The robust set of 38 features related to MST were used as input for Machine Learning classifiers. KNN algorithm was used to develop a predictive model to distinguish subjects belonging to the two diagnostic classes (autism vs other disorders). Models' performances were tested with training/testing cross-validation procedures.

The best machine learning system (KNN algorithm) obtained a global accuracy of 93.2% (92.37 % sensitivity and 94.03 % specificity) in differentiating ASD subjects from NPD subjects (table 1).

## Conclusions:

In conclusion the results obtained in this study suggest that the new preprocessing methods introduced, in particular the MST algorithm, have great potential to allow a machine learning system to discriminate EEGs obtained from subjects with autism from EEGs obtained from subjects affected by other psychiatric disorders.

### **516.036** (Virtual Poster) EEG Based Non-Linear Measures in Pre-School Children with Autism and Other Neurodevelopmental Disorders during Awake and Sleep States

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## Background:

While Electroencephalography (EEG) studies have investigated spectral power, coherence rhythms and hemisphere asymmetries, newer methods are being employed for investigating the complex brain networks in Autism Spectrum Disorder (ASD). Nonlinear measures can potentially help to interpret time-series data obtained from EEG signals and facilitate understanding of the complex symptom profile seen in ASD [1-3]. Studies comparing ASD and other neurodevelopmental disorders (here non-ASD) in both awake and sleep states of EEG recording are minimal.

## Objectives:

The aim of this study is to characterize EEG patterns in ASD and non-ASD cohorts by extracting non-linear features from time-frequency data using paradigms of Recurrence Plots (RP), Entropy and Fluctuation Analysis in awake and sleep states.

## Methods:

Preschool children ages 2 to 6 underwent prolonged EEG recording (up to 180 mins) with 64 Channel EGI-GES400 system. They were divided into two groups. ASD group had 28 children (24 males, 4 females). Non-ASD had 10 children (6 males, 4 females) with other neurodevelopmental disorders (ADHD, Speech Delay, Global Developmental Delay. Awake and sleep stages (N1, N2 & N3) were included as available. An artifact free

continuous segment of 60s in all 4 states was selected manually. Wavelets were extracted for 10s epoch with 50% overlap for spatially separated subset of 19 channels to constitute 6 bands viz.  $\gamma'$  [ $>64\text{Hz}$ ],  $\gamma$  [ $32-64\text{Hz}$ ],  $\beta$  [ $16-32\text{Hz}$ ],  $\alpha$  [ $8-16\text{Hz}$ ],  $\Theta$  [ $4-8\text{Hz}$ ],  $\Delta$  [ $0.1-4\text{Hz}$ ].[2]. 9 non-linear parameters of which 7 from Recurrence Quantification Analysis (RQA), Sample Entropy (SE) and Detrended Fluctuation Analysis (DFA) were computed for each band per channel. Mean Differences were computed between groups in all 4 states and the significance level were measured with p-values using  $\alpha=0.05$ .

## Results:

In our study group differences were seen in -

- Sample Entropy - N2 & N3 for Gamma & Delta respectively.
- DFA - N2 for Gamma & Beta in Occipital, Parietal & Frontal areas.
- Recurrence Rate - N1 & N2 over Alpha & Theta and additionally for Gamma High in N1.
- Determinism - N1-Gamma & N2-Gamma & Theta.
- Laminarity - N1 for Alpha and in N3 for Alpha, Beta & Delta.
- Trapping Time - N1 for Theta & Delta
- Entropy from RP - N1 or GammaH, Beta & Delta while in N2 for GammaH, Gamma, Theta & Delta.
- Max Line Length - N1 for GammaH & Gamma while in N2 for GammaH, Alpha & Delta.
- Mean Line Length - Theta & Delta in N1 & N2 respectively.

Table 1 summarizes areas of significant differences between the ASD (red) & non-ASD (blue) groups ( $p < 0.05$ ). It represents all 9 non-linear parameters over 6 bands in 4 states of Awake & Sleep (N1, N2, N3).

## Conclusions:

Majority of significant differences are seen in N1 & N2 across parameters & bands. Most single point deviations have occurred at Pz across all states. There are clear patterns for each nonlinear parameter across the states in both groups. This becomes effective for a binary classification in Machine learning paradigm. Deriving clinical implications of these patterns correlating with functional behavioral changes are underway.

**516.037 (Virtual Poster)** Face-Encoding Fusiform Gyrus (FFG) Neural Activity in Preschool Children with and without Autism Spectrum Disorder  
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**Background:** Encoding facial information is a fundamental pillar of the 'social brain'. Electrophysiology studies of adults and school-age children have identified FFG responses to face stimuli as potential diagnostic and prognostic markers for autism spectrum disorder (ASD). However, given developmental changes in brain activity from infancy through adolescence, it cannot be assumed that the FFG findings translate to children with ASD at the time of initial diagnosis (age ~3 years).

**Objectives:** The present study used magnetoencephalography (MEG) to examine face-encoding FFG activity in 3 to 4 year old children with ASD and typical development (TD). Study aims were to identify TD and ASD group differences in FFG activity to face and non-face stimuli at the time of initial diagnosis, with both time-domain and time-frequency domain FFG measures of interest.

**Methods:** Nineteen children with TD (11 males; mean age 4.16 +/- 0.60 years) and 7 children with ASD (5 males, mean age 3.87 +/- 0.67 years) viewed 80 face and 80 non-face stimuli (randomly presented). For each child, MEG data (CTF 275, Coquitlam, BC) were co-registered to an age-appropriate MRI template. Artifact-free epochs 200 ms pre- to 500 ms post-stimulus were averaged according to stimulus type. Dynamical Statistical Parametric Mapping (dSPM) estimated whole-brain neural activity. FFG source timecourses to both conditions were extracted from a cortical regional source model (Desikan-Killiany Atlas). For time-domain measures, FFG peak latency (= the latency with the largest amplitude difference between the face and non-face conditions) and amplitude (time window where FFG source strength differed between conditions) were obtained. For time-frequency measures, single-trial phase and magnitude were calculated from FFG source timecourses using Morlet Wavelets, and total power (TP) and phase-locking (PL) measures were computed. ANOVAs with hemisphere entered as a repeated measure examined group differences in FFG measures.

**Results:** Time-domain analyses showed later left and right FFG responses in ASD ( $M = 238\text{ms} \pm 78$ ) compared to TD ( $M = 168\text{ms} \pm 45$ ) post-stimulus ( $p < 0.01$ ). No group difference in FFG source strength was observed. Time-frequency analyses showed reduced left and right FFG 12-15 Hz PL in ASD ( $M = 0.15 \pm 0.06$ ) than TD ( $M = 0.28 \pm 0.12$ ) 150-250 ms post-stimulus ( $p < 0.05$ ). No TP group difference or other frequency ranges were observed.

**Conclusions:** ASD children took longer to encode facial information compared to TD children. The trial-to-trial similarity of the response to faces was also more variable in ASD than TD, in the low beta band. Present findings thus extend the adult and older child studies, here finding the latency of the FFG face response as a possible diagnostic and prognostic marker at the time of initial diagnosis (~3years). Study findings also showed beta-band PL to be of potential interest. Follow up studies are needed to replicate present findings and to examine if the FFG neural measures obtained at time of initial diagnosis predict later functioning.

**516.038 (Virtual Poster) Frontal Lobe Hyperconnectivity As a Biomarker for Executive Dysfunction in Fragile X Syndrome**

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**Background:**

Fragile X Syndrome (FXS) is the leading inherited monogenetic cause of Autism Spectrum Disorder and intellectual disability. The cysteine-guanine-guanine trinucleotide repeat expansion (>200 repeats) on the *FMRI* gene leads to an absence of Fragile X Protein (FXP, formerly FMRP), a crucial protein for neurodevelopment. Executive function (EF), necessary for adaptive goal-oriented behavior and associated with frontal lobe activity, is impaired in individuals with FXS. Previous resting state electroencephalogram (EEG) research has indicated reduced alpha activity and increased gamma activity in FXS compared to typically developing controls (TDC). Yet, little is known how these alterations in neural activity are related to EF deficits in FXS.

**Objectives:**

Using high-density EEG recordings, we aim to quantify the strength of phase-based connectivity of the resting state frontal cortex activity for alpha and gamma band in individuals with Fragile X Syndrome compared to age- and sex- matched controls as well as to evaluate the correlation between phase-based connectivity and EF performance.

**Methods:**

Sixty-one participants with FXS (5.9-45.7; 54% males) and 71 age- and sex-matched TDC (5.9-48.2) completed a five-minute resting state EEG recording and KiTAP, a computer-based measure testing multiple aspects of EF. We computed debiased-weighted phase lag index (dWPLI), a phase connectivity value, for each gyrus paring in the frontal and prefrontal regions for the alpha (10.5-12.5 Hz) and gamma (30-55 Hz) bands. Linear mixed-effect models were generated with fixed factors of group, sex, and gyri with correction for multiple comparisons. Last, we conducted Spearman's correlations between KiTAP variables and dWPLI values.

**Results:**

The linear mixed-effect model showed significant group x sex x gyrus interactions for both alpha and gamma bands. Individuals with FXS, especially FXS males, demonstrated reduced alpha band connectivity the left and right frontal regions and increased gamma band connectivity in the right frontal and left prefrontal regions compared to TDC. Increased error rates on EF tasks of inhibition, flexibility, and distractibility were associated with reduced alpha band connectivity within the right frontal regions and increased bilateral gamma band connectivity.

**Conclusions:**

During high-density resting state EEG study, we documented increased frontal gamma band connectivity and reduced frontal alpha band connectivity in FXS compared to TDC. As expected, these findings were particularly pronounced among males, implicating hyper-connectivity within frontal brain regions in FXS, especially among males, as previously found. We also report relationships between resting state frontal hyper-connectivity and executive dysfunction in FXS. These findings suggest increased connectivity within high frequency (gamma) bands may impair EF performance whereas increased connectivity within lower frequency (alpha) bands may provide compensatory support for EF in FXS. Our study supports and extends previous findings demonstrating excitatory-inhibitory imbalance in FXS, and for the first time links these findings to executive dysfunction. Together, these findings provide important insight into potential mechanisms of deficit in EF in FXS and future directions for treatment intervention.

**Acknowledgements:**

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**516.039 (Virtual Poster) Functional Connectivity to Emotional Faces in ASD and ADHD Children**

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**Background:**

Individuals with neurodevelopmental disorders (NDDs), including autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) demonstrate deficits in emotional face processing, which is associated with altered emotional face processing networks. Despite high rates of symptom overlap amongst these NDDs, functional connectivity underlying emotion processing across NDDs compared to typical development (TD) has scarcely been examined.

#### Objectives:

Using magnetoencephalography (MEG) we investigated whole-brain functional connectivity during the presentation of happy and angry faces in ASD, ADHD and TD children to determine possible processing differences. We also performed data-driven clustering to determine whether patterns of connectivity differed amongst the diagnostic groups.

#### Methods:

Happy or angry faces were presented while MEG was recorded in 258 children (5-19 years; ASD=100, ADHD=71, TD=87). Children attended to the colour of the border and ignored the emotional content of the faces (75% of trials). Randomly presented 'catch' trials were included to ensure task attention (25% of trials), identified by the colour of the border, where participants responded with a button press. Time-series for each emotion were derived from 90 cortical and subcortical sources of the AAL atlas using the LCMV beamformer. The phase lag index was used to assess phase synchronization of neural oscillations among sources. Main effects of group, emotion and their interactions were assessed using Network Based Statistics. Group-by-age, group-by-sex, emotion-by-age and emotion-by-sex interactions were tested. For data-driven subgrouping, the main effect of each emotion (happy, angry) compared to the baseline was extracted for each frequency band (theta=4-7Hz, alpha=8-14Hz, beta=15-29Hz, gamma=30-55Hz).

#### Results:

We found a main effect of group in the beta frequency band, with covariates age and sex ( $p_{corr}=0.007$ ). *Post hoc* tests showed that mean network connectivity strength was reduced in ADHD compared to ASD ( $p_{corr}<0.001$ ) and TD ( $p_{corr}<0.001$ ) groups, and in ASD compared to the TD group ( $p_{corr}=0.021$ ; all Bonferroni-corrected for multiple comparisons). The network contained frontal, subcortical and temporal connections, mostly anchored in the left hemisphere, with the most highly connected areas being the left middle frontal gyrus, pallidum and superior temporal gyrus (STG). The network also involved key face processing regions including the bilateral amygdalae, right fusiform gyrus and left insula, along with orbital frontal areas. No significant main effects of emotion, emotion-by-age or emotion-by-sex interactions were found.

We also observed a group-by-emotion interaction in the gamma frequency band ( $p_{corr}=0.026$ ). Greater connectivity to happy compared to angry faces was found in the ADHD, ( $p<0.0005$ ) and TD groups, ( $p=0.011$ ); while the opposite pattern was found in ASD, such that connectivity was greater to angry relative to happy faces, ( $p<0.0005$ ). The network involved connections among bilateral frontal, largely inferior and orbital frontal, along with limbic and temporal brain areas. No group-by-age or group-by-sex interactions were found. Data-driven subgrouping identified two distinct subgroups: NDD-dominant and TD-dominant. Emotion-specific and frequency-specific differences in connectivity were found between subgroups.

#### Conclusions:

Our findings establish atypical frequency- and emotion-specific patterns of functional connectivity between NDD and TD children. Importantly, data-driven clustering highlights no distinction between the ASD and ADHD children.

**516.040** (Virtual Poster) Hearing the World Differently: Examining Predictive Coding Accounts of Autism Using MEG and a Roving Auditory Oddball Paradigm

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#### Background:

According to the 'predictive coding' theory of brain function, our perceptual experience is determined by (a) incoming sensory signals from the world, and (b) stored knowledge and beliefs about the world. The relative influence of sensory signals and prior knowledge on perception is thought to be flexibly adjusted in response to environmental volatility. This flexibility ensures that the perceptual experience is not dominated by unreliable sensory signals, nor by prior knowledge when there is important sensory information to respond to in the world. Differences in brain development – such as in the case of autistic people – could give rise to perceptual experiences that might be vastly different from the norm. The precise nature of this neurodivergence, however, is disputed.

#### Objectives:

Here, we sought to evaluate several competing predictive coding accounts of autism by testing them at the neural level.

#### Methods:



We used paediatric MagnetoEncephaloGraphy (MEG) to record the auditory evoked fields of 10 autistic ( $M_{age} = 6.2$  years, range = 4.2 – 8.6) and 63 neurotypical children ( $M_{age} = 6.1$  years, range = 3.0 – 9.8) as they listened to a roving auditory oddball paradigm. For each participant, we subtracted the evoked responses to the ‘standard’ from the ‘deviant’ pure tones to calculate the mismatch field ‘MMF’: an electrophysiological component that is widely interpreted as a neural signature of predictive coding. Under the ‘hypo-prior’ predictive coding account (Pellicano & Burr, 2012), autistic children should show smaller MMF amplitudes relative to their neurotypical counterparts. Conversely, under the ‘HIPPEA’ account (Van de Cruys et al., 2014), autistic children should show larger MMF amplitudes relative to their neurotypical counterparts.

## Results:

We found no significant differences between the autistic and neurotypical children’s MMF amplitudes. However, between-group differences may have been obscured by within-group, age-related variability in the MMF waveforms. To address this potential confound, we conducted a series of exploratory case-cohort analyses, comparing the MMF amplitudes of each of the 10 autistic children to that of their average-age-matched neurotypical counterparts. Six of the 10 autistic children showed significantly larger MMF amplitudes relative to their neurotypical counterparts. An additional two autistic children likewise showed larger MMF amplitudes relative to neurotypical children, although these differences did not reach significance. We interpret these exploratory findings as offering preliminary evidence in support of the HIPPEA predictive coding account of autism.

## Conclusions:

Given the exploratory nature of the case-cohort analyses, as well the small autistic sample on which it was based, the results need to be both replicated and modelled on a trial-by-trial basis in future work if they are to be used in strong support of the HIPPEA account. If the HIPPEA account is ultimately supported, it would provide a comprehensive and compelling neurocognitive account of why autistic people often perceived the world differently.

### 516.041 (Virtual Poster) Investigating EEG Band Differences in Preschool Children with Autism during Awake and Sleep States

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## Background:

Electroencephalography (EEG) studies in Autism Spectrum Disorder (ASD) have investigated spectral power, coherence of EEG rhythms and asymmetry of the bands across various brain regions. In ASD cohorts, Frontal Alpha Asymmetry has been identified as a potential neural endophenotype[1]. There is inadequate evidence in literature for ascertaining hemispherical dominance or asymmetry using four or more spectral bands. Further, natural sleep state EEG recordings are generally not frequent[2].

## Objectives:

In this study we aim to compute spatial band asymmetries across cerebral hemispheres using EEG in preschool children diagnosed with ASD and compare them with non-ASD age matched clinical controls in both awake and sleep states.

## Methods:

Preschool children between the ages of 2 and 6 years underwent prolonged EEG recording (up to 180 mins) with 64 Channel EGI-GES400 system after sleep deprivation for at least 4 hours. ASD group had 28 children (including 4 females). The clinical controls who were diagnosed with ADHD, Specific Speech Delay, and Global Developmental Delay had 10 children (6 males, 4 females). None of the children were on any medication.

Awake state (ASD= 24, non-ASD=8) and sleep stage 1 (N1)(ASD=19,non-ASD=9), stage 2 (N2) (ASD=18,non-ASD=8) and stage 3 (N3)(ASD=10,non-ASD=7) recordings were included. An artifact free continuous segment of 60s in all 4 states was selected manually. Power Spectral Density was computed for each epoch of 10s duration with 50% overlap using Welch's periodogram. Powers for 4 bands viz. beta [13-30Hz], alpha[8-13Hz], Theta [4-8Hz], Delta [0.5-4Hz] were computed using composite Simpson's rule. All computations were carried out for 36 scalp locations spanning 10 regions in both hemispheres (Left and Right of frontal, central, parietal, temporal, occipital). Asymmetry Indices were calculated for each band averaged per region using difference of natural logarithms[3].

## Results:

In the awake state, non-ASD group had left beta dominance in frontal, temporal and occipital while left occipital was alpha dominant. Theta and delta had right dominance. In the ASD group, all four bands were occipital dominant on the left side. Group differences were found for beta in frontal & delta in central.

In N1, most bands were left dominant in non-ASD, while the ASD group had right dominance for delta and theta in parietal and occipital areas. In N2, most bands were left occipital dominant in non ASD, whereas in ASD, delta and theta were left dominant in central and right dominant in

occipital. In N3, all bands were right dominating at central, while alpha and beta were towards left in temporal in the non-ASD group. In ASD, except alpha in occipital, rest of regions had right dominance for all bands.

#### Conclusions:

In the awake state, left occipital predominance in ASD may demonstrate potential deficits in frontal, parietal and temporal functions including cognition, motivation, emotion, verbal, and executive functions of the left cerebral hemisphere compared to the non-ASD group. [4].

We demonstrate band power differences over multiple cerebral regions indicating differences in activity in terms of spectral density which could be related to trait differences and tendencies.

#### **516.042 (Virtual Poster) Neural Response to Intervention: Alpha Asymmetry and Theta Oscillations of Reward**

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#### Background:

Autistic individuals demonstrate varied neural responses when anticipating and responding to social and nonsocial rewards. The PEERS social skills intervention is a well-established program that has been shown to increase social behaviors and reward processing using event-related potentials (ERPs) (Baker et al., 2020; 2021). Examining neural oscillations may further inform what is known about reward anticipation and processing in response to intervention, particularly changes from pre- to post-intervention. Oscillatory brain activity may also serve as a meaningful and objective measure of intervention outcome.

#### Objectives:

Examine pre- and post-PEERS intervention effects by measuring alpha asymmetry (during reward anticipation) and theta (during reward response) in 13 autistic teens (ASD) and 11 age and IQ-matched neurotypical (TD) teens.

#### Methods:

Electroencephalography (EEG) was recorded during a social/non-social reward task with ASD adolescents ( $n = 13$ ,  $M_{age} = 14.2$  years) before and after the 16-week PEERS intervention. This group of ASD participants has previously demonstrated enhanced social behaviors after PEERS (see Baker et al., 2021). TD teens ( $n = 11$ ,  $M_{age} = 13.2$  years) had brain activity measured at two time points—16 weeks apart, but did not participate in the intervention. Anticipatory alpha asymmetry (8-12 Hz) was examined in central-temporal-parietal regions in both hemispheres in a time window corresponding with the stimulus-preceding negativity (SPN) component. Post-feedback theta band oscillations (4-6 Hz) were examined in the frontal-midline region in a time window corresponding with the reward positivity (RewP) component.

#### Results:

**Pre-stimulus alpha asymmetry:** A four-way interaction was observed between time, condition, region, and group,  $F(2,21) = 4.46$ ,  $p = .054$ . Post-hoc tests revealed an effect of time in the social condition for the ASD group within the parietal region, such that there was more left hemisphere alpha suppression at Time 1 compared to Time 2,  $F(1,22) = 6.80$ ,  $p = .02$ .

**Post-stimulus theta:** An interaction between group and feedback was observed ( $F(1,25) = 4.08$ ,  $p = .054$ ), such that in the ASD group, larger theta-band activity was observed in the incorrect condition compared to the correct condition ( $F(1,25) = 4.70$ ,  $p = .04$ ).

#### Conclusions:

Approach motivation increased after intervention in the ASD group, evidenced by greater left-hemisphere alpha suppression after intervention in the parietal region. Thus, for the ASD group, more approach motivation was observed in the social condition after intervention, suggesting an enhancement of social motivation after learning social skills in PEERS. Additionally, incorrect feedback elicited larger theta activity vs correct feedback in the ASD group, indicating an increased evaluation of negative feedback. As such, adolescents with ASD appear to find incorrect feedback more salient than correct feedback. In sum, these objective and brain-based findings demonstrate that social motivation was strengthened in teens with ASD after PEERS.

#### **516.043 (Virtual Poster) Relative Alpha Power in Autism Spectrum Disorder: Sex Differences and Association with ASD Features**

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**Background:** Autism spectrum disorder (ASD) affects males at a rate of 4:1 compared to females (Baird et al., 2006), and females with ASD tend to exhibit fewer repetitive behaviors (Mandy et al., 2012) and lower IQ (Banach et al., 2009). These sex differences remain poorly understood, and there

is increasing effort to understand neural mechanisms involved. Alpha activity is an electroencephalographic (EEG) measure of particular interest given that shifts in alpha activity throughout childhood index neural development (Boersma et al., 2011). In typically developing (TD) children, females exhibit reduced alpha power, indicating increased neural activation (Clarke et al., 2001). Recent research found similar sex differences in children with ASD (Neuhaus et al., 2021), but there remains a notable lack of literature examining sex differences in alpha activity within this population.

**Objectives:** The current study examined sex differences in relative alpha activity in TD and ASD cohorts of children and evaluated the relationship between relative alpha activity and ASD symptomatology.

**Methods:** Resting EEG data (with eyes closed) and behavioral measures were collected from 72 children with ASD (n=19 female) and 47 TD controls (n=21 female) aged 8 to 18 years. At least 30 seconds of artifact free EEG data were available for each participant. Relative alpha power was extracted from occipital electrodes. Statistical analyses included a two-way ANOVA and post-hoc Tukey HSD to examine sex and diagnostic group differences, and Spearman correlations to examine bivariate relations among EEG and clinical measures.

**Results:** A significant effect of sex on relative alpha power was observed ( $F(1, 112)=11.43, p<.001$ ), such that females showed reduced alpha power. There was not a significant effect of diagnosis on relative alpha power. Post-hoc comparisons indicated that, in the ASD group, males exhibited significantly increased relative alpha power compared to females ( $p=.01$ ). A pattern of increased relative alpha power was also observed in TD males relative to TD females, but the difference was not statistically significant. Among participants with ASD, relative alpha power was positively associated with Social Communication subscale scores on the SRS-2 ( $r(70)=.247, p=.04$ ) and with Restricted Interests and Repetitive Behavior subscale scores on the SRS-2 ( $r(70)=.244, p=.04$ ). Relative alpha power was not associated with SRS-2 scores in the TD group, and there were no sex differences among SRS-2 scores in either cohort.

**Conclusions:** Our results replicate prior findings indicating greater relative alpha power in males with ASD. Notably, sex differences in alpha activity were independent of differences in ASD symptomatology. This finding suggests that females with ASD exhibit greater neural activation at rest and underscores the importance of considering sex differences in EEG power spectra in the context of ASD. It remains to be determined if sex differences in alpha activity reflect a differential mechanistic pathway to social function in ASD. Similar to previous studies (Leno et al., 2018; Neuhaus et al., 2021), findings also suggest that reduced neural activation is associated with more pronounced ASD symptomatology. Future research should further examine the relationship among neurophysiological measures and phenotypic outcomes associated with ASD.

#### **516.044** (Virtual Poster) Resting State EEG Connectivity: Functional Neural Differences in Toddlers and Preschoolers with ASD

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Background: Atypical functional connectivity is one of the most widely replicated neural findings in autism spectrum disorder (ASD) (Courchesne & Pierce, 2005, Just et al., 2004, Shepard et al. 2019). Infants later diagnosed with ASD exhibit significantly lower coherence (Righi et al., 2014). Further, positive correlations between connectivity and both social-cognitive functioning and reduced ASD symptom severity support the role of connectivity in behavioral phenotypes (Jaime et al., 2016, Keehn et al., 2015, Mathewson et al., 2012). Yet, inconsistent patterns of functional connectivity suggest that neural substrates may be variably impacted across development. Uddin (2015) suggests that consideration of childhood development is critical to understanding these varying results related to connectivity. Resting EEG functional coherence provides a useful tool to characterize connectivity differences in early development as it (a) is easier to collect in younger children than fMRI and (b) patterns of EEG coherence during resting tasks in ASD vs non-ASD samples may provide the foundation for contextualizing coherence differences at older ages and during other event-related paradigms. To our knowledge, few EEG studies have examined awake resting coherence among toddlers and preschool children with ASD; however, examining coherence in this population may be critical to delineate the course of functional neural differences in children with ASD.

**Objectives:** To evaluate whether resting state EEG coherence (a) differs in young children with ASD compared to age matched non-ASD children and (b) correlates with core behavioral features of ASD, namely an average of social and communication skills scores from the Vineland Scales of Adaptive Functioning (VABS-3).

**Methods:** Parents completed the VABS-3 for two- and four-year-old children with ASD (ns = 12 and 24, 66% and 87.5% boys, respectively) and no developmental concerns (ns = 20 and 31, 55% and 58% boys). Resting EEG coherence was computed in this sample in the theta band (4-7.99 Hz) interhemispherically as well as in the left and right hemispheres. Independent t-tests examined whether EEG coherence significantly differed in the (a) left (b) right, or (c) across hemispheres between diagnostic groups. When differences were significant, we examined whether (1) IQ correlated with coherence and (2) coherence predicted the socialization and communication composite score (SCC).

**Results:** In both the two- and four-year-old group, EEG coherence in the right hemisphere was significantly reduced in ASD compared to non-ASD participants ( $ps = .030$  and  $.017$ ). IQ did not significantly correlate with coherence. Coherence significantly predicted SCC at both ages (standardized  $\beta s = .391$  and  $.317, ps = .027$  and  $.019$ ). Coherence did not differ significantly in the left hemisphere or interhemispherically.

**Conclusions:** Children with ASD exhibited reduced right hemispheric coherence at age 2 and age 4 compared to non-ASD children. Right hemispheric coherence positively correlated with the SCC, suggesting that improved socialization and communication skills are correlated with increased functional coherence. This extends previous findings showing reduced coherence in older children (Shepard et al. 2019) and lends preliminary support for using resting coherence in early development as a tool to characterize neural and behavioral differences in ASD.

#### **516.045** (Virtual Poster) Similarities and Differences within a Pediatric Sample of High Intellectual Potential Vs High Functioning Autism: The Potential Role of Event Related Potentials (ERPs)

#### Background:

High Intellectual Potential (HIP) and High Functioning Autism (HFA), are two different conditions, which share some clinical features such as specific cognitive profile (greater verbal skills, executive functions deficits), social skills difficulties as well as the presence of restricted and specific area of interests. Moreover, an atypical neurodevelopmental trajectory has been described in both, HFA and HIP. As a matter of fact, in clinical and research activities, the distinction between these conditions has proved to be challenging.

Neurophysiological techniques, such as Event Related Potentials (ERPs)- particularly referred to Mismatch Negativity (MMN) and P300 paradigms- have been used in these populations, in order to better evaluate psychophysiological features. Specifically, evidences of reduced MMN amplitude have been found in the HFA individuals. By contrast, few and contrasting results are available for the HIP population, with no previous studies aimed to investigate differences within ERPs indexes between HIP and HFA and the correlation to clinical features.

#### Objectives:

To characterize a pediatric sample of HIP individuals in comparison to those with HFA and to neurotypical developmental (NTD) ones, from clinical and neurophysiological perspectives, particularly referred to ERPs.

#### Methods:

A sample of 43 individuals (age range 6-16 years) was included, divided into three groups: HIP (n 16), HFA (n 17) and NTD (n:10). The sample was recruited from the Child Psychiatry Unit of the University of Rome Tor Vergata Hospital. The HIP and the HFA groups underwent a standardized clinical assessment of cognitive and adaptive skills, autistic symptoms, executive functions and behavioral aspects. The NTD group underwent a screening evaluation of IQ and autistic symptoms. Finally, the whole sample underwent ERPs recordings, aimed to evaluate the MMN and the P300 paradigms.

#### Results:

From a clinical perspective HIP individuals demonstrated greater cognitive ( $p<0.001$ ) and adaptive skills ( $p<0.001$ ) as well as neuropsychological performances if compared to HFA ones. Moreover, our data highlighted the presence of subthreshold autistic symptoms ( $p=0.004$ ) as well as adaptive skills impairment ( $p=0.010$ ) in HIP population when compared to the NTD ones.

Interestingly so, no significant alterations of neurophysiological patterns came out within the HIP and NTD group, with evidence of reduced Mismatch Negativity (MMN) amplitude only in the autistic population (HFA vs HIP:  $p=0.001$ ; HFA vs NTD:  $p<0.001$ ; HIP vs NTD:  $p=0.99$ ). Finally, no differences on P300 component came out (HIP vs HFA  $p=0.347$ ; HIP vs NTD  $p=0.420$ ; HFA vs NTD  $p=0.616$ ).

#### Conclusions:

Despite similarities within the intellectually gifted individuals and the ones with autism came out at a clinical level, from a neurophysiological perspective a distinct characterization between groups came out. Particularly, our results highlight the potential role of MMN index as candidate *neuromarker* for autistic condition, thus starting to provide a more informative characterization of the HIP phenotype in comparison to those with autism and to NTD ones.

#### **516.046 (Virtual Poster)** Use of Computer Vision Analysis for Coding Visual Attention during EEG Experiments

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#### Background:

Traditionally, EEG experiments have required human coding to determine periods in which participants attended to the visual stimulus, which is critical for visual experiments that require the participant to be actively viewing the stimulus. Typically, researchers manually code the participant's visual attention in real-time, or code videos taken of the participant during EEG acquisition post-hoc. This is a labor-intensive process and relies on human judgement. The use of computer vision analysis (CVA) for the automatic coding of participant visual attention during EEG experiments could reduce the time burden of human coding and minimize the variation in attention coding strategies.

## Objectives:

We hypothesized that automatic CVA codes of eye gaze coordinates in the presentation screen plane, as well as head pose descriptors pitch, yaw, and roll, could reliably predict visual attention to the screen. To compare CVA to human coding, visual attention to the screen was coded in two ways by a human: first, eye gaze on the screen, and second, head position towards the screen. Our objective was to compare the CVA codes with the human codes to validate the use of CVA measures of visual attention in a sample of young children with autism.

## Methods:

To assess the reliability of CVA coding of attention in young children, we compared human vs. CVA coding of attention during EEG acquisition for 22 autistic children, 3-8 years of age. We videotaped the child's face using a separate camera while EEG was recorded. Inattention (moments when the child's gaze/eyes were not directed towards the screen) and head turns were hand coded. Start and endpoint of each occurrence of inattention or head turning was noted. Because inattention was part of head turning, any occurrence that included both head turning and inattention was coded as a head turn. 778,612 frames of data were hand coded. CVA measures for gaze ("X" and "Y" coordinates in the presentation screen plane) and head pose (pitch, yaw, and roll) were automatically extracted from the video (see Fig. 1). A general linear mixed effects logistic regression model with CVA measures as predictors was fit to the data separately for "head turn" and "gaze off screen" as a binary target variable.

## Results:

Head turn and gaze off screen events were detected by the model with AUC = 0.95 and AUC = 0.90, respectively, with all CVA measures being significant ( $p < 0.001$ , see Table 1). For the prediction of gaze off screen events, gaze X (horizontal axis) was the strongest CVA predictor (Odds Ratio [OR] = 1.22). For the prediction of head turns, Yaw was the strongest CVA predictor (OR=1.12).

## Conclusions:

Our results confirm that CVA measures can reliably code participants' attention during EEG acquisition. Thus, compared to human annotators, CVA may provide an efficient and more systematic way of coding attention in EEG experiments. However, the decision thresholds can be subject-dependent, thus requiring calibration of CVA measures before the experiment and possibly using machine-learning techniques to predict subject-specific thresholds.

### 516.047 (Virtual Poster) Amplitude of Low Frequency Fluctuations during Resting State fMRI in Autism

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**Background:** Disrupted brain functional connectivity has been widely reported as a neurobiological signature of autism (Maximo, Cadena, Kana, 2014). Resting state functional MRI (rs-fMRI) studies provide an excellent platform for examining spontaneous low frequency fluctuations and their temporal correlations during rest (Fox & Raichle, 2007). The resting amplitude of low-frequency fluctuations (ALFF) and fractional amplitude of low frequency fluctuations (fALFF) are such measures which have been used only sporadically in autism. The ALFF and fALFF measures can provide more insights into the underlying mechanisms of brain functioning in autism.

**Objectives:** The goal of this rs-fMRI study is to quantify the differences in ALFF and fALFF measures in autistic children in comparison with typically developing (TD) children.

**Methods:** rs-fMRI data from 73 children (44 autistic, mean age =  $8.83 \pm 2.75$  years; and 29 TD, mean age =  $9.02 \pm 1.97$  years) were obtained from the NYU Langone Medical Center of the Autism Brain Imaging Data Exchange (ABIDE II). Imaging was done on a 3T Siemens Allegra MRI Scanner, and the participants were instructed to keep their eyes open during rest. All processing of ALFF and fALFF measures were done using the CONN Connectivity Toolbox (conn20b; [www.nitrc.org/projects/conn](http://www.nitrc.org/projects/conn)) and SPM12 software ([www.fl.ion.ucl.ac.uk/spm/](http://www.fl.ion.ucl.ac.uk/spm/)). Harvard-Oxford Cortical atlas was used for selecting the regions of interest (ROI) and Networks. A two-sampled t-test and a 2 Group (ASD, TD) x 4 Networks [Default Mode Network (DMN), Salience Network (SN), Frontoparietal Network (FPN) Language Network (LN)] repeated measures ANOVA was conducted to test the difference in ALFF and fALFF values between autistic and TD participants. We hypothesized that low frequency fluctuations in DMN would be significantly different between the two groups. In addition to whole brain analysis to determine group differences in ALFF and fALFF, regression analyses were conducted with age and Full-Scale IQ as covariates.

**Results:** The ANOVA revealed a main effect of group for both ALFF and fALFF values, for DMN and SN. The ALFF values were found to be significantly reduced in autistic, relative to TD children, in DMN [ $F(1,71)=4.45$ ,  $p=0.38$ ] and SN [ $F(1,71)=10.73$ ,  $p=0.002$ ]. The fALFF values were found to be significantly reduced in autistic, relative to TD children, in SN [ $F(1,71) = 4.19$ ,  $p=0.045$ ]. No significant difference was found in FPN or LN. Whole brain analysis controlling for age and FSIQ revealed decreased ALFF and fALFF values in autistic, relative to TD, children in posterior and anterior cingulate cortex and superior parietal areas.

**Conclusions:** These findings suggest that the alterations in brain connectivity widely reported in autistic individuals may underlie differences in low frequency fluctuations in key resting state networks, such as the DMN, and networks involved in task regulation and attention switching such as the SN. Such intrinsically different network level responses in autistic participants may have implications for task-level recruitment and synchronization of brain areas, which in turn may impact optimal cognitive functioning in this population.

**516.048 (Virtual Poster)** Association between Eyes Closed Resting State Alpha EEG Power and Social Responsiveness in Youth with and without ASD: The Gendaar Study

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**Background:** Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in communication, and social impairments. Alpha power, EEG activity between 8 and 12 Hz, is found present during quietly resting with greater power (amplitude squared) when the individual's eyes are closed than when eyes are open. This is thought to reflect increased cortical activation (decreased power) when eyes are open in preparation for attention and cognition (Klimesch, 2012). Previous research has found lower alpha power in individuals with ASD compared to typically developing (TD) (Neuhaus et al., 2021, review Wang et al, 2013) and has been associated with attention and cognition and social understanding and imitation in individuals with ASD (Neuhaus et al., 2021; Perry et al., 2011).

**Objectives:** To evaluate association between eyes closed EEG resting state alpha power and social responsiveness in youth with and without ASD by gender and diagnosis.

**Methods:** Data were collected from 152 youth (ASD = 76) ages 8-17 years, from an NIH funded study investigating sex and gender differences in youth with ASD. Youth sat with eyes closed while high density EEG data was collected. Data were processed per Neuhaus et al. (2021). A fast fourier transformation (FFT) was applied to artifact free EEG data to extract alpha power for central and posterior electrodes. Regions of interest (ROIs) for alpha power were calculated over: left frontal (LF: 23, F3-24, 27, 28), mid frontal (MF: 5, FZ-11, 12, 16), right frontal (RF: 3, 117, 123, F4-124), left central (LC: 35, 36, 41, 42); left posterior (LP: 51, P3-52, 59, 60) mid central (MC:7, 31, 80, 106); mid posterior (MP: 62, 71, 72, 76); right central (RC: 93, 103, 104, 110); and right posterior (RP: 85, 91, 92, 97). Parents of children completed the Social Responsiveness Scale-2 (SRS-2) which is a 65-item rating scale measuring autism traits. A series of one-way ANOVAs and correlations were conducted to evaluate the differences in frontal, central and posterior alpha power x group (ASD/TD), gender (male/female) and associations with social responsiveness. We previously report on EEG alpha power during eyes open calm viewing (Neuhaus et al., 2021) and extend this work to the eyes closed resting condition.

**Results:** Preliminary analysis shows significant main effect of diagnosis for eyes closed alpha power in LF, MF, RF, LC, MC, MP, RC and RP regions ( $F(1,150)s > 6.14, ps < .05$ ). No significance was observed for the LP region ( $F(1,150) 2.17, p = .14$ ). Power was significantly lower in the ASD group compared to the TD group. Within the ASD group, correlations between the SRS total score and alpha power was non-significant for any regions, including the SCI subscale ( $p = > .05$ ).

**Conclusions:** Initial findings are consistent with prior research suggesting alpha power is reduced in youth with ASD when compared to TD, and extends this work to EEG acquired during eyes closed. No significant correlations were observed with SRS-2 parent report of autism traits. Additional analysis will include additional phenotypic correlates (Vineland and verbal/nonverbal IQ) and will examine relations by gender.

**516.049 (Virtual Poster)** Bringing EEG from the Lab into the Clinic for Autism Biomarker Implementation

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**Background:** Biomarkers from electroencephalographic (EEG) measures may help identify young autistic people. EEG methods have great potential for use in field and clinical settings due to their scalability, relatively low costs, and portability. Combined EEG and eye-tracking (ET) may furthermore help improve data quality. EEG recordings while watching social and non-social videos are suitable for children across developmental stages.

**Objectives:** In this study we aimed to examine the feasibility of the implementation of an EEG-ET paradigm in a large longitudinal study at a clinical site in South Africa. We tested how demographic and clinical variables relate to data availability and neural oscillations across children.

**Methods:** 100 children from the Safe Passage Study (Perinatal Alcohol SIDS and Stillbirth (PASS) Network) follow-up participated, of whom 76 provided sufficient EEG and ET data - including 31 females, mean age = 8.19(2.23), mean WASI FSIQ = 74(12.25). The videos consisted of 2 women singing nursery rhymes (social condition), and spinning toys (non-social condition), with a duration of 1 minute each, and were presented twice. A 20-channel gel-based Enobio EEG system and screen-based Tobii Pro X2 eye-tracker were used. Data availability was quantified using the number of clean trials (NCT). For both conditions we calculated neural oscillatory measures - log theta (4-7Hz) and alpha (8-12Hz) power across frontal and central regions - and proportional looking time (PLT) - ratio between the number of gaze samples on the scene and the total valid samples. We set up 3 mixed models assuming NCT /alpha /theta power as dependent variables, demographic and clinical variables (sex, age, FSIQ, Childhood Autism Rating Scale, maternal years in education) as fixed effects, with varying intercepts per participant, and condition and region as random slopes.

**Results:**

Participants provided 74% clean trials on average (SD = 15%), and average PLT was 86% (SD = 14%). The models showed 1) higher NCT in the non-social condition (Coef. = 10.28%, SE = 3.47, p-value = 0.003), which decreased with higher CARS scores (Coef. = -0.76%, SE = 0.21, p-value =

0.0003) 2) a decreasing effect of age on alpha (Coef. = -0.05, SE = 0.02, p-value = 0.04) 3) higher theta in the social condition (Coef. = 0.07, SE = 0.02, p-value = 0.003).

**Conclusions:** This study demonstrated good EEG and ET data quality in a clinical setting. The high NCT allows for high inclusion rates. The observed interaction from condition and autistic traits on the NCT may arise from preferential engagement and/or marked individual variability in the social condition. We found a condition effect for theta power and a developmental change for alpha power, which are both consistent with previous findings. Together, these findings show good potential for use of EEG-ET methods in large scale field developmental studies examining EEG biomarkers for autism.

**516.050 (Virtual Poster)** Elevated E/I Ratio Is Associated with Intellectual Disability in Children with Autism

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**Background:** An altered balance of neuronal excitation and inhibition (E-I balance) might be implicated in the co-occurrence of autism and intellectual disability, but this hypothesis has never been tested. E-I balance changes can be estimated from the spectral slope of the aperiodic 1/f neural activity.

**Objectives:** Herein we used magnetoencephalography (MEG) to test whether the 1/f slope would differentiate ASD children with and without intellectual disability.

**Methods:** MEG was recorded at rest with eyes open/closed in 49 boys with ASD aged 6-15 years with a broad range of IQs, and in 49 age-matched typically developing (TD) boys. The cortical source activity was estimated using individual brain models and the LCMV beamformer approach. By fitting a linear function to the source activation spectra in the 35-45 Hz range, we extracted the 1/f slope.

**Results:** The grand averaged 1/f slope was steeper in the eyes closed than in the eyes open condition, but had high rank-order stability between these conditions. In line with the previous research, the slope flattened with age. Children with ASD and below-average (<85) IQ had flatter slopes than either TD or ASD children with normal IQ. These group differences could not be explained by differences in signal-to-noise ratio or power of periodic (alpha and beta) activity.

**Conclusions:** The atypically flattened spectral slope of aperiodic activity in children with ASD and below-average IQ suggests a shift of the global E-I balance toward neuronal hyper-excitation. The spectral slope can provide an accessible non-invasive biomarker of the E-I ratio for translational research and making objective judgments about treatment effectiveness.

**516.051 (Virtual Poster)** Fewer Transient Alpha Frequency Events Predict Phase Synchronization Impairments during the Sensory Auditory Chirp in Fragile X Syndrome

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**Background:** Sensory hypersensitivity is common in Fragile X Syndrome (FXS) and can be quantified with EEG (1). For example, individuals with FXS do not mount precise neural responses to the sensory auditory chirp and have excessive background gamma activity. Resting-state EEG studies have shown decreased alpha power and alpha power is commonly associated with . To date, alpha activity at the trial level is poorly understood but is predicted to have an impact on sensory processing (2). Previous work has observed that high-power beta spectral events can predict sensory function across species (3).

**Objectives:** 1) studying transient alpha frequency events instead of spectral average trial data may reveal mechanisms related to abnormal sensory processing in FXS and 2) study relationship of novel analysis with conventional measure of sensory auditory chirp intertrial coherence.

**Methods:** Auditory event related potentials (ERPs) were obtained from 17 adolescents and adults with FXS and 17 age- and sex-matched healthy controls using 128-channel EEG. Subjects heard a sensory auditory chirp generated using an amplitude-modulated 1000-Hz tone linearly increasing in frequency from 0–100 Hz over 2 s. We calculated intertrial coherence (phase synchrony) and identified high-power alpha spectral events using the Jones laboratory spectral events toolbox (3).

**Results:** Transient alpha events were successfully detected across both groups (**Fig. 1A**). In FXS the alpha event rate was between .6 to .9 events for a 2.5 second trial (**Fig. 1B Left**). On average, there were significantly fewer alpha events per a 2.5 s trial in FXS compared to controls ( $p < .001$ ; **Fig. 1B Right**). Interestingly, in FXS a higher alpha rate (in the direction of controls) was significantly associated with greater phase locking to the sensory auditory chirp ( $R = .45$ ,  $p < .001$ ; **Fig. 1C**).

**Conclusions:** Transient spectral events are a novel approach to understanding trial level neural responses in EEG data that may overcome limitations of trial averaged data. We show a markedly reduced alpha event rate in FXS which is associated with a decreased ability to phase synchronize with sensory perception. Spectral events in ERP neural activity may be predictive of subject-specific features of trial-averaged tasks and may pose a novel method of understanding neurophysiology in neurodevelopmental disorders.

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## **516.052** (Virtual Poster) Imbalanced Empathy in Children with Autism Spectrum Disorder: Evidence from Hemodynamic Responses Measured By Functional Near-Infrared Spectroscopy

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### Background:

Deficits in empathy have been widely reported in individuals with Autism Spectrum Disorder (ASD; Bons et al., 2013; Hadjikhani et al., 2014; Rogers et al., 2007). The empathy imbalance hypothesis (EIH) proposed that individuals with ASD may display intact or even heightened emotional contagion, accompanying by a perspective-taking deficit (Smith, 2009). However, this hypothesis has not been fully examined yet.

### Objectives:

The current study investigates the imbalanced empathy and empathy-related prosocial behaviors in children with ASD and typically developing (TD) controls, using the functional near-infrared spectroscopy (fNIRS) technique. We aimed to provide new evidence for the inappropriately empathic reactions to others' pain in children with ASD in terms of their hemodynamic responses, as well as their behavioral indices.

### Methods:

We used the moral reasoning task modified from Cheng and colleagues (2014). This task included two experimental conditions depicting an individual's limb in painful situations or non-painful control situations. Each condition consisted of 10 trials, and each trial lasted for about 12 sec (3 sec for stimuli display, about 3 sec for behavioral rating, and 6 sec for inter-trial rest).

Twenty-three 5- to 7-year-old children with ASD and twenty-three age-matched TD controls were shown static images depicting an individual's limb in pain or control situations. Their hemodynamic responses were recorded by optical imaging instruments (Nirsport, NIRx Medical Technologies) with 46 measure channels covering the somato-sensory cortices (SI/SII), temporo-parietal junction (TPJ), and temporal regions (Figure 1a). They were asked to rate the pain intensity of the person. After the scanning, children were asked to share some stickers out of 10 to an anonymous child who was suffering in pain.

### Results:

We found that (a) compared with the TD controls, children with ASD showed increased brain activation in the SI/SII (channels 27, 33, 38, and 41), TPJ (channels 40 and 46), and the temporal areas (channels 16, 22, and 35) when perceiving others' pain (Figure 1b) but no differences in non-painful control situations; b) children with ASD repeatedly overestimated the pain intensity of other people (Figure 2a); and (c) children with ASD were less willing to share their stickers than the TD peers (Figure 2b).

### Conclusions:

Our study proved imbalanced empathy and reduced empathy-related prosocial behaviors in children with ASD. These findings indicated that the impaired empathic reactions in children with ASD may be explained by their hyperarousal to the pain stimuli, which interferes cognitive processing towards others and reduces empathic behaviors.

## **516.053** (Virtual Poster) Neural Effects of Sham-Controlled Alpha Auditory Entrainment in Fragile X Syndrome: Pilot Study

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**Background:** Fragile X Syndrome (FXS), a monogenetic neurodevelopmental disorder, has a variable phenotypic presentation, including autistic symptomatology, cognitive disability, and sensory hypersensitivity. FXS subjects do not mount precise neural responses to the sensory auditory chirp and, instead, have “noisy” asynchronous gamma activity (Ethridge, 2017). These changes may be involved in the reduced ability to detect signal from noise and represent potential tractable targets for entrainment.

**Objectives:** We hypothesized that external alpha auditory entrainment (AAE) of corticothalamic drive would individually modulate and normalize peak power frequency with the ultimate goal to increase the ability to mount precise neural responses to stimuli and diminish asynchronous gamma “noise” in FXS. We aim to measure neural responses to sham controlled AAE stimulus including quantification of 1) individual response variability, 2) regional causality analysis of AAE information outflow, 3) peak frequency response in FXS during AAE.

**Methods:** We performed AAE on 8 age- and sex-matched subjects (N=4 FXS, N=4 control; ages 6-48) using a block-design AAE stimulus that creates a differential rhythm between the left and right ear starting at high theta range (7-Hz) through high alpha (13-Hz) in 2 Hz steps on a 500 Hz sine carrier tone. The sham stimulus was the carrier tone alone. Subject-level neural responses to continuous EEG (128-channels) were measured and analyzed measured through AAE blocks.

**Results:** We demonstrate spectral response variability to AAE (controlled by sham) across eight subjects (**Fig. 1A**). Using causality analysis (direct directed transfer function), we observed alpha phase entrainment from temporal lobes to frontal, central, and occipital regions (**Fig. 1B**). In a 15 year old FXS subject we identified both an endogenous peak frequency in the theta range and a novel alpha peak frequency around 10 Hz (and mu rhythm) emerged in the presence of AAE (**Fig. 1C**). AAE appeared to increase alpha power and decrease theta power over sham AAE in this subject (**Fig. 1D**).

**Conclusions:** We observed highly individualized physiological changes across all 8 subjects following sham controlled AAE. In one participant with FXS, we observed reversal of EEG power abnormalities. The findings support speculation that alpha entrainment that may provide compensatory action within the FXS brain. To what degree AAE can improve signal-to-noise abnormalities in well-characterized paradigms such as the sensory auditory chirp or has therapeutic potential remains an open question.

#### **516.054 (Virtual Poster)** Predictive Coding in Autism Spectrum Disorder: Electrophysiological Alterations in Early Auditory Predictive Processing As Potential Markers for Autistic Symptomatology

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**Background:** Autism spectrum disorder (ASD) is a pervasive neurodevelopmental disorder that has been linked to a range of perceptual processing alterations, including hypo- and hyperresponsiveness to auditory stimulation. A recently proposed theory that attempts to account for these symptoms suggest that autistic individuals have a decreased ability to anticipate upcoming sensory stimulation.

**Objectives:** If the ability to anticipate upcoming sensory stimulation is indeed decreased in ASD, perception in ASD could be less affected by prior expectations and more driven by sensory input. Here, we tested this hypothesis with a series of event-related potential (ERP) studies in which we examined the neural correlates of motor-auditory prediction (N1 attenuation), visual-auditory prediction error (omission N1) and deviancy detection of auditory, visual and audiovisual speech (MMN).

**Methods:** In a series of ERP studies, we first compared the electrophysiological brain response to self- versus externally-initiated tones between a group of individuals with ASD and a group of age matched individuals with typical development. Next, we assessed between-group differences in prediction error signaling by comparing ERPs evoked by unexpected auditory omissions in a sequence of audiovisual recordings of a handclap in which the visual motion reliably predicted the onset and content of the sound. Finally, we examined between group differences in deviancy detection of auditory, visual and audiovisual speech by applying a MMN paradigm.

**Results:** The results of our first ERP study showed that, unlike in age-matched participants with typical development, self-initiation of tones through a button press did not attenuate the auditory N1 in autistic individuals, indicating that the ability to anticipate the auditory sensory consequences of self-initiated motor actions might be decreased in ASD. The results of our second study showed that unexpected omissions of a sound of which the timing and content could be predicted by preceding visual anticipatory motion elicited an increased early auditory omission response (oN1) in the ASD group, indicating that violations of the prediction model produced larger prediction errors in autistic individuals when compared to their peers with typical development. Finally, the results of our third study showed that deviancy detection of auditory speech is reduced in autistic individuals, while deviancy detection of visual speech and incongruent audiovisual speech seems to be intact.

**Conclusions:** Taken together, our findings suggest that individuals with ASD may indeed experience difficulties in anticipating upcoming auditory stimulation. Importantly, these difficulties might be due to domain-specific alterations, rather than general impairments in predictive coding. This notion provides potential avenues for future research on electrophysiological markers for autistic symptomatology

**516.055** (Virtual Poster) Relation of Imagination Deficit with Severity ASD Symptoms Associated with N-Acetyl-Aspartyl Glutamate Metabolism Imbalance.

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**Background:** Autism is defined neurodevelopmental disorder characterized by significant impairments in social interaction, and imagination as symptoms highlights. Recently have described been the differences of brain function in voluntary and involuntary imagination. Although, individuals with moderate to severe autism spectrum disorder (ASD) usually manifest a range of deficits related to the voluntary imagination network, its neurological etiology follow unclear. The AQ is a psychometric test has five developmental domains to assess autistic characteristics in adults (social, communication, imagination, attention to detail, and attention switching/tolerance of change), and in this study we will focus on the domain of 'Imagination', that is directly related to the development of social skills in healthy subjects. Previously, we had described been the altered N-Acetyl-aspartyl-glutamate (NAAG) levels found in cingulated cortices by 1H-MRS in individuals with ASD that suggested the neuronal damage. In this sense and following our research line linked to the neuropeptide NAAG as a key mechanism underlying symptoms of ASD, arise the hypothesis of NAA-NAAG metabolism imbalance and their relationship with impairments of the imagination linked to cingulated cortices in ASD.

**Objectives:** To study the participation of neuropeptide NAAG metabolism in the cingulated cortices and their correlation with the AQ domain 'Imagination' associated with ASD severity using 1H-MRS.

**Methods:** We quantified NAAG, and NAA signal in anterior (ACC) and posterior (PCC) cingulated cortices separately from the 1H-MRS assessed in 22 patients with ASD and 44 healthy comparison subjects, matched for age, gender on a 3.0 Tesla MR scanner. We used the 'Imagination' subscale of the Autism Spectrum Quotient (Baron-Cohen et al., 2001), since nine of the ten items on this subscale involve aspects of social imagination. Statistic one-way ANOVA and Bonferroni correction was applied. Pearson correlation hallmarks the goal.

**Results:** Pearson correlation represented graphically, was observed that there is a positive correlation between the AQ domain 'Imagination' and the NAA/NAAG ratio in the ACC ( $r = 0.21$ ,  $p = 0.63$ ) and PCC ( $r = 0.30$ ,  $p = 0.31$ ) in ASD group (see Fig.1). In contrast to TD group, the correlation was negative. However, when was stratified ASD plus TD groups by AQ1, AQ2, AQ3, and AQ4 threshold, was shown a positive correlation in AQ2 ( $r = 0.32$ ,  $p = 0.12$ ), AQ3 ( $r = 0.001$ ,  $p = 0.79$ ), and AQ4 ( $r = 0.47$ ,  $p = 0.50$ ) (see Fig. 2). Highlighting, that in PCC, the AQ2, AQ3, and AQ4 groups maintain a pattern correlation to 'imagination' different than the AQ1 group that was considered (below the mean of the autistic characteristics) as a group of healthy subjects that indicate undisturbed metabolism. These results make us suggest the relation of deficit of Imagination with severity ASD symptoms in PCC, and its correlation with NAA/NAAG imbalance according to, (Vyshedskiy, A., 2020).

**Conclusions:** The opportunity to measure NAAG in cingulated cortices creates a new and promising approach for intensified research on this neuropeptide and on the effects of new venue novel drug candidates in ASD.

**516.056** (Virtual Poster) Relationships Among Social Motivation, Sex, and Neural Response during Vocal Emotion Recognition in Youth with and without ASD

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**Background:** Autism spectrum disorder (ASD) is characterized by social communication impairments (APA, 2013) which may stem from differences in social reward processing as posited by the Social Motivation Hypothesis (Chevallier et al., 2012). Social motivation is reduced in children with ASD (Neuhäus, Bernier, & Webb, 2020), specifically in males (e.g., Sedgewick et al., 2016) and partially mediates the association between better facial emotion recognition and faster face processing, measured by Event-Related Potentials (ERPs; Garman et al., 2016). Social motivation and face processing are well studied, yet there is relatively less research on vocal emotion processing. The N100 is an ERP elicited 100 ms after onset of an auditory stimulus that indexes early encoding of sound (Näätänen & Picton, 1987; Paulmann & Kotz, 2008). The N100 is delayed (Korpilahti et al., 2007) and a longer latency is related to poorer vocal emotion recognition in ASD (Lerner et al., 2013). However, the relationship between the N100 and social motivation, and whether a plausible covariate (i.e., sex) better accounts for this relationship, is unclear.

**Objectives:** Examine associations among N100 amplitude and latency (during a standardized vocal emotion recognition task), social motivation, and sex in youth with and without ASD.

**Methods:** Eighty-seven youth with and without ASD completed a vocal emotion recognition task while electroencephalography (EEG) was recorded (Table 1). Social motivation was measured by the parent-report Social Responsiveness Scale, Second Edition (SRS-2) Social Motivation T-Score (Constantino & Gruber, 2012). Relationships among variables were examined using Pearson and point-biserial correlations, and corresponding post-hoc partial correlation analyses controlling for sex.

**Results:** Social motivation impairments were more prevalent in females, compared to males, with ASD and males, compared to females, without ASD (Table 2). In participants with ASD, social motivation and N100 amplitude were correlated (Table 2), and remained so when controlling for sex ( $r(37) = -0.317$ ,  $p < 0.05$ ).

**Conclusions:** A more negative N100 amplitude was associated with lower social motivation in youth with ASD. Youth with ASD who have lower social motivation may exhibit "hyper-orientation" to emotional prosodic cues like youth with ADHD (Chronaki et al., 2015). Females with ASD and

males without ASD group displayed more social motivation impairments, contrary to prior work showing males with ASD exhibit reduced social motivation (e.g., Sedgewick et al., 2016). Since we found social motivation is higher in males with ASD while others have found it is higher in females with ASD (Sedgewick et al., 2016) and still others have not found differences between males and females with ASD (Neuhaus, Bernier, & Webb, 2020), future research should explore when and for whom social motivation differences emerge as a function of sex in ASD. Nevertheless, the association between the N100 amplitude and social motivation remained significant after controlling for sex, suggesting that this relationship is durable even in the face of potential sex-related effects on social motivation.

**516.057** (Virtual Poster) Sensory Neurophysiology and Intrinsic Connectivity in Autism Spectrum Disorder: Mismatch Negativity and P50  
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#### Background:

Aberrant mismatch negativity and P50 sensory gating have been demonstrated in individuals with autism spectrum disorder (ASD). The mismatch negativity and P50 sensory gating involve pre-attentive mechanism. Whether the mismatch negativity and P50 sensory gating in ASD can be attributable to the alterations in the resting-state functional connectivity in the brain has not been examined.

#### Objectives:

This study aimed to investigate the mismatch negativity, P50 sensory gating and their interrelationship with functional connectivity in ASD.

#### Methods:

This study recruited 75 ASD participants and 50 TDC. All the participants underwent clinical assessment, mismatch negativity on the oddball paradigm, and resting-state functional MRI. Part of the sample (n=20) also took P50 paradigm. We compared the mismatch negativity, P50 sensory gating, and resting state brain connectivity between ASD and TDC, then examined the relationship between mismatch negativity, P50 sensory gating, and functional connectivity.

#### Results:

The ASD and TDC groups were not significantly different on mismatch negativity, while the ASD group showed N100 sensory gating deficits and a higher functional connectivity between auditory network and thalamus compared to the TDC group. As for the relationship between mismatch negativity and functional connectivity, we found that P3a latency towards duration deviant was negatively correlated with functional connectivity between auditory network and right orbitofrontal cortex. Higher connectivity was related to an earlier response in the orbitofrontal cortex. As for sensory gating paradigm, we found a N100 suppression deficit in ASD was associated with functional connectivity between auditory network and frontal cortex.

#### Conclusions:

Our findings implied that earlier P3a response in ASD was associated with higher intrinsic connectivity between auditory network and orbitofrontal cortex. Whether sensory sensitivity in ASD is related to higher intrinsic connectivity between sensory processing networks warrants further investigation.

**516.058** (Virtual Poster) Spanning the Auditory System: Subcortical and Cortical Auditory Processing of Speech Sounds in Autistic and Typically Developing Children

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#### Background:

Autistic individuals often report atypical sensory processing, particularly in the auditory domain. However, the neural mechanisms which produce such symptoms are poorly understood. Speech Auditory Brainstem Responses (speech-ABRs) and the Mismatch Negativity (MMN) are neurophysiological measures that capture different levels of auditory processing, such that speech-ABRs reflect subcortical processing whereas the MMN assesses cortical brain activity. These measures are rarely examined together despite their adjacent neuroanatomy and findings that both are atypical in autism.

#### Objectives:

The purpose of the present study was to bridge subcortical and cortical auditory processing of speech sounds by collecting speech-ABRs and the MMN in a sample of autistic children and their age and IQ matched typically developing (TD) peers. In so doing, we test whether the integrity of

subcortical processing measured via the V-O interpeak latency of the speech-ABR could predict the latency of the speech-MMN and whether these differ by group.

#### Methods:

Participants included 11 autistic children (mean age = 12.8) and 11 TD children matched on chronological and non-verbal mental age using the Perceptual Reasoning Index (PRI) of the WASI-II. Participants completed audiological testing, which elicited the speech-ABR using 40ms /da/ syllables with an alternating polarity of 11.1/sec. An oddball paradigm with the syllables /ba/ and /da/ was used to capture the MMN. speech-ABR integrity was measured via the V-O interpeak latency while the latency onset of the MMN was measured via the point at which 30% of the rectified area under the curve was accrued.

#### Results:

The interpeak V-O latency of the speech-ABR significantly predicted the latency of the MMN across participants ( $F(1, 18) = 11.6, p = .00315$ ), such that a longer V-O interpeak latency predicted a later MMN latency across TD and autistic participants. However, visual inspection of the data suggested that this relationship may be weaker in autism, as the latency of the MMN was less variable in this group. No group differences in interpeak V-O latency ( $t(1, 20) = 0.15, p = 0.96$ ) nor MMN latency ( $t(1,20) = 0.00, p = 0.52$ ) were noted.

#### Conclusions:

Preliminary results from this ongoing study suggest that subcortical speech processing can predict cortical speech processing. However, this relationship between the subcortical and cortical auditory system may be different in autistic and TD children, which warrants future investigation. Lastly, the lack of group differences on the subcortical and cortical neurophysiological measures highlights the importance of matching participants on the basis of developmental level in research with atypically developing populations.

#### **516.059 (Virtual Poster)** Task-Based Functional Connectivity Predicts Language Ability of Autistic and Typically-Developing Adolescents Using Connectome-Based Predictive Modeling

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**Background:** Communication deficits are a core feature of ASD. While there is significant variability in language ability across autistic individuals, most show some impairment. Language is an important area for assessment and intervention across the lifespan: from infancy when many parents observing speech delay first seek ASD assessment, to childhood when language difficulties are linked to risk for anxiety, to adulthood when they are tied to job attainment and friendship. One way to investigate neural correlates of language deficits is using functional connectivity. Existing work reported decreased activation in the superior temporal gyrus (STG), a region involved in auditory processing. Connectome-based Predictive Modeling (CPM) is a method which predicts individual behavior using such functional connectivity data (connectomes) derived from fMRI. Most studies use fMRI data collected during “rest,” a supposed task-free state; however, recent work calls into question its ecological validity and predictive power.

**Objectives:** Determine CPM’s efficacy in predicting language ability in ASD and TD individuals using connectomes derived from rest and a language task. Explore the role of sex and/or diagnosis on predictive power of these tasks.

**Methods:** Subjects were 144 adolescents (75 girls, 8-17), autistic (ASD,  $n=57$ ) and typically developing (TD,  $n=87$ ). Language ability was assessed with Clinical Evaluation of Language Fundamentals (CELF-4) Core Language Score (range 40-134,  $M=105.6, SD=17.6$ ). MRI scans were collected across several sites. Functional sequences included resting state and a language paradigm where participants listened to streams of nonsense speech. Subjects with mean FD  $>0.35\text{mm}$  were excluded. Connectomes were generated from nuisance-corrected functional data (fmrprep, AFNI) after applying the Shen-268 atlas. We compared the predictive power of resting state and language task on CELF in the entire sample and then explored effects of sex and/or diagnosis on overall predictive power. Finally, we projected features into brain space (Bioimage Suite) and assessed whether brain networks used to make successful predictions were the same across groups and tasks.

**Results:** In the combined sample, the language task was able to predict the CELF Core Language Score ( $R^2=0.07, MSE=287.6$ ), whereas resting state could not. Brain regions involved in the auditory network (e.g., rSTG) had a high degree of predictive power. Within TDs, females appeared to drive the predictive power of the language task ( $R^2=0.10, MSE=87.3$ ). Conversely, within ASDs-only, males appeared to drive the task’s predictive power ( $R^2=0.36, MSE=339.7$ ), recruiting visual and memory processing regions. Additionally, resting state was minimally predictive of CELF in both TD groups (females:  $R^2=0.02, MSE=95.3$ ; males:  $R^2=0.047, MSE=120.3$ ) and in ASDmales.

**Conclusions:** Task-based fMRI connectomes can not only be used in place of traditional resting state to predict behavior and clinical characteristics, but may improve accuracy. Examination of the models underlying these predictions suggest heterogeneity in brain recruitment across sex and diagnosis. While TDs employed a more classic language network, ASDmales used an alternative network. Further examination of ASDfemales’ connectomes may elucidate individual differences that preclude prediction, assisting in design of interventions targeting language deficits in ASD, and increasing favorable mental health outcomes into adulthood. Task-based CPM provides novel insight and a more targeted method to investigate the neural underpinnings of symptoms in ASD.

**516.060** (Virtual Poster) The Dual Pathways of Oxytocin Neural Effects in Youth with ASD: A MEG Study

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**Background:**

Autism Spectrum Disorders is a neurodevelopmental condition characterized by difficulties in the social domain. In addition to the clinical symptomatology, studies have shown that individuals with ASD tend to present atypical patterns in face perception. Several studies have shown that oxytocin (OT), a naturally occurring hormone that relates to social communication in mammals, can modulate social behaviors in ASD. However, the mechanism underlying the effects of OT in ASD is relatively unknown. One of the possible reasons for this gap in the literature could stem from the lack of research on the effect of OT during the early stages of the perceptual processes using tools with high time resolution.

**Objectives:**

The current work focused on the effects of single-dose OT on the early stages of face processing in individuals diagnosed with ASD during social and non-social perception. Using magnetoencephalography (MEG), we investigate, in several social-related neural regions, the effect of OT on M100, M170, and M250, neural components that relate to face perception. We also examined the effects of OT on alpha and gamma connectivity between these regions during social and non-social perception.

**Methods:**

Twenty-five individuals diagnosed with ASD took part in this double-blind placebo-controlled design and performed a social task which required identification of social and non-social stimuli during a scan in the MEG.

**Results:**

Our results show that OT influence both social and non-social stimuli from the early stages of the perceptual process. OT enhances social-related perception within and between social-related regions, but it also increases the general attention toward external stimuli, regardless of their social context. Namely, our results suggest that OT increased social perception in medial frontal regions alongside modulation of the top-down and bottom-up processes between this region and posterior tempo-occipital regions

**Conclusions:**

The current study highlights the complexity of the effects of OT during early perceptual stages in ASD. By providing a new model that is composed of both social-related influence and modulation of the overall attention, we provide a new platform for exploring and establishing novel treatments for early attentional phases in ASD.

**516.061** (Virtual Poster) Preliminary Sex Differences in Longitudinal Functional Connectivity in Mid-to-Older Adults with Autism

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**Background:** Research on cognitive and brain aging in autistic adults is emerging, but no studies have examined sex differences. Mid-to-older autistic women show poorer employment retention (Taylor & Mailick, 2014), quality of life (Mason et al., 2018), and greater Parkinson's risk (Hand et al., 2020; Geurts et al. 2021), suggesting distinct vulnerabilities in brain aging.

**Objectives:** The objectives of this study were to use a data-driven, connectome-wide approach to examine sex differences in functional connectivity (FC) changes in mid-to-older autistic adults in a small, preliminary longitudinal sample.

**Methods:** Participants included autistic men/women and neurotypical (NT) counterparts ages 40-71 years at enrollment (average age: 52.2 [8.0]; follow-up interval: 2-3 years; autistic females:  $n=8$ ; autistic males:  $n=23$ ; NT females:  $n=7$ ; NT males:  $n=19$ ). There were no significant differences across groups for age at enrollment. Participants completed a six-minute, resting-state fMRI scan. A conservative preprocessing/denoising pipeline was implemented in SPM12 and the CONN Toolbox. Group-MVPA tested three regression models: 1) diagnosis group differences in FC changes, 2) "sex-typical" FC changes, and 3) "sex-atypical" FC changes. Post-hoc seed-to-voxel analysis characterized significant group-MVPA effects. A height threshold of  $p<.001$  and cluster threshold  $p<.05$  FWE-corrected was used across analyses. Associations with baseline cognitive control (Wisconsin Card Sorting Task errors) and fine motor abilities (finger tapping) were examined. Model significance identified substantial associations (one model per MVPA cluster containing suprathreshold post-hoc cluster mean FC values as predictors), and post-hoc inspection of predictor significance provided qualitative characterization.

**Results:** Diagnosis group MVPA revealed differences in age-related changes in cerebellar vermis 8, characterized by increasing somatosensory FC in autism and decreasing FC in NT (driven by females). No significant behavioral associations were identified. For sex effects, all patterns were characterized by declining FC in females and stable or increasing FC in males. These patterns were observed in four clusters including 1) the mid-brain, driven by intrinsic midbrain and intraparietal sulcus FC, 2) bilateral frontal poles, driven by visual cortex/precuneus FC, 3) and the right paracingulate, driven by default mode network FC. Left FP changes, especially "male-typical" increasing FC with the precuneus, predicted worse

baseline cognitive control. For the midbrain, greater “female-typical” FC declines within the midbrain and with the thalamus predicted poorer baseline motor performance. The left frontal pole showed sex-by-diagnosis patterns of longitudinal FC change, driven by greater FC declines with the default mode network and frontal poles in autistic males/NT females and inverse patterns in autistic females/NT males (again, driven by females). No significant behavioral associations were identified.

Conclusions: “Sex-typical” FC changes in autistic males suggest greater age-related vulnerability to cognitive decline than for autistic females. In contrast, autistic females may show more risk to brain aging linked to Parkinson’s disease. Both “sex-atypical” and diagnosis effects are driven by female groups, and given the small female sample, there is limited power to detect behavioral correlates. Furthermore, given substantial sex-related effects, the role of hormones and menopause in aging in autistic females requires further examination. Validation of these results is warranted with larger sample sizes.

## Brain Structure (MRI, neuropathology)

### ORAL SESSION - 3B — BRAIN STRUCTURE (MRI, NEUROPATHOLOGY)

#### 309 - The Neuroanatomical Underpinnings of Different Clinical ASD Phenotypes

**309.001** (Oral) Investigating Shared and Distinct Neuroanatomical Underpinnings of ASD in Individuals with and without Comorbid ADHD  
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#### Background:

Autism spectrum disorder (ASD) is a neurodevelopmental condition that is accompanied by an atypical development of the brain (Ecker et al., 2015). Neuroanatomical differences in ASD are, however, highly variable across individuals (Amaral et al., 2008) and most likely represent different clinical phenotypes (Mizuno et al., 2019). To parse heterogeneity, it is therefore essential to establish how, and to what degree, the neuroanatomy of ASD is modulated by inter-individual differences in clinical symptom profiles, and commonly occurring comorbid conditions such as Attention Deficit Hyperactivity Disorder (ADHD) (Baker & Blacher, 2015).

#### Objectives:

This study aimed to investigate neuroanatomical differences between autistic people with and without co-morbid ADHD relative to typically developing (TD) controls to determine whether autistic individuals with ADHD represent a distinct neuroanatomical subgroup on the autism spectrum.

#### Methods:

Our sample consisted of N=535 individuals aged 7-31 years from the Longitudinal European Autism Project (LEAP, Charman et al., 2017) cohort. Based on ASD DSM-IV or DSM-5 diagnostic criteria and an estimate of a diagnosis of ADHD based on questionnaire data on the DSM ADHD rating scale, we divided the total sample into four subgroups: ASD only (N=172), ASD with comorbid ADHD (N=142), ADHD only (N=25), TD: N=196. Cortical thickness (CT) and surface area (SA) were extracted from T1-weighted volumetric images using FreeSurfer\_v6.0.0 (<http://surfer.nmr.mgh.harvard.edu/>). Vertex-wise differences in neuroanatomy were quantified using a general linear model (GLM) of the form:  $Y \sim \text{ASD} + \text{ADHD} + \text{ASD} \times \text{ADHD} + \text{Sex} + \text{Age} + \text{IQ} + \text{Total\_Brain} + \text{Site}$ .

#### Results:

Following random field theory (RFT)-based cluster-correction ( $p < 0.05$ , two-tailed), autistic participants on average had increased CT in the anterior-cingulate cortex, left temporal lobe (superior and middle temporal gyrus), right superior frontal gyrus, and right occipital lobe (Figure 1A). Decreases in CT in ASD were observed in the right parietal cortex, and in the superior frontal gyrus. The main effect of ADHD was associated with decreased CT in the right anterior cingulate, and in the occipital lobe. We observed significant ASD-by-ADHD interactions for measures of CT in fronto-parietal areas, the right temporal gyrus, and in occipital regions. In these regions, autistic people with ADHD had increased - or decreased - CT compared to individuals with ASD or ADHD only depending on the brain region.

For measures of SA (Figure 1B), autistic participants on average had decreased SA in the right anterior-cingulate cortex relative to non-autistic people. The main effect of ADHD was associated with increased SA in left parahippocampal gyrus only. Significant ASD-by-ADHD interactions for measures of SA were observed in the right frontal gyrus exclusively.

#### Conclusions:

Our results of atypical CT in individuals with ASD or ADHD are in accordance with previous findings reporting differences in surface neuroanatomy in these conditions (Ecker et al., 2021; Almeida et al., 2010). Moreover, our finding of significant ASD-by-ADHD interactions implies that the neuroanatomy of ASD is significantly modulated by ADHD, and that individuals with ASD and comorbid ADHD may constitute a distinct neuroanatomical subgroup on the autism spectrum that differs from individuals with idiopathic ASD or ADHD only.

#### **309.002 (Oral)** Variation in Neuroanatomical Development Is Associated with Variation in Adaptive Outcome in Autism

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Background: Autism spectrum disorder (ASD) is associated with significant difficulties in adaptive behaviour and variation in clinical (e.g., adaptive) outcome across the life span. The neurobiological underpinnings of this clinical variability remain poorly understood; but understanding them is essential to develop effective, personalised interventions in ASD. We have previously shown that neuroanatomical (and associated genetic) variation is associated with adaptive outcome ~12-24 months later.

Objectives: However, it remains unclear if adaptive outcome in ASD is also associated with variation in the developmental *trajectory* of specific aspects of cortical anatomy and their associated genetic factors.

Methods: Therefore, we carried out a longitudinal follow-up study of 304 individuals (149 ASD, 155 neurotypicals, 6-30 years) collecting behavioural (Vineland Adaptive Behaviour Scale-II; VABS-II), neuroanatomical (structural magnetic resonance imaging), and genetic (DNA) data at T1 and T2 (timepoints separated by ~12-24 months). We grouped autistic individuals into clinically meaningful 'Improvers/No-changers/Decreasers' in adaptive behaviour (defined using previously published VABS-II Minimal Clinically Important Difference [MCID] measures). We then compared neuroanatomy (cortical volume, cortical thickness, surface area) at i) T1, ii) T2, and iii) the change in neuroanatomy ( $\Delta T = T2 - T1 / T1$ ) between the neurotypicals and each outcome group. Further, we explored the genetic underpinnings of the observed neuroanatomical differences. All results were corrected for multiple comparisons using standard procedures (Random Field Theory, False Discovery Rate etc.).

Results: Outcome groups differed from neurotypicals in neuroanatomy at T1, T2, and  $\Delta T$  in regions previously associated with ASD (e.g., prefrontal cortex, temporal lobe) (see Figures 1 and 2 for the most pronounced between-group contrasts). 'Improvers' displayed the most neurotypical neuroanatomical *development* (Figure 1 b), while 'No-changers' and 'Decreasers' (Figure 2 b) developed atypically – with each group displaying widespread neuroanatomical differences at T2 (Figure 1c and 2c). Moreover, cross-sectional and longitudinal neuroanatomical variation was associated with genetic variation in pathways previously implicated in ASD, including excitatory cells, inhibitory (GABAergic) pathways, and intermediate progenitor cells.

Conclusions: Here, we provide proof-of-concept that clinical (adaptive) outcome groups/profiles in ASD display distinct neuroanatomical developmental *trajectories*, which are associated with genetic factors relevant both to these neuroanatomical phenotypes and to ASD.

#### **309.003 (Oral)** Subcortical Brain Alterations across Copy Number Variants Converge with Those in Autism and Neurodevelopmental Psychiatric Disorders

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**Background:** Rare copy number variants (CNVs) are important contributors to neurodevelopmental psychiatric disorders (NPDs) including autism spectrum disorder (ASD). While brain mechanisms mediating genetic risk for NPDs remain largely unknown, a growing number of morphometry studies of CNVs using T1-weighted structural MRI have begun to address this challenge. Subcortical brain regions, which play a critical role in cognitive and social functions in humans, are broadly affected by CNVs with mild to large effect sizes (Ching et al. 2020). Knowledge gap: Prior studies of subcortical alterations in CNV-carriers have been conducted one mutation at a time, leaving the field with a complex catalog of alterations linked to different genomic loci. It is unknown if CNV-associated brain alterations are related to or distinct from those observed in idiopathic ASD and other NPDs (attention-deficit-hyperactivity-disorder, bipolar-disorder, major-depressive-disorder, obsessive-compulsive-disorder, schizophrenia).

**Objectives:** We aimed to i) characterize subcortical brain alterations in 11 CNVs, ii) compare effect sizes with previously reported effects for 6 NPDs, and iii) identify latent subcortical brain morphometry dimensions across CNVs and NPDs.

**Methods:** We analyzed 1,457 T1-weighted MRI scans (675 CNV-carriers and 782 controls) including individuals who carry one of the 11 CNVs at the following loci: 1q21.1, 1q21.1-TAR, 13q12.12, 15q11.2, 16p11.2, 16p13.11, and 22q11.2. Data were pooled across six cohorts (Modenato et al. 2021): SimonsVIP, Montreal, UCLA, Cardiff, SFARI, and UK-Biobank. FreeSurfer v5.3.0 segmented volumes for seven subcortical regions were used as morphometry measures of interest. Linear regression models (R v3.6.3) were used to compute case-control differences (Cohen's d) for the 11 CNVs, after adjusting for age, sex, site, and Intracranial-volume using Gaussian processes regression. Cohen's d for subcortical volumes of 6 NPDs were obtained from previously published ENIGMA studies (Ching et al. 2020). Principal component analysis (PCA) was run to identify latent dimensions across CNVs and NPDs.

**Results:** Nine of the 11 CNVs had significant effects on the volume of at least one subcortical structure that survived FDR correction. The largest effects were observed for 22q11.2 deletions. Every structure was affected by at least 2 CNVs, and the hippocampus and amygdala were affected by 5 CNVs. Effect sizes of CNVs were 2-fold larger than those of NPDs. The ASD alteration profile was most highly correlated with that for the 16p11.2 deletion; separate clusters emerged for childhood and adult NPDs. PCA identified the same latent dimension - defined by opposing loadings on basal ganglia and limbic structures - across CNVs and across NPDs explaining 45% of the Cohen's d profiles' variance across all CNVs and NPDs.

**Conclusions:** The simultaneous analysis of CNVs and NPDs showed that the effect sizes of CNVs were larger than NPDs. A parsimonious set of brain dimensions captured global common effects on subcortical volumes of a seemingly heterogeneous group of genetic variants. However, over half of the variance in the mean CNV effects on subcortical structures remained distinct. This approach may help subgroup the complex landscape of rare genetic variants conferring risk to NPDs and dissect the heterogeneity of NPDs.

### **309.004 (Oral) Clinical Correlates of GABAergic Interneuron Pathology in the Autistic Prefrontal Cortex**

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**Background:** Autism Spectrum Disorder (ASD) is a prevalent and debilitating neurodevelopmental disorder, characterized by social communication deficits and restricted repetitive behaviors. Patients often show comorbidities, including impairments in intellectual ability, epilepsy, and ADHD. While a variety of pathological changes have been identified in the human ASD brain, including work from our group that identified alterations in GABAergic interneurons in the ASD prefrontal cortex, it remains largely unclear how specific neuropathological changes are related to ASD symptomatology.

**Objectives:** Here, in an exploratory retrospective study, we assessed the relationship between GABAergic interneuron pathology and ASD symptom severity and comorbidity.

**Methods:** Clinical records were collected from Autism (n=20) and control (n=19) brain donors, from whom we previously identified a reduction in parvalbumin+ Chandelier Cells (ChCs), a specific type of GABAergic interneuron, in the ASD prefrontal cortex (BA9, BA46, and BA47). The relationship between ASD core symptom severity, as indicated by ADI-R scores, and ChC pathology was assessed using Pearson Correlation. The relationship between ASD comorbidities and GABAergic interneuron cell counts (including parvalbumin+ [PV], calbindin+ [CB], and calretinin+ [CR] interneurons) were assessed using repeated measures ANOVA.

**Results:** We found a significant correlation between the severity of ChC loss in the Orbitofrontal Cortex (BA47) with the severity of stereotypic motor behaviors in ASD subjects. This finding was replicated in two sets of subjects measured with two separate indicators of ChC loss – reductions in PV+ interneurons in one cohort (r= -0.722, p=.043), and reduced GAT1+ cartridges in a second cohort (r= -0.710, p=.049), both corresponding to increased severity of stereotypic motor behavior. Patterns of interneuron loss in the prefrontal cortex differed between ASD subjects with Intellectual Disability (ID, IQ<70) and ASD subjects without ID. While all ASD subjects showed a significant reduction in PV+ interneurons (p<.05), ASD with ID exclusively showed a reduction in total interneuron number (PV+, CB+, CR+), relative to non-ID ASD (-38.7%, p<.05), and also relative to controls (-36.6%, p<.01).

**Conclusions:** Through this retrospective study, we identified that distinct patterns of GABAergic interneuron pathology in the ASD prefrontal cortex are associated with specific types of ASD symptomatology. ChC pathological severity in the orbitofrontal cortex (BA47) corresponded with the severity of stereotypic motor symptoms in ASD patients. ASD subjects with comorbid ID showed more widespread and severe loss of GABAergic interneurons throughout the prefrontal cortex than ASD subjects without ID, suggesting that ID in ASD may reflect a more severe form of a shared underlying ASD pathology. These findings highlight the importance of accounting for clinical subtypes when investigating neuropathological



changes in the ASD brain, emphasize the importance of GABAergic dysfunction to the neurobiology of ASD, and thus provide strong rationale for further investigation.

## ORAL SESSION - 9B — BRAIN STRUCTURE (MRI, NEUROPATHOLOGY)

### 321 - White Matter Differences and Their Impact on Clinical Symptoms Across the Human Lifespan in ASD

**321.001** (Oral) White Matter Microstructure Differences in Autism: A Pilot Study from the Enigma ASD Working Group

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**Background:** Converging lines of evidence – ranging from genetics and postmortem studies to neuroimaging work – indicate that autism is characterized by altered neural connectivity. Prior analyses using diffusion tensor imaging (DTI) generally reported weaker white matter connections in autism, but findings are inconsistent regarding the implicated tracts, greatly hindering our understanding of brain connectivity in autism. This variability in results may stem from demographic/clinical heterogeneity and differences in inclusion/exclusion criteria across samples, as well as variability in analytic techniques and limited statistical power. To address these methodological considerations and improve statistical power, the ENIGMA ASD Working Group aims to conduct the largest coordinated multi-site investigation to date of white matter microstructure in autism. Here we establish the feasibility of such a study by using a harmonized DTI protocol to examine microstructural alterations in a subset of contributing sites.

**Objectives:** Characterize white matter microstructure differences in autism using standardized ENIGMA pipelines.

**Methods:** Diffusion-weighted brain magnetic resonance imaging (dMRI) data was analyzed from 214 participants (122 with autism, 92 neurotypical controls; 82.2% male; 5-46 years old) from 5 datasets available through the Autism Brain Imaging Data Exchange (ABIDE). All dMRI processing was completed according to standardized ENIGMA DTI protocols (<http://enigma.ini.usc.edu/protocols/dti-protocols/>). Preprocessing consisted of eddy current correction, echo-planar imaging-induced distortion correction, and tensor fitting. The following DTI metrics were derived for each subject: fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD). DTI indices were then projected to a standard white matter skeleton using FSL's tract-based spatial statistics, and mean values for each DTI measure were extracted from 25 bilateral white matter regions of interest (ROIs) across the brain. Primary group-level analyses examined white matter microstructure differences between the autism and neurotypical control groups, including the following nuisance covariates as fixed effects: sex, age, and the interaction between age and diagnostic group; site/scanner was modeled as a random effect. Supplemental analyses also included full-scale IQ as a fixed effect. A false discovery rate of 5% was applied across ROIs to correct for multiple comparisons.

**Results:** Significant and widespread white matter differences were observed between the autism and neurotypical control groups. Participants with autism exhibited lower FA ( $\beta=0.11-0.34$ ), as well as higher MD ( $\beta=0.12-0.25$ ) and RD ( $\beta=0.12-0.35$ ), on average. These differences included altered white matter microstructure in the corpus callosum, cingulum, *corona radiata*, external capsule, internal capsule, fornix, posterior thalamic radiation, *sagittal stratum*, superior longitudinal fasciculus, and uncinate fasciculus. There were no significant group differences in AD. Follow-up analyses statistically adjusting for full-scale IQ yielded similar results.

**Conclusions:** We found widespread white matter microstructure alterations in autism, which is consistent with and expands upon previous work in smaller samples suggesting weaker structural connectivity in autism. These analyses demonstrate the feasibility of examining microstructural differences using a coordinated multi-site approach. Our future work will expand on these findings by including a substantial number of additional sites and investigating the impact of possible sources of heterogeneity, such as the severity of autism symptoms and the presence of comorbid symptoms.

**321.002** (Oral) White Matter Microstructural and Morphometric Alterations in Autism: Implications for Intellectual and Verbal Capabilities

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**Background:** Neuroimage literature of autism spectrum disorder (ASD) has a moderate-to-high risk of bias, partially because those combined with intellectual impairment (II) and/or minimally verbal (MV) status are generally ignored.

**Objectives:** Using the state-of-the-art dMRI acquisition (four b-values with ~200 gradient directions), data processing framework (fixel-based analysis), as well as the extensive psychopathological measures, the current study aimed to provide more comprehensive insights into the structural brain changes underpinning ASD. The current study included individuals with II and MV, who are generally left out in the current lore. We hypothesized that the FBA could highlight potential differences in ASD that are driven by intellectual challenges. Autistic traits, cognitive impairment, and poor adaptive function were in fact expected to map onto fixel pathology in the tract interconnecting social and cognitive brain networks.

**Methods:** Sixty-five participants with ASD (ASD-Whole; 16.6±5.9 years; comprising 34 intellectually able youth, ASD-IA, and 31 intellectually impaired youth, ASD-II, including 24 ASD-II-Only plus 7 ASD-MV) and 38 demographic-matched typically developing controls (TDC; 17.3±5.6 years) were scanned in accelerated diffusion-weighted MRI. Fixel-based analysis was undertaken to investigate the categorical differences in fiber density (FD), fiber cross-section (FC), and a combined index (FDC), and brain-symptom/cognition associations.

**Results:** ASD-Whole had reduced FD in the anterior and posterior corpus callosum and left cerebellum Crus I, and smaller FDC in right cerebellum Crus II, compared to TDC. ASD-II, relative to TDC, showed almost identical alterations to those from ASD-Whole vs. TDC. ASD-II-Only had greater FD/FDC in the isthmus-splenium of callosum than ASD-MV. Autistic severity negatively correlated with FC in right Crus I. Non-verbal full-scale IQ positively correlated with FC/FDC in cerebellum VI. FD/FDC of the right dorsolateral prefrontal cortex showed a diagnosis-by-executive function interaction.

**Conclusions:** We confirmed that changes in anatomical connections linking hemispheres, as well as cerebellum Crus I/II might contribute to autism phenotypes. These ASD-associated alterations appear to be mainly driven by autistic individuals with minimally verbal status and/or intellectual impairment. Across the functional spectrum, autistic severity, nonverbal intelligence and executive function associated with white matter fiber-bundle properties in regions where white matter pathology based on diffusion MRI are seldom reported. These results highlight that by embracing the inclusion of understudied sub-populations on the spectrum, together with the development of novel neuroimaging methods, we may better reconcile heterogeneity across studies and advance the understanding of the neuropathology of ASD.

### **321.003 (Oral) Maternal Perinatal Depressive Symptoms, Neonatal White Matter, and Emerging Autistic Traits in Toddlers**

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**Background:** Poor maternal mental health during pregnancy may contribute to an increased likelihood of neurodevelopmental conditions such as autism. This relationship may be explained, at least in part, by changes in the developing brain during intrauterine life. However, much of the existing neuroimaging literature is based on studies with older participants, where it is difficult to separate the effects of prenatal and postnatal environment.

**Objectives:** The aim of this study was to examine associations between maternal perinatal depressive symptoms, infant white matter, and emerging autistic traits in toddlers.

**Methods:** 413 mother-infant dyads enrolled in the developing Human Connectome Project. Mothers completed the Edinburgh Postnatal Depression Scale (median = 5, range = 0-28, n=52 scores ≥ 11) prenatally or at the time of the neonatal study visit. Infants (n=223 male) (median gestational age at birth=40 weeks, range 32.14-42.29) underwent MRI scans (median postmenstrual age at scan=41.29 weeks, range 36.57-44.71). Fixel-based fibre metrics (mean fibre density, fibre cross-section, and fibre density modulated by cross-section) were calculated from diffusion imaging data in the left and right uncinate fasciculus, and cingulum bundle. For n=311, a neurodevelopmental assessment was conducted at a median corrected age of 18 months (range 17-24). This included the Quantitative Checklist for Autism in Toddlers (Q-CHAT) as a measure of emerging autistic traits, and the Child Behaviour Checklist (CBCL) as a measure of emotional and behavioural difficulties. Statistical analysis used multiple linear regression and mediation analysis with bootstrapping.

**Results:** Maternal perinatal depressive symptoms were positively associated with infant fibre density in the left (B =.0005, p=.003, q=.027) and right (B=.0006, p=.003, q=.027) uncinate fasciculus. Infants with higher fibre density in the left uncinate fasciculus had elevated autistic traits as reflected by higher scores on the Q-CHAT in toddlerhood (B =105.70, p=.0007, q=.004). In a mediation analysis, higher maternal depressive symptoms predicted toddler Q-CHAT scores (B=.342, t(307)=3.003, p=.003), but this relationship was not mediated by fibre density in the left uncinate fasciculus (Sobel test p=.143, bootstrapped indirect effect=.035, SE=.02, 95%CI [-.01,.08]).

**Conclusions:** Maternal perinatal depressive symptoms are associated with increased fibre density in the infant uncinate fasciculus and an elevated likelihood of emerging autistic traits in toddlers. Our findings have important implications for clinical practice, as a better understanding of how maternal depressive symptoms can impact offspring brain and behaviour can help inform future interventions and ensure more positive outcomes for mother and child.

### **321.004 (Oral) Brainstem White Matter Is Uniquely Related to Sensory Features and Motor Performance in Autistic Children.**

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**Background:** The brainstem is associated with sensory and motor processing in both humans and animals and may play a unique role in the etiology of autism (Dadalko and Travers, 2018), making it a key region of interest for investigating the neural contributions to sensory and motor differences

autism. Previous investigations have broadly linked brainstem white matter to sensory features (Wolff et al., 2017) and motor behaviors (Travers et al. 2015) in autism, but historically, the brainstem has been a challenging area to image *in vivo*, preventing thorough investigation of individual brainstem white matter tracts. Fortunately, recent advancements in diffusion weighted imaging (DWI) have allowed us to assess the brainstem more accurately, providing the opportunity to investigate the relationships among brainstem white matter tracts, sensory features, and motor challenges in autistic youth.

**Objectives:** Examine how individual differences in sensory features and motor behavior relate to brainstem white matter in autistic and non-autistic children. Please note that we use identity-first language per the expressed preference of autistic individuals.

**Methods:** DWI and measures of both observed motor behavior (BOT-2SF; Bruininks and Bruininks, 2005) and caregiver-report sensory features (SEQ 3.0; Baranek, 2009) were acquired from 125 children (53 autistic; 6.9-10.9 years old). Multi-shell DWI was acquired using a 3T GE Scanner with a protocol optimized for enhanced visualization of the brainstem. Free water elimination diffusion tensor imaging was used to remove contaminating signal contributions from free water, and fractional anisotropy (FWE-FA) and mean diffusivity (FWE-MD) maps were generated. Eleven bilateral white matter tracts delineated using a probabilistic brainstem connectome atlas (Tang et al., 2018) were registered to the study-specific population fiber orientation distribution (FOD) template. Within diagnostic group (autistic and non-autistic) overall SEQ and BOT-2SF scores were correlated with weighted median FWE-FA/MD properties in each tract, controlling for age, sex, and DWI head motion (FDR-corrected  $p<.05$ ).

**Results:** In non-autistic children, there were no significant correlations with brainstem white matter FWE-FA or FWE-MD. In autistic children, more prominent sensory features were associated with lower FWE-MD in the medial lemniscus ( $r=-.38$ ,  $p=.006$ ) and the cerebello-thalamic portion of the superior cerebellar peduncle ( $r=-.40$ ,  $p=.004$ ) (Fig 1A). Better motor performance was associated with higher FWE-MD in the corticospinal ( $r=.42$ ,  $p=.002$ ) and frontopontine ( $r=.41$ ,  $p=.003$ ) tracts (Fig 1B). Within the middle cerebellar peduncle, more prominent sensory features were associated with lower FWE-MD ( $r=-.57$ ,  $p<.001$ ) and higher FWE-FA ( $r=.44$ ,  $p=.001$ ) and better motor performance was associated with higher FWE-MD ( $r=.33$ ,  $p=.01$ ) (Fig 1C).

**Conclusions:** In autistic, but not non-autistic children, brainstem white matter tracts were associated with individual differences in sensory and motor behavior. Specifically, sensory features were associated with white matter tracts that carry information from brainstem and cerebellar nuclei to the cortex, while motor performance was associated with white matter tracts that carry information from the cortex to the brainstem nuclei. Sensory and motor behaviors were associated with the middle cerebellar peduncle, a tract involved in transmitting information computed in brainstem nuclei to the cerebellum. Taken together, these results suggest a brainstem mechanism for sensory-motor computation in autism.

## POSTER SESSION — BRAIN STRUCTURE (MRI, NEUROPATHOLOGY)

### 422 - Brain Structure (MRI, neuropathology)

#### 422.001 (Poster) Investigating Transdiagnostic White Matter Complexity Using Shannon Entropy Analysis

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#### Background:

CNS disorders associate with disruptions in white matter (WM) integrity and likely exist on a continuum of biologically defined phenotypes (IOM, 2013). Shannon entropy analysis (SE), which uses information theory to describe data complexity, yields a robust metric of WM complexity derived from diffusion tensor imaging (DTI; Delic et al., 2016). This neuroimaging study seeks to evaluate SE as an objective, noninvasive metric for measuring whole-brain WM complexity (Woo et al., 2017). Autism spectrum disorder (ASD) and Alzheimer's dementia (AD) may exist on a continuum of biological phenotypes that associate with cognitive and behavioral symptoms. ASD and AD share pathological markers, including increased levels of amyloid-beta precursor protein (Rhodus et al., 2020; Khan et al., 2016). A metric of WM complexity, evaluated by non-invasive DTI, may provide a proxy for these pathological disruptions.

#### Objectives:

We analyzed data from two neuroimaging databases, Autism Brain Imaging Data Exchange II (ABIDE II, BNI/SAARC subset) and the Alzheimer's Disease Neuroimaging Initiative Phase 3 (ADNI3), to conduct SE analysis of adult DTI scans, examine SE group differences, SE test-retest reliability, and the association between SE and behavior.

#### Methods:

Study participants included 29 adult males with ASD (mean age=37.5 years; SD=16; range = 18-62), 29 adult male controls with no diagnosis (CON) (mean age=39.6 years; SD = 15; range =18-64) from ABIDE II, 14 males with AD (mean age=68.01 years; SD=6.6; range=55-75), 47 males with MCI (mean age=68.16 years; SD=4.624; range=56-75), and 69 CON males (mean age=68.16 years; SD=4.002 years; range=57-75) were included. DTI scans were preprocessed and corrected for non-zero resonances and eddy currents, followed by the calculation of a whole-brain SE score (Andersson et al., 2016; Delic et al., 2016; Smith, 2004). FSL, version 6 was used (Jenkinson et al., 2012; Smith et al., 2004; Woolrich et al., 2009). Subsequent data analysis steps included screening for outliers, identifying covariates, and examining group comparisons. Correlations

between SE and clinical behavioral measurements [(e.g., Social Responsiveness Scale, Second edition; Clinical Dementia Rating Scale (CDR)] were conducted.

## Results:

Using SE as the dependent variable, a main effect for diagnosis was found,  $F(3, 163) = 20.28, p < .001$ . Post-hoc analysis revealed that individuals with ASD had significantly lower SE values than all other groups. When scanner type and age were included in the model, a significant interaction of diagnosis X age emerged,  $F(3, 157) = 5.23, p = .002$ , with older individuals with ASD having significantly lower SE values compared to other groups. Using FA as the dependent variable, no main effects of diagnosis were found  $F(3, 163) = 1.46, ns$ . Moderate correlations were found between SE and SRS-2 Awareness and Cognition; moderate correlations were found between SE and the Clinical Dementia Rating Scale items. Test-retest analysis revealed a strong correlation for SE,  $r(14) = .990, p = <0.001$

## Conclusions:

The results indicate SE as a reliable biomarker of WM integrity that associates with measures of social behavior and distinguishes ASD individuals from other diagnostic groups.

### 422.002 (Poster) Association of Subcortical Volumes with Sleep Problems in Autistic and Typically Developing Children

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**Background:** It is estimated that 80% of autistic children and adults have sleep problems -- a rate that far exceeds their typically developing (TD) peers. Common problems include delayed sleep onset, frequent nighttime awakenings, and restlessness. Both environmental and biological factors likely contribute to sleep problems in autism. For example, dysregulation of neurobiological process such as circadian rhythm (i.e., sleep that follows an ~24-hour cycle) and sleep-wake homeostasis (i.e., increased pressure to sleep driven by duration of wakefulness and duration of prior sleep) are likely contributors to sleep problems. While these processes involve several distinct neurobiological components, they function in a coordinated manner and are underpinned by subcortical neural regions that include the hypothalamus, thalamus, amygdala, hippocampus, globus pallidus, basal forebrain, and brainstem.

**Objectives:** Investigate associations between subcortical brain volumes and sleep problems in autism and typical development, and identify differences in these associations attributable to autism.

**Methods:** This study included 203 autistic children (131 males, 72 females) and 92 TD controls (49 males, 43 females) enrolled in the UC Davis MIND Institute Autism Phenome Project. Sleep transition problems were measured using a scale comprised of the sum of seven items from the Children's Sleep Habits Questionnaire (CSHQ). These items have been shown to capture a single reliable construct representing sleep problems in autistic and TD 2- to 4-year-olds. Total cerebral volumes and volumes from a priori regions of interest including the left and right hypothalamus, thalamus, amygdala, caudate nucleus, putamen, globus pallidus, hippocampus, nucleus accumbens, and pons were extracted using a multi atlas approach. Associations between regional brain volumes and measures of sleep quality were assessed using linear effects modeling in R version 3.6 and included sex as a categorical fixed effect factor, age in months, and total cerebral volume as continuous covariates, and an interaction term between diagnosis and both left and right regional volume.

**Results:** Compared to TD, autistic children had significantly higher CSHQ composite scores ( $t=5.42, p<0.001$ ). Of the nine brain regions investigated (18 bilateral ROIs), the right hypothalamus showed a significant negative association with CSHQ measures of sleep problems ( $p=0.002$ , FDR adjusted  $p=0.033$ ). Smaller right hypothalamus volume was associated with increased sleep problems. A similar relationship between right hypothalamus volume and sleep problems was observed within both the autistic and TD groups; no significant diagnosis-by-right hypothalamus effect was observed. No other brain regions investigated showed a significant association with CSHQ sleep problem scores, or significant ROI-by-diagnosis interactions.

**Conclusions:** There is a negative association between right hypothalamus volume and sleep problems in both autistic and TD children. This transdiagnostic relationship indicates a possible generalizable biomarker of sleep problems in young children, which represent a significant detriment to quality of life for both children and their caregivers

### 422.003 (Poster) Atypical Intrinsic Grey-Matter Connectivity in Autism Spectrum Disorder - an Analysis of the EU-AIMS Longitudinal European Autism Project (LEAP)

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#### Background:

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition accompanied by atypical brain connectivity (Amaral et al., 2008). To date, structural connectivity in ASD has mainly been investigated within the white-matter using techniques such as Diffusion Tensor Imaging (e.g. Vissers et al., 2012). However, many genetic variants associated with ASD highlight genes related to synaptogenesis and axonal guidance, hence also implicating atypical 'intrinsic' (i.e. grey-matter) connectivity in the pathophysiology of ASD (Darbandi et al., 2020; McFadden & Minshew, 2013). Intrinsic connections typically travel in parallel to the cortex (Levitt et al., 1993), and might be assessed via global and local intrinsic wiring costs (Ecker et al., 2013). So far, only one MRI study has examined intrinsic brain connectivity in adults with ASD *in vivo*, reporting reduced intrinsic wiring costs on the global and local level (Ecker et al., 2013).

#### Objectives:

We aimed to replicate and extend previous findings of atypical grey-matter connectivity in a large and clinically heterogeneous sample of autistic participants to assess their importance as a characteristic cortical hallmark of the autism phenotype.

#### Methods:

We included N=360 autistic participants and N=279 controls, aged 7-31 years from the EU-AIMS Longitudinal European Autism Project (LEAP, Charman et al., 2017). FreeSurfer\_v6.0 was used to derive surface mesh representations to compute intrinsic grey-matter wiring costs across the cortex. Here, global wiring costs indicated the minimum length of connections required to connect a vertex to the remaining cortex. These costs were estimated using the so-called mean separation distance (MSD) representing the average geodesic distance (the shortest path connecting two points along the surface) from one vertex to all others. Local intrinsic wiring costs were derived using geodesic circles covering 5% of the total surface area. This allowed us to quantify (i) the 'intra-areal' connection lengths, i.e. the minimum length of connections required to connect a vertex with neighbouring vertices (so-called radius function); and (2) the 'inter-areal' wiring costs, which represent the costs required to wire a vertex to vertices outside the area (so-called perimeter function) (Ecker et al., 2013; Griffin, 1994). Vertex-wise neuroanatomical differences between the ASD and control group were assessed using a general linear model (GLM) with a main effect of group, covarying for age, IQ, gender, and acquisition site.

#### Results:

Following RFT-based cluster-correction ( $p < 0.05$ , two-tailed), autistic participants on average showed a decrease in MSDs (i.e. global wiring costs) in the bilateral medial and lateral prefrontal cortex. Here, participants with ASD also had significantly reduced intra-areal, and enhanced inter-areal, wiring costs based on the radius and perimeter function respectively (see Figure 1). In addition, between-group differences in local intrinsic wiring costs were observed in inferior temporal regions, and at the left temporoparietal junction (TPJ).

#### Conclusions:

This is the first study to report robust differences in intrinsic brain connectivity in ASD across developmental stages. Our results replicate previous findings (Ecker et al., 2013) in a large and clinically diverse sample representing the ASD phenotype, and highlight the importance of assessing grey-matter connectivity in characterizing the neuropathology of ASD *in vivo*.

**422.004 (Poster)** Decreased Number and Increased Activation State of Astrocytes in Grey and White Matter of the Prefrontal Cortex in Autism  
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**Background:** The cerebral cortex presents with alterations in the number of specific cell types in Autism Spectrum Disorder (ASD). Astrocytes have many functions in the brain including a role in higher cognitive functions and in inflammatory brain processes.

**Objectives:** To determine if there is an alteration in number and/or activation state of astrocytes in ASD.

**Methods:** We quantified astrocyte number in the grey and white matter of the prefrontal cortex - BA9, BA46, and BA47 – in 15 ASD and 15 age and sex-matched control cases. We labeled astrocytes with antibodies against the protein GFAP and S100 $\beta$ , markers of astrocytes.

**Results:** We found a significant decrease in the number of astrocytes in the grey and white matter of all prefrontal areas of interest with both markers. We also found an increased state of activation of GFAP+ astrocytes in all areas.

Conclusions: A reduced number of astrocytes in the cerebral cortex in ASD could lead to impaired synaptic function and disrupted connectivity. An increased astrocyte activation may indicate a chronic mild inflammatory state of the cerebral cortex in ASD. Overall, we found that astrocytes are disrupted in ASD.

**422.005 (Poster)** Factors Influencing Sleep MRI Scan Success Rates in Preschoolers with Autism Spectrum Disorder Compared to Their Typically Developing Peers

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Background: Rapidly evolving MRI techniques and specialized research teams have helped in overcoming some of the challenges inherent to pediatric MRI data acquisition, leading to increased interest of developmental scientists. Investigating brain anatomy and function during early childhood is imperative to understand the biological basis of typical and atypical development. Scanning children during their natural nocturnal sleep has improved data quality (Nordahl et al., 2016), but may be particularly challenging for preschoolers with autism spectrum disorder (ASD), for example because it requires them to fall asleep in a new environment.

Objectives: We examined the impact of different factors on the MRI success rate in preschoolers with and without ASD to gain insight into best practices for sleep scanning and potentially enhance future success rates.

Methods: As part of the Preschool Brain Imaging and Behaviour Project, 50 preschoolers (36 male, 14 female; 15 with ASD and 35 without, mean age 44 months (range 27 to 55 months)) were invited for a sleep MRI with structural scans, MRS, DTI and fMRI. Parent-reported questionnaire data (Highly Sensitive Child Scale and Sensory Experience Questionnaire), behavioral measures (Mullen Scales of Early Learning), observational data (time it took the child to fall asleep, if the child was difficult to move once they were asleep (i.e. they woke up when being moved), if ear protection could be easily placed, parent fear, child fear levels and parental preparation) and demographic data (age and sex) were collected during or before scan preparations. Hierarchical regression analyses and model comparison using AIC were used to observe the most parsimonious model predicting scan success rate.

Results: After two attempts, the entire protocol could be acquired for 42% of the children; at least structural scans could be acquired for 66%. Success rates did not differ between children with and without ASD. Hierarchical regression analyses with scan success rate as dependent variable showed that for children with ASD, only difficulty to move once they were asleep was a significant predictor for scan success ( $p = .05$ ,  $R^2 = .26$ ). For children without ASD, only child fear level was a significant predictor ( $p = .01$ ,  $R^2 = .17$ ). Child fear levels and difficulty to move did not differ significantly between the two groups. There was no effect of age or sex. No additional significant effects were observed for either group.

Conclusions: Scanning success rate did not differ between children with and without ASD. For children with ASD, difficulty to move was the primary predictor for scan success, for children without ASD this was child fear level. It is important to take into account that a different approach may be needed when scanning children with ASD compared to children without ASD. This information may be useful when conducting screening interviews with children with ASD for MRI scanning. Other variables not investigated here may play a role in the scanning success rate (e.g., level of ASD characteristics). This will be further investigated in a larger sample as data collection is ongoing, and presented during the INSAR meeting.

**422.006 (Poster)** Gray Matter Thickness and Gyrification in Language-Related Brain Areas Are Associated with Language Impairment in Primary-School-Aged Children with Autism Spectrum Disorder

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Background: Language impairment is usually co-occurred in children with Autism Spectrum Disorder, ASD (Kjelgaard & Tager-Flusberg, 2001) but its neural basis is poorly understood. Recent studies have revealed a multiple of volume- and surface-based abnormalities related to language impairment in autism (Lu et al., 2016; Zhao et al., 2018).

Objectives: The goal of the present study was 1) to provide a whole-brain comparison between groups of children with and without ASD on gray and white matter (GM and WM) volumes, GM thickness, gyrification (GI), sulcus depth (SD), fractal dimension (FD); 2) and to investigate the relationships between these parameters in language-related regions of interest (ROIs) and language abilities of children with ASD.

Methods: 36 children participated in the study: 18 children with ASD (13 boys, age range 8.01 – 14.01 years,  $M_{age} = 10.02$ ,  $SD = 1.8$ ) and 18 age- and gender-matched TD children (13 boys, age range 7.06 – 12.03 years,  $M_{age} = 10.00$ ,  $SD = 1.4$ ). All children with ASD were diagnosed according to ICD-10, and 16 out of 18 children were also assessed with ADOS-2. The non-verbal IQ of children with ASD was measured with the Kaufman Assessment Battery for Children, NVI index, and the Wechsler Intelligence Scale for Children – Third Edition, performance IQ score; the non-verbal intelligence of TD children was screened with the Raven's Colored Progressive Matrices. Language abilities were measured with the Russian Child

Language Assessment Battery. There was a high variability in both non-verbal IQ (from very low, IQ = 40, to normal, IQ = 118) and language abilities (from non-verbal / minimally verbal to normal) in the group of children with ASD.

The high-resolution whole-brain structural MRIs were acquired for each child on a 1.5 T Siemens Avanto scanner, using the following parameters: repetition time = 1900 ms, echo time = 3.37 ms, flip angle = 15°, matrix size = 256×256×176, voxel size = 1.0×1.0×1.0 mm<sup>3</sup>. The preprocessing and analysis were performed with CAT12 and SPM toolboxes.

**Results:** The whole-brain analysis revealed differences in multiple brain areas between groups of children in all parameters except SD. GM thickness was the most affected parameter and *was reduced* in 27 ROIs of both hemispheres in children with ASD. The analysis also showed the relationships between GM thickness and GI of all language-related ROIs (temporal cortex, speech motor cortex, inferior parietal lobule) and language abilities of children with ASD: a pathological *decrease* of GM thickness in all ROIs was associated with more severe language impairment; as well, pathological *increase* of GI in all ROIs was related to more severe language impairment. Importantly, there were no any relationships between GM thickness and GI of these ROIs and other individual characteristics of children (non-verbal IQ, severity of autism, and age).

**Conclusions:** We showed, first, that atypical patterns of brain development, reflected in both volume- and surface-based morphology, exist in primary-school-aged children with ASD; second, that the abnormalities in the surface morphology (GM thickness and gyrification) in language-related ROIs are associated with language impairment in these children.

**422.007 (Poster)** IQ Development across Childhood in Autism Differentiated By Structural Differences in Default Mode and Fronto-Parietal Network

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**Background:** Intellectual disability (IQ ≤ 70) affects a third of individuals with autism spectrum disorder (autism), yet a major unresolved question remains concerning the neurobiology that differentiates autistic individuals with and without intellectual disability. IQ is highly variable during childhood. We previously identified subgroups of autistic children with differentiated trajectories of IQ development from early to middle childhood: (a) Persistent-Higher: Individuals whose IQs remained in the normal range throughout development, (b) Persistent-Lower: Individuals whose IQs remained in the range of intellectual disability throughout development, and (c) Changers: Individuals whose IQs began in the range of intellectual disability but increased to the moderate or normal range by middle childhood.

**Objectives:** In the present research, we sought to identify neurobiology that would differentiate these trajectory-defined groups within our autism cohort in two brain networks with established links to intellectual functioning and its impairment (1) the frontoparietal network (FPN), and (2) the default mode network (DMN).

**Methods:** We conducted multivariate distance matrix regression (MDMR) and effect size analyses to examine the volumes of 22 (11 regions x 2 hemispheres) brain regions within the FPN and of 24 (12 regions x 2 hemispheres) brain regions within the DMN in 48 Persistent-Higher (18 female), 108 Persistent-Lower (32 female), and 109 Changers (39 female) individuals using structural MRI that had been acquired at baseline. FPN and DMN network regions of interest were defined on the basis of the large-scale networks defined in Smith et al., (2009).

**Results:** The Changers exhibited different DMN from both Persistent-Lower and Persistent-Higher trajectory groups at baseline, but Persistent-Higher did not differ from the Persistent-Lower group, suggesting that DMN structure may be an early predictor for change in IQ trajectory across childhood. In contrast, Persistent-Higher exhibited differences in the FPN from both Persistent-Lower and Changers as baseline, suggesting a difference related more to the concurrent IQ and perhaps the absence of intellectual disability.

**Conclusions:** Within autism, the DMN at baseline may differentiate individuals with persistently low IQ from those with more transitory low IQ that improve to moderate IQ through in early childhood, potentially indicating compensatory mechanisms which may be targeted by future interventions. The brain structure differences between these three IQ-based subgroups may be indicative of distinct neural underpinnings of ASD phenotypic subtypes.

**422.008 (Poster)** Investigating Homogeneous Subgroups across ASD, ADHD, and Typical Development Using Measures of Cortical Thickness, Surface Area, Cortical/Subcortical Volume, and Structural Covariance

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**Background:** Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) are complex neurodevelopmental conditions, with large within-diagnosis heterogeneity and significant between-diagnosis overlap. Several studies have highlighted the misalignment between biological homogeneity and the existing diagnostic labels. However, the existing approaches ignore *a priori* knowledge about the brain and its structure, knowledge which can further contextualize the contributions of differences across the brain.

**Objectives:** The objective of this work was to introduce a clustering method that integrates statistically-driven structural brain data into the clustering algorithm as an additional source of information.

**Methods:** This study used a dataset from the Province of Ontario Neurodevelopmental Disorder Network (POND) consisting of typically developing (TD; n=137) children as well as participants with ASD (n=288), and ADHD (n=171). Participants were characterized phenotypically using the Social Communication Questionnaire (SCQ) for autism-like traits, the Strengths and Weaknesses of ADHD-symptoms and Normal Behavior (SWAN) for ADHD-like traits, Adaptive Behavior Assessment System-II (ABAS) for adaptive functioning, and Wechsler or Stanford-Binet scale for IQ. Neuroimaging data were acquired on a 3-Tesla Siemens Trio TIM at the Hospital for Sick Children (n=184) with an upgrade to Siemens Prisma scanner. Cortical thickness, surface area, and cortical volume were extracted using CIVET pipeline (version 2.1.0), while subcortical volumes were computed using the multiple automatically generated templates (MAGeT) pipeline. Neuroimaging data were corrected for age, sex, and total brain volume. The analytic pipeline consisted of the following steps. First, participant-specific structural connectivity matrices were computed using the Gaussian-transformed Cook's distance of each participant to the regression line for each region pair; next, participant similarities were computed using the Lambda distance for the four brain measures, and fused using Similarity Network Fusion (SNF). The final similarity matrix was integrated with the measures of cortical thickness, surface area, and volume using a graph neural network and clustered using K-means clustering.

**Results:** The optimal number of clusters was found to be two based on Davies Bouldin score. Figure 1 depicts the proportion of each diagnosis group within the clusters. The first cluster was predominantly composed of individuals with ASD and/or ADHD (NDD cluster) whereas the second cluster contained a larger proportion of TD participants (mixed cluster). The two clusters were significantly different in age and sex proportion ( $p < 0.0001$ ). The mixed cluster had relative strengths in adaptive functioning (NDD:  $75.5 \pm 28$ , mixed:  $84 \pm 37$ ,  $p < 0.001$ ), attention (NDD:  $5 \pm 6$ , mixed:  $2 \pm 4$ ,  $p < 0.0001$ ), and full-scale IQ (NDD:  $100 \pm 23$ , mixed:  $105 \pm 22$ ,  $p = 0.007$ ). Different patterns of connectivity were observed for the two clusters (Figure 2). These differences were particularly prominent in the cingulate cortex and temporal gyri (overconnectivity in the NDD group). The NDD cluster was also associated with pervasive overconnectivity in subcortical regions, except the right thalamus.

**Conclusions:** This study integrated structural connectivity data with other measures of brain structure to derive homogeneous subgroups across ASD, ADHD, and typical development. The incorporation of structural covariance in the clustering allowed us to reveal differences in patterns of connectivity in measures of cortical thickness, surface area, and volume.

#### 422.009 (Poster) Linking Structural and Functional Imaging Modalities to Characterize Atypical Face Processing in Autism

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#### Background:

Atypical emotional and face processing is among the core social difficulties of individuals with autism. However, pinpointing neural underpinnings of atypical face processing in autism has yielded inconsistent results across different imaging modalities. Most analyses have been confined to separate modalities and linking them has so far been a methodological and statistical challenge. By cutting across single-modality analyses, and integrating different imaging modalities that have been associated with atypical face processing previously, we aim to increase sensitivity in detecting underlying and shared mechanisms of face processing in autism. To this end, we leveraged the large-scale EU-AIMS Longitudinal European Autism Project (LEAP) dataset which has a rich battery of different structural and functional imaging modalities available. Using Linked Independent Component Analysis (LICA) we combined different structural and functional modalities that relate to face processing and integrated these findings with clinical information.

#### Objectives:

To provide a more comprehensive characterization of atypical face processing at the neural level in autism by integrating several complementary neuroimaging modalities.

#### Methods:

We included 101 individuals with autism and 101 typically developing individuals, aged between 6 and 30 years from LEAP. This sample size reflects the intersection of available data across four imaging modalities that were integrated: a) neuroanatomy (voxel-based morphometry to derive grey matter volume within the fusiform gyrus), b) intrinsic brain activity (resting-state fMRI based functional-connectivity gradients within fusiform gyrus), c) task-fMRI during emotional face-matching task (contrast maps reflecting brain areas with higher sensitivity for emotional faces compared to shapes and confined to fusiform gyrus) and d) EEG-based event-related potential (ERP at P7/P8) timeseries in response to a facial stimuli paradigm. LICA was used to simultaneously factorize all subjects' data into 40 independent components (ICs) of spatial variations. A Generalized



Linear Model was used to examine case-control differences and univariate brain-behaviour-associations while regressing out the effects of age, sex, IQ, handedness and scanning site. Next, Canonical Correlation Analysis (CCA) was performed to quantify the aggregated effects between multi-modal ICs and subscales related to social functioning of ADI, ADOS, Social Responsiveness Scale, and the Vineland. The statistical significance of each pair of canonical variates was determined by permutation testing (10,000 times).

#### Results:

LICA resulted in seven multi-modal components. None of these were associated with categorical group membership or clinical features (when applying univariate tests). Applying multivariate CCA revealed a significant association between the seven multimodal ICs and the set of social-cognitive features ( $r=0.56$ , permutation  $p=0.01$ ). IC27 was most implicated in this pattern and comprised right and left grey matter volume within the fusiform gyrus and right connectivity changes within the fusiform gyrus as captured by resting-state fMRI.

#### Conclusions:

We successfully merged imaging data across four different modalities to characterize a multimodal neurophenotype of autism in a key region related to face processing. None of the components showed associations with the categorical labels, but there was a multivariate association with features related to social-communicative functions in autism. Thus, multimodal aspects related to face processing can explain variance in social functioning and daily living skills in autism.

#### **422.010 (Poster)** Predicting Accelerated Visual Memory Decline in Middle-Age and Older Adults with ASD with Multi-Modal MRI: The Case for Hippocampal System Free-Water

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Background: Research aimed at understanding cognitive and brain aging in adults with autism spectrum disorder (ASD) is growing, but critical longitudinal studies in middle-age and older adults and candidate brain-based biomarkers have yet to emerge. Adults with ASD struggle with visual memory compared with neurotypical (NT) adults, making this an area of concern for cognitive aging.

Objectives: We first described longitudinal aging trajectories in short- and long-term visual memory abilities in middle-age and older adults with ASD, compared with matched NT adults. Next, we evaluated baseline multi-modal imaging metrics of the hippocampus and fornix, including the relatively novel metric free-water, as predictors for longitudinal memory change.

Methods: Middle-age and older adults between the ages of 40 and 70 years (ASD,  $n=25$ ; NT adults,  $n=25$ ) were followed longitudinally at approximately two-year intervals (range 2-5 years) with 2 to 3 visits (mean 2.3). Participants completed the Wechsler Memory Scale III Visual Reproduction task. Longitudinal linear mixed effect models were run to detect group differences in memory change with baseline age and sex as covariates. Hippocampal volume was measured via T1-weighted MRI images with FreeSurfer. Fornix FA and hippocampal and fornix free-water were measured from diffusion tensor imaging (DTI) scans. Correlations between individual hippocampal system metrics and longitudinal slopes of visual memory change were examined, with correction for multiple comparisons (false discovery rate, FDR). Additionally, multi-modal hippocampal system components were generated via principal component analysis and correlated with longitudinal slopes of visual memory change without the need to correct for multiple comparisons ( $\alpha=0.05$ ).

Results: There was a significant group by age interaction for long-term visual memory, such that middle-age and older adults with ASD declined faster than matched NT adults ( $p=0.005$ ; Fig. 1a). Such interaction did not exist for short-term visual memory, suggesting groups changed similarly. Baseline free-water in the left hippocampus, bilateral fornix cres, and fornix body, and FA in the fornix body predicted long-term visual memory change in middle-age and older adults with ASD, but only left fornix cres free-water survived correction for multiple comparisons [ $r(23)=-0.549$ ,  $p=0.004$ ]. The first principal component loaded all hippocampal and fornix free-water metrics, and significantly predicted long-term visual memory change in middle-age and older adults with ASD [ $r(22)=-0.517$ ,  $p=0.01$ ; Fig. 1b]. The second component was multi-modal and loaded bilateral hippocampal volumes, bilateral hippocampal free-water, and fornix body FA (ascending order), but did not predict long-term visual memory change.

Conclusions: In one of the first longitudinal cognitive and brain aging studies in middle-age and older adults with ASD, findings suggest accelerated long-term visual memory decline, compared to matched NT adults. Baseline hippocampal system measures of the relatively novel DTI metric, free-water, outperformed traditional hippocampal volume and FA measures individually and in multi-modal combinations, as a biomarker for accelerated cognitive decline in middle-age and older adults. Free-water measures extracellular fluid as a marker of neurodegeneration and has previously been applied to Alzheimer's in Parkinson's disease. These preliminary findings lay the groundwork for future prognostic applications of free-water for cognitive aging outcomes in middle-age and older adults with ASD.

#### **422.011 (Poster)** Prenatal PM2.5 and Subcortical Volumes in Children with Neurodevelopmental Disorders

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Background: With the growing climate crisis, particulate matter (PM) air pollution is expected to increasingly impact human health with effects magnified in vulnerable populations including pregnant women and young children. Air pollution (particulate matter  $< 2.5$   $\mu\text{m}$ ; PM<sub>2.5</sub>) exposure increases risk for autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD), yet the neural mechanisms underlying these

associations are largely unknown. To understand links between prenatal PM<sub>2.5</sub> exposure and structural brain changes, we pilot a mixtures approach in cohort enriched for ASD and ADHD.

**Objectives:** To examine the impact of prenatal exposure to ambient PM<sub>2.5</sub>, on sub-cortical brain volumes in children with ASD and ADHD.

**Methods:** We used Freesurfer to quantify 14 subcortical volumes from high-resolution structural T1-weighted images acquired from 238 children (5-15 years; 88 females; 4% ASD; 49% ADHD; 11% comorbid ASD/ADHD; 24% other diagnosis, 12% no diagnosis) enrolled in the Healthy Brain Network (HBN); a well-established behavioral and magnetic resonance imaging (MRI) phenotyping biobank. We estimated average prenatal PM<sub>2.5</sub> levels using a satellite-based gradient boosting hybrid model at a 1x1 km spatial resolution. We used weighted quantile sum (WQS) regression to generate a subcortical volume index (representing 14 subcortical brain regions volumes) and investigated associations between the subcortical index and PM<sub>2.5</sub>.

**Results:** PM<sub>2.5</sub> was positively associated with the subcortical index ( $\beta = 0.19$  [95% CI 0.18, 0.20]), indicating higher prenatal exposure to PM<sub>2.5</sub> is associated with increased subcortical volumes. This association is driven mainly by volumetric changes in the thalamus and pallidum, regions that play key roles in ASD and ADHD.

**Conclusions:** Prenatal exposure to PM<sub>2.5</sub> is associated with changes in subcortical volumes in a pediatric population enriched with ASD and ADHD; these results may inform prevention and intervention efforts for reducing PM<sub>2.5</sub> exposures.

**422.012 (Poster)** Whole-Brain White Matter Compromise across the Lifespan in Autism Is Not Predictive of Behavioral Symptomatology  
**S. R. Otto, Y. Yang, L. M. Ray, J. A. Travers, J. Hutsler and S. M. Haigh, Psychology, University of Nevada, Reno, Reno, NV**

**Background:** Autism Spectrum Disorder (ASD) pathology involves multiple distributed neural networks. Abnormal white matter (WM) connectivity in particular has been implicated as a potential mechanism for perturbed neural functioning across these distributed networks. Much of the existing literature surrounding WM connectivity in ASD has primarily focused on children, while little is known about the structural and behavioral profile across the lifespan into adulthood. Diffusion MRI (dMRI) has developed into a promising technique to investigate complex brain network connectivity *in vivo* and its application in clinical populations is rapidly gaining popularity because of its sensitivity to changes in WM structure.

**Objectives:** The present study used diffusion MRI repository data from a large sample of children and adults to investigate the degree to which WM connectivity is abnormal in ASD compared to aged-matched neurotypical controls (NT). Furthermore, we examined whether a relationship exists between diffusion indices and both diagnostic indicators and behavioral symptom severity.

**Methods:** dMRI data was acquired from the ABIDE II repository, Carnegie Mellon University, and the University of Pittsburgh. In total, we analyzed 336 subjects (187 ASD, 149 IQ-matched NT controls). All data were collected on a 3-Tesla scanner. Tract Based Spatial Statistics (TBSS) was performed using FMRIB's FSL software. Due to the nested nature of the data, robust linear mixed-effects modeling was used to examine if group differences in diffusion measures were present between individuals with ASD and NT controls while controlling for several covariates (Age, IQ, motion, brain volume). To investigate the relationship between diffusion and symptomatology, we used Confirmatory Factor Analysis (CFA) and regression models to determine if the diffusion measures were predictive of diagnosis and behavioral symptom severity. Diagnostic indicators were measured using the Autism Diagnostic Observation Schedule (ADOS) and behavioral symptom severity was indicated by the Social Responsiveness Scale (SRS).

**Results:** Taken altogether, individuals with ASD exhibited poorer whole-brain diffusion, even after controlling for age, motion and IQ. Compared to NT controls, individuals with ASD showed decreased fractional anisotropy (FA), increased mean diffusivity (MD) and increased radial diffusivity (RD). These results were evident across the entire brain. CFA and regression analyses found that the biological measures of FA, MD, AD and RD were not predictive of behavioral outcome on the ADOS or SRS.

**Conclusions:** These results suggest that WM compromise begins early in ASD and persists throughout adulthood. Due to the nonlinear and dynamic nature of brain development in ASD, it is difficult to isolate aberrant changes in WM connectivity that might reflect core ASD symptomatology. Focusing more efforts on adults with ASD may give researchers a better understanding of which of these changes in diffusion are sustained beyond development and maturation. Our findings highlight the need for longitudinal studies to better understand how age-related changes in WM diffusion properties may relate to the behavioral profile often seen in ASD across the lifespan. Furthermore, measures of cognitive performance may be more suitable indicators in determining relationships between biological markers and behavioral outcome.

## VIRTUAL POSTER SESSION — BRAIN STRUCTURE (MRI, NEUROPATHOLOGY)

### 522 - Brain Structure (MRI, neuropathology) --- (V)

**522.001 (Virtual Poster)** Amygdala Subnuclei Involvement in Restrictive and Repetitive Behaviors in Children with Autism Spectrum Disorder  
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**Background:** Restrictive and repetitive behaviors (RRBs) are included in the diagnostic criteria for Autism Spectrum Disorder (ASD). These heterogeneous behaviors can include motor stereotypies such as finger flapping, repetitive play and restrictive interests. Some forms of RRBs, like stereotypic movements, are thought to be linked to anxiety, and may serve as a self-soothing mechanism. The amygdala is a key structure involved in regulating emotion and controlling inhibitory behaviors.

**Objectives:** The main objective of our study was to investigate whether RRBs behaviors in children with ASD are associated with amygdala subnuclei development, and whether this relationship is modified by anxiety.

**Methods:** A total of 123 children underwent an MRI scan, 44 (34M) children with a diagnosis of ASD, and 79 (38M) typically-developing (TD) children. Children were 5-10 years of age (mean=7.98, SD=1.45). Parents completed the Child Behavior Checklist (CBCL), the Autism Spectrum Screening Questionnaire (ASSQ) and the Screen for Child Anxiety Related Disorders (SCARED). Restrictive and Repetitive Behaviors (RRBs) were measured using the subscale of the CBCL. We extracted the amygdala subnuclei volumes using FreeSurfer.

To examine whether RRBs were associated with amygdala subnuclei volumes and parent-reports of anxiety, a general linear model (GLM) with RRB total score as the dependent variable and amygdala subnuclei volumes, diagnosis (Dx), CBCL-Anxiety/Depression subscale scores, and Screen for Child Anxiety Related Disorders (SCARED-P) scores were predictor variables, adjusting for gender, age, scan site, and total cerebral volume (TCV).

**Results:** Children's RRB scores were significantly higher in children with ASD ( $p < .001$ ), as did gender ( $p = .003$ ), age ( $p < .001$ ), left Anterior/amygdaloid area (AAA) volume ( $p = .006$ ), left central subnuclei volume ( $p = .008$ ), left medial subnuclei volume ( $p < .001$ ), right accessory basal (AB) subnucleus volume ( $p = .008$ ) and right medial nucleus volume ( $p = .002$ ). Neither anxiety measures were associated with RRBs. An interaction analysis found significant main effects of diagnosis on left AAA volumes ( $p = .010$ ) and right AB volumes ( $p = .008$ ). Males with ASD had larger AB volumes, and females with ASD had smaller volumes.

**Conclusions:** Larger AAA and right AB subnuclei, regions deemed important for sensory information related to fear processing, were significantly larger in children with higher levels of repetitive behaviours. These enlarged amygdaloid subregions may be linked to repetitive behaviours in children with ASD. Longitudinal studies are needed to better understand these associations.

#### **522.002 (Virtual Poster) Cerebellar Anatomy and Sensorimotor Impairment in Autism Spectrum Disorder**

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**Background:** Sensorimotor issues and cerebellar structural abnormalities are common in autism spectrum disorder (ASD), but information on how they covary is limited. Studies examining the relationship between sensorimotor behaviors and discrete cerebellar systems are needed to clarify the brain basis of sensorimotor deficits.

**Objectives:** To test the overarching hypothesis that sensorimotor deficits across multiple effector systems are associated with discrete, localized cerebellar volumetric differences.

**Methods:** Fifty-eight participants with ASD (21 females) and 34 typically developing (TD) controls (18 females) matched on age (8-30 years), sex, and handedness completed a structural MRI scan and either precision grip testing, oculomotor testing, or both. Volumes of 18 cerebellar ROIs were extracted. Force variability was examined for each hand separately. Absolute error and variability of visually guided saccades were examined across multiple target locations (12° and 24°; left and right). Mixed effects models were used to compare sensorimotor behavioral performance and cerebellar volume between individuals with ASD and TD controls. Similar models were used to examine the relationship between force variability, saccade error, saccade variability, cerebellar lobular volume, and clinical symptoms of ASD.

**Results:** Relative to TD controls, individuals with ASD showed greater force variability across hands ( $p < .001$ ). Individuals with ASD showed reduced volume of cerebellar vermis VI-VII relative to TD controls ( $p = .005$ ). Relative to males with ASD, females with ASD showed reduced volume of cerebellar Crus II/lobule VIIB, while TD males and females showed similar volumes ( $p = .007$ ). Associations between saccade error and cerebellar volume for vermis I-V ( $p = .013$ ), bilateral Crus II/lobule VIIB (left:  $p = .002$ ; right:  $p = .010$ ), bilateral lobule VIII (left:  $p = .003$ ; right:  $p = .046$ ), and right lobule X ( $p = .013$ ) varied across groups: greater volume was associated with lower saccade error for TD controls only. Increased volume of vermis VI-VII was associated with reduced rightward saccade variability for TD controls only ( $p = .044$ ). More severe clinical issues were associated with greater right lobule VIII ( $p = .018$ ) and cerebellar white matter ( $p = .016$ ) volumes as well as reduced right lobule VI ( $p = .024$ ) and right lobule X ( $p = .003$ ) volumes. Reduced volume of right Crus II/lobule VIIB was associated with greater ASD symptom severity in males only ( $p = .043$ ), while reduced volume of right Crus I was associated with more severe restricted and repetitive behaviors in females only ( $p = .046$ ).

**Conclusions:** We identify multiple differences in cerebellar structure in ASD, including reduced volume of vermal lobules VI-VII across sexes and reduced volume of cerebellar Crus II/lobule VIIB specific to females, suggesting sex-specific structural alterations vary across cerebellar subregions. Together with our finding of associations between cerebellar dysmorphology and clinical severity, our finding of disassociations between cerebellar structure and oculomotor performance in individuals with ASD suggests cerebellar reorganization and structural variation contribute to multiple developmental issues in patients.

#### **522.003 (Virtual Poster) Gray Matter Covariations in Autism. out of Sample Replication of Using the Enigma-Autism Dataset**

#### Background:

Autism Spectrum Disorder (henceforth autism) is a complex condition associated with alterations in gray matter (GM) volume covariations, as reported in our previous study of a large multicenter dataset -- LEAP (Mei et al., 2020). One of the current aims for research into autism is to parse the neural heterogeneity of autism and better understand brain-behavior relationships.

#### Objectives:

To make progress on identification of potential neural markers and to validate the robustness of our previous findings, we intended to replicate our results using the Enhancing Neuroimaging Genetics Through Meta-Analysis (ENIGMA) autism working group.

#### Methods:

We studied 781 individuals with autism and 927 typically developing (TD) individuals, aged between 6 and 30 years, IQ>50 and across 37 sites. To quantify the GM volume, we used voxel-based morphometry (VBM) as before. Each participant's T1-weighted structural image was processed to acquire VBM maps using our previous customized group DARTEL template in CAT12. In the previous study, we found two independent components (ICs) with a significant group effect. Therefore, we used these two ICs spatial maps as masks and performed dual regression to separately estimate the participant's weights of corresponding ICs in the ENIGMA dataset. A Generalized Linear Model (GLM) was then used to examine case-control differences between participants loadings of each component while correcting for age, sex, IQ, and sites. Additionally, we also used GLM to investigate the relation between the brain GM covariation patterns and available Autism Diagnostic Observational Schedule (ADOS) scores in autism group (N = 494).

#### Results:

The two components of interest, isolated in the in the ENIGMA dataset, showed significant case-control differences in participant loadings (first IC:  $p=0.0013$ ; second IC:  $p=0.0021$ ), and we constructed the brain patterns of these two components in the ENIGMA data (Figure 1). These brain patterns were consistent with those found in the initial study. The first IC was primarily associated with decreased volumes of bilateral insula, inferior frontal gyrus, orbitofrontal cortex in the autism group relative to TD individuals. The second IC was related to decreased volumes of the bilateral amygdala, hippocampus, parahippocampal gyrus and cerebellum in the autism group relative to TD individuals. In keeping with our previous study, we did not find significant univariate associations between the brain measures and symptom severity in autism.

#### Conclusions:

In the present study, we have replicated our initial findings in a second large independent sample. This shows the robustness of GM covariation as a potential neural marker for autism and provides support for its future investigation as a biomarker.

#### References:

Mei, T. *et al.* (2020) 'Gray matter covariations and core symptoms of autism: the EU-AIMS Longitudinal European Autism Project', *Molecular autism*, 11, p. 86. doi: 10.1186/s13229-020-00389-4.

**522.004 (Virtual Poster)** Impact of Intermittent Theta-Burst Stimulation over the Bilateral Posterior Superior Temporal Sulcus on White Matter Structural Connectome in Children and Adolescence with Autism Spectrum Disorder

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#### Background:

Although theta burst stimulation (TBS) had therapeutic potential on autism spectrum disorder (ASD), no investigation explored the impact of TBS on white matter connectome in ASD.

#### Objectives:

In our randomized, double-blinded, sham-controlled and parallel trial, we aimed to explore the impact of TBS over the bilateral posterior superior temporal sulcus (pSTS) on white matter connectome in children and adolescence with ASD.

#### Methods:

65 children and adolescents with ASD were recruited and assigned randomly to the Active-Active (n=33; five female; mean age=13.5 years) or Sham-Active group (n=32; four female; mean age=12.7). First, participants received either iTBS or sham stimulations twice per week for the first 4 weeks. Later, all of the participants received iTBS stimulation twice per week for the following 4 weeks. Multishell high angular resolution diffusion imaging was acquired at baseline, week 4 and week 8. Whole-brain structural connectomes were reconstructed based on constrained spherical deconvolution and global tractography using MRtrix3. Schaefer-Yeo 100 cortical atlas combined with subcortical parcellations was used to generate a weighted structural network. Network-based statistics were employed to identify subnetworks of brain connections that exhibit significant group by time interactions.

#### Results:

In the between group analysis, no significant group by time interaction on subnetworks analysis from baseline to week4 and week8 was found. In the within group analysis, we found significant increase of white matter connectome between left post-central and dACC (Salience network) in the Active-Active group from baseline to week 8 (FDR-corrected  $p < 0.05$ ). However, we did not find significant change of white matter connectome in the Sham-Active group from baseline to week 8.

#### Conclusions:

Our preliminary results suggest 8-week iTBS over bilateral pSTS might induce neuroplastic changes in structural connectivity on the Salience network in ASD. We will further investigate how these white matter changes correlate with symptomatic changes following iTBS treatment.

#### **522.005 (Virtual Poster) Non-Verbal Cognitive Trajectories from Infancy through School-Age Reflect Brain Growth during the Same Period in Familial High-Risk Siblings**

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**Background:** Cognitive ability is an important predictor of functional outcomes in individuals with autism spectrum disorder (ASD). In typical development, larger brain volume and surface area has been associated with greater cognitive ability. However, research in ASD suggests that disproportionately larger brain size may be related to poorer cognitive outcomes in the toddlerhood through school-age period (Amaral et al., 2017; Lee et al., 2020). Ideally, biomarkers of school-age cognitive outcomes would be identifiable in infancy, when the brain is most plastic and responsive to intervention. The relationship between brain growth in infancy, and school-age cognitive outcomes in ASD is unknown.

**Objectives:** This study aimed to understand how brain growth during the infant to school-age period is related to non-verbal cognitive trajectories in high familial risk siblings of children with ASD (high-risk siblings).

**Methods:** High-risk siblings (n=123) from the Infant Brain Imaging Study (IBIS) Network were seen at 12 and 24 months and followed up during the school-age period (5-11 years old) for structural MRI and clinical assessment. Non-verbal ability (NVIQ) was assessed at 12 and 24 months using the Mullen non-verbal developmental quotient (NVDQ), and at school-age using the Differential Ability Scales special nonverbal composite (SNC). Clinical diagnoses of ASD were assessed at 24-months (ASD+ = 29; 83% male, ASD- = 94; 57% male). Linear mixed effects models regressed NVIQ scores on age, while controlling for mother's education and sex. Participants' random intercepts and age slopes were clustered using K-means and Bayesian information criterion (BIC). Mean levels of total cerebral volume (TCV), total grey matter volume (GM), total white matter volume (WM), and total cortical surface area (SA) were estimated at each time point. Differences in these volumetric data were tested between the clusters using multiplicity-corrected repeated measures ANOVA.

**Results:** BIC identified a 4-cluster solution (n1 = 23, 9% ASD+; n2 = 55, 13% ASD+; n3 = 6, 67% ASD+; n4 = 39, 41% ASD+)(Figure 1). Several brain measures at school-age were significantly different between clusters 2 and 4: TCV ( $\bar{x}$  = -80,780 mm<sup>3</sup>, SE = 19,576,  $p$  = 0.0012); GM ( $\bar{x}$  = -43,598mm<sup>3</sup>, SE = 12,609,  $p$  = 0.0153); WM ( $\bar{x}$  = -36,915, SE = 8021,  $p$  = 0.0001), and SA ( $\bar{x}$  = -11,512 mm<sup>2</sup>, SE = 2242,  $p$  = < 0.0001) (Figure 2).

**Conclusions:** The clusters suggested three general patterns of cognitive development trajectories: Cluster 1: start above average and declining; Cluster 2: start at the average, with no change; and Cluster 3/4: start below average and improving. Across all brain volume measures, the largest cluster showing cognitive improvement (cluster 4) had the largest brain volumes at school-age compared to those with average, stable cognitive development (cluster 2). No significant differences were found between the clusters in brain measurement at the 12 or 24 month time points. This suggests that in familial high-risk siblings, regardless of ASD outcome, larger brain size may be related to a phenotype of improved cognitive functioning over time, however brain volume differences may not be evident until school age.

#### **522.006 (Virtual Poster) Phenotypic Correlates of Brain Morphometry in Young Children with Autism Spectrum Disorders**

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#### Background:

A growing body of literature suggests that neuroanatomic abnormalities such as increased cortical volume, thickness, and surface area, are evident in the first years of life in children with ASD.

#### Objectives:

The goal of this preliminary study is to characterize cerebral underpinnings of the behavioral phenotype in young children with ASD.

#### Methods:

A total of 113 scans were acquired from children with ASD (n=64, 10F), typically developing children (n=23, 8F). In children younger than 6 years, images were acquired in natural nocturnal sleep at Campus Biotech, Geneva (78 scans). Children of various developmental and sleep profiles were included, following the extensive and personalized behavioral training to adapt to the scanning environment.

Given the relatively large age span of the current sample we constrained these preliminary analyses to males younger than 6 with the diagnosis of ASD (n= 29, 3.24±0.92 years old). Cortical surfaces were reconstructed using the freesurfer 7.1 and were manually inspected and edited. Vertex-wise analyses were deployed to probe for the relation between brain morphology and behavioral phenotype. The supratentorial brain volume and age were used as covariates and results were corrected for multiple comparisons using Monte Carlo simulations.

#### Results:

Our preliminary results demonstrated a negative relationship between autism severity, as measured with the ADOS-2, and cortical thickness in the left lateral occipital area. The severity of symptoms in the Social Affect domain was negatively correlated with the cortical thickness of the left fusiform area. Moreover, a higher level of severity of social symptoms showed a negative association with the volume of a cluster in the left superior temporal lobe. Additionally, a higher level of repetitive behaviors negatively correlated with the cortical volume of the cluster in the left cuneus. No significant correlation was evidenced between the measure of cortical area and behavioral measures.

#### Conclusions:

Capitalizing on our rich database of phenotypic characteristics of children included in our cohort, we further intend to correlate differences in morphologic brain measures with behavioral measures of the processing of social information obtained using various eye-tracking paradigms.

#### **522.007 (Virtual Poster)** Use of Diffusion Tensor Imaging to Create Subgroups of Individuals with Autism Spectrum Disorder

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**Background:** Autism spectrum disorder (ASD) is a neurodevelopmental disorder with individualized trajectories in symptom manifestation. Such heterogeneous characteristics have called for subgroups that meet the individual's course, treatment, and outcome needs. While researchers believe that ASD stems from the associations of widespread white matter connectivity networks, previous studies creating subgroups have been limited to the use of observable behavioral data.

**Objectives:** The purpose of this study is (1) to explore the differences in the white matter microstructures between the ASD and their typically developing (TD) groups and (2) to create ASD subgroups by using the results from the voxel-wise comparisons.

**Methods:** A total of 229 individuals, aged 5-64 years, comprised of 134 ASD and 95 TD from the Autism Brain Imaging Data Exchange (ABIDE-II) dataset were included for analysis. Participants were divided into age groups to investigate potential effects by age (children n=67, adolescents n=108, adults=54). The Social Responsiveness Scale (SRS), a caregiver report with five subscales, was used to measure ASD-related traits. FMRIB Software Library (FSL) was used to pre-process and run the tract-based spatial statistics (TBSS) to perform the microstructural analysis. FSL Randomise with 5000 permutations was performed to examine between-group differences while covarying for age and intracranial volume (ICV). Multiple comparisons were corrected by threshold-free cluster enhancement. Fractional anisotropy (FA) and mean diffusivity (MD) values were used in the hierarchical cluster analysis of Euclidean distance and Ward's method to create subgroups. The number of subgroups was decided based on the distance presented in the agglomeration schedule. Univariate analysis of covariance (ANCOVA), while covarying for age, was performed to explore the clinical characteristics of each cluster group.

**Results:** There were no significant differences between the ASD and TD groups in white matter tracts when covaried with age and ICV. As a result, the findings from previous studies identified as the top key regions (e.g., corpus callosum, superior longitudinal fasciculus, fronto-occipital

fasciculus, cingulum) unique among individuals with ASD were chosen to be used as features in creating clusters. Two subgroups were made per age group, with the adolescent group differing in full-scale intelligent quotient and the adult group differing in the SRS attention subscale (Table 1).

Conclusions: There were no differences in FA and MD values between the two diagnostic groups. The clinical phenotypes per subgroup suggest the need for different treatment goals and approaches. Future studies with larger sample sizes and gold-standard diagnostic assessments to measure ASD-related traits are needed.

## Cognition: Attention, Learning, Memory

### PANEL — COGNITION: ATTENTION, LEARNING, MEMORY

#### 223 - Executive Functioning in Autistic Adolescents and Adults: Lived Experience, Relation to Outcomes and Response to Intervention

**Panel Chair:** Lauren Kenworthy, *Center for Autism Spectrum Disorders, Children's National Hospital, Washington, DC*

**Discussant:** Sharon daVanport, *Autistic Women & Nonbinary Network, Lincoln, NE*

**223.001 (Panel)** “When You’re Anxious, Planning Becomes Much More Painful”: Everyday Executive Function Difficulties from the Perspectives of Autistic Adolescents and Their Parents

**L. Kenny<sup>1</sup>**, A. Remington<sup>2</sup> and E. Pellicano<sup>3</sup>, (1)University College London, UK, London, United Kingdom, (2)UCL Centre for Research in Autism and Education, London, United Kingdom, (3)Macquarie School of Education, Macquarie University, Sydney, NSW, Australia

#### Background:

Researchers have long held that autistic people have executive function (EF) problems. Yet, despite decades of research on EF in autism, the existing literature remains contradictory and “confusing”, with, according to a recent meta-analysis, group differences of only moderate effect. Such effects are a far cry from the large effect sizes reported by autistic people and (more often) their caregivers on questionnaire measures of real-world EF. This discrepancy suggests that our current lab-based measures may lack sensitivity to the subtler, everyday experiences of autistic people. Yet, there is exceedingly little research eliciting such experiences and examining whether they map on to the construct as it is commonly assessed in the laboratory.

#### Objectives:

Understand in-depth the everyday EF experiences of autistic adolescents and their parents.

#### Methods:

Eighteen participants, including 11 autistic adolescents (10 young men, one young woman; aged 12 – 19 years) and seven of their parents completed semi-structured interviews about their EF abilities, including managing their time, multitasking, retaining information and adapting flexibly to changes in task demands. We adopted a critical incident technique, whereby participants were asked to recollect specific situations in which they (or their child) had excelled or had difficulties deploying EF. We followed Braun and Clarke’s method for reflexive thematic analysis using an inductive (bottom-up) approach to identify patterned meanings within the dataset.

Results: We identified four themes. Young people were adamant that their EF skills did not exist in a vacuum (Theme 1) but varied markedly depending on their motivation (“if it’s something in which I’m extremely focussed on in terms of interest, then I plan ahead of time quite well”) and mood (“when you’re anxious, planning becomes much more painful”) and could sometimes result in inertia. They also spoke of how their own (or their children’s) EF abilities were not fixed (Theme 2) but changed over time. Parents noticed that their children’s EF difficulties were becoming more apparent with age, which young people found frustrating as they longed for greater autonomy: “I do sometimes wish that they would leave me to make my own sort of decisions”. Young people were, however, divided about whether they viewed their EF difficulties as part and parcel of being autistic (Theme 3). While some felt that their executive difficulties “should not be planted at the door of autism”, others felt that they were intrinsic to who they are: “I have a one-track mind – it’s just the way I work”. Finally, while participants valued the strategies and accommodations to support their EF difficulties (Theme 4), they nevertheless felt that they often weren’t given sufficient opportunities “for me to do my own stuff” and thus exercise and develop these skills.

Conclusions: Participants’ phenomenological reports provide rare insights into their and their children’s executive difficulties – insights that do not straightforwardly map onto traditional theoretical models of EF. Future work on EF needs to take seriously the perspectives and subjectivity of autistic people themselves by triangulating quantitative, objective assessments with qualitative, subjective reports in complementary (controlled, uncontrolled) settings.

**223.002 (Panel)** Executive Function Problems Persist into Young Adulthood in Autism and Drive Psychopathology

#### Background:

Executive Function (EF) challenges are well established in autism and linked to key outcomes such as co-morbid psychopathology (Wallace et al., 2016; Hollocks et al., 2014). Longitudinal investigations of EF as measured by performance tasks have identified *gains in skills* with age (Kouklari, Tsermentseli, & Monks, 2018; Pellicano, 2010), while cross-sectional data on parent reported EF problems indicates *increasing difficulties* with age, perhaps reflecting a widening gap between autistic adolescents' EF capacities and environmental demands (Rosenthal et al., 2013). Assessment of parent reported EF problems across multiple time points is needed to better understand this apparent discrepancy and the impact of EF challenges on psychopathology in autism.

#### Objectives:

Explore trajectory of parent-reported executive function (EF) problems in autism from early childhood through young adulthood and the relationship of EF problems to psychopathology.

#### Methods:

Archival data (n = 941 data points) on 313 autistic people (79 female; mean age at first visit=9.5±4.6 years (range: 2.6-23.1 years) was extracted from a combined clinical/research database (see Figure 1). Inclusion criteria were: a DSM-5 autism spectrum disorder diagnosis, Full Scale IQ ≥70 at a time point when the participant was ≥5 years of age; and each participant had at least two assessments which were six or more months apart. Variables of interest were: age-appropriate Behavior Rating Inventory of Executive Function (BRIEF) Inhibit (inhibition), Shift (flexibility) and Working Memory scale scores, and parent-reported Child and Adult Behavior Checklist Affect, Anxiety and Aggression Scale scores.

Results: Growth curve modeling revealed that parent reported problems with flexibility and working memory are elevated and stable throughout childhood and young adulthood. Inhibition problems, while also elevated, decline significantly with age (0.5 T-score points/year of age,  $p<.001$ ). Level of parent education, sex-assigned at birth, visit type (clinical versus research) and child Full Scale IQ scores were not significant predictors of EF problems over time, a notable finding given the range of IQ scores observed in this sample across time points (64-145). The only exceptions to this were that females had significantly higher (3.45 T-score points) Inhibit scores across development than males, and research versus clinic visit predicted reduced (2 T-score points) Working Memory scores. Parent reported EF problems were significant predictors of psychopathology as reported on the Child and Adult Behavior Checklist. Flexibility (BRIEF Shift) was a consistent predictor of psychopathology across all three scales (Aggression, Affect, Anxiety) investigated ( $ts=3.5-6.2$ ;  $ps<.001$ ). In each case, higher levels of parent reported inflexibility predicted higher levels of psychopathology. Inhibition (BRIEF Inhibit) predicted Aggression scores ( $t=9.3$ ;  $p<.001$ ) and working memory predicted Affect scores ( $t=2.69$ ;  $p=.007$ ).

Conclusions: Parents report significantly elevated EF problems in their autistic children throughout childhood and into early adulthood. With the exception of inhibition, trajectories of change in EF problems do not indicate improvement over time. EF problems predict increased burden of psychiatric comorbidities over time, making them an important target for intervention.

Figure 1. Accelerated longitudinal structure of study participants. Each line is one participant (Male = blue, Female = black); each circle is a data collection time point.

#### **223.003 (Panel) Associations between Executive Functioning and Subjective Quality of Life in Autistic Adults**

**G. L. Wallace<sup>1</sup>, G. A. McQuaid<sup>1</sup> and N. R. Lee<sup>2</sup>**, (1)The George Washington University, Washington, DC, (2)Department of Psychological and Brain Sciences, Drexel University, Philadelphia, PA

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Background: Executive function (EF), or the set of cognitive functions that serve self-regulatory roles in the service of problem solving and goal attainment, is a well-established marker of critical outcomes (e.g., adaptive skills and co-occurring psychopathology) in autism. To date, most of this work has focused on the developmental periods of childhood and adolescence, and the outcome metrics rarely prioritize subjective outcomes. Thus, whether EF is linked to subjective outcomes in autism during adulthood remains largely unknown.

Objectives: Examine associations between components of EF and various domains of subjective quality of life (QoL) in a large sample of autistic adults spanning a wide age range.

Methods: 805 autistic adults (447 assigned female at birth) aged 18-83 (M=40, SD=14) years were recruited via Simons Powering Autism Research Knowledge (SPARK) Research Match to complete online questionnaires. EF was assessed using the self-report versions of the Flexibility Scale-Revised and components of the Barkley Deficits in Executive Function Scale (inhibitory control and emotion regulation), while subjective QoL was evaluated across four domains (physical, psychological, social, environmental) using the World Health Organization Quality of Life (WHOQOL-BREF), and a fifth domain focused on autism-specific QoL (Autism Spectrum Quality of Life [ASQOL]). Five hierarchical linear regressions were conducted with age, sex assigned at birth, educational attainment, and autistic traits (Autism Spectrum Quotient-28) entered as covariates in the



initial step, and the three EF variables entered in the second step. To account for issues of multiple comparisons, a Bonferroni correction was calculated; thus,  $p < .01$  (.05/5) was considered statistically significant.

Results: All five regression models were consistent; after controlling for age, sex assigned at birth, educational attainment, and autistic traits, emotion regulation (unlike flexibility and inhibitory control) challenges contributed additional variance to subjective QoL (physical:  $\Delta R^2 = .08$ ; psychological:  $\Delta R^2 = .13$ ; social:  $\Delta R^2 = .04$ ; environmental:  $\Delta R^2 = .05$ ; autism-specific:  $\Delta R^2 = .07$ ; all  $ps < .001$ ).

Conclusions: These findings reveal for the first time that components of EF are selectively linked to aspects of subjective QoL in autism across adulthood. Specifically, emotion regulation, unlike flexibility and inhibitory control, challenges were associated with all five subjective QoL measures. Prior research has shown that emotion regulation difficulties are linked to increased risk for developing various forms of psychopathology (e.g., depression), which in turn detrimentally impact adult outcomes in autism. Therefore, EF in the form of emotion regulation, might directly and/or indirectly impact subjective QoL in autism during adulthood, though this possibility has yet to be tested. Regardless of the pathway of influence, these findings provide preliminary evidence for the importance of emotional regulation as a treatment target for future interventions that seek to optimize adult outcomes in autism.

**223.004 (Panel)** Developing Phenotype-Specific Interventions to Promote Meaningful Outcomes for Transition-Age Youth with ASD  
**C. E. Pugliese<sup>1</sup>, L. Anthony<sup>2</sup> and L. Kenworthy<sup>1</sup>**, (1)Center for Autism Spectrum Disorders, Children's National Hospital, Washington, DC, (2)University of Colorado, Denver, Aurora, CO

Background:

Executive function (EF) impairment is pervasive in ASD and linked to poor adult outcome. Autistic people have unique perspectives, knowledge and skills, but are often prevented from sharing their gifts by EF weaknesses. EF problems are pivotal targets for intervention (Hume, Loftin & Lantz, 2009) because they are common (Hill, 2004), linked to independence (Pugliese et al., 2015), and responsive to treatment (Kenworthy et al., 2015). However, there are no evidence-based EF treatments for transition-age youth and youth have difficulty generalizing skills learned in the clinic to real-world settings. In response, we leveraged cognitive neuropsychological approaches to develop a novel EF intervention based on the unique cognitive phenotype in ASD to capitalize on EF strengths and teach skills to support/accommodate EF weaknesses. Unstuck & On Target: High School (UoT:HS) is a 25-lesson CBT delivered by trained teachers at school. Intervention content is directly relevant to the EF profile in ASD (e.g., emphasis on self-advocacy, flexible problem solving, planning, time management, and independent goal-setting). Intervention delivery capitalizes on the learning strengths in ASD (e.g., scripts and routines) and promotes application to real-world situations.

Objectives:

1) Discuss development process of UOT:HS informed by existing models of the cognitive phenotype in ASD that teaches teens to capitalize on cognitive strengths and accommodates challenges, and 2) test preliminary effectiveness on improving EF skills and more distal outcomes relevant to the autistic community (adaptive/classroom behavior).

Methods: UOT:HS content was developed by neuropsychologists, psychologists, and educators with input from the autistic community. To evaluate effectiveness, 10 schools were randomized to school supports as usual (SAU) or UOT:HS delivered by school staff. All participants ( $n=55$ ) were aged 14-20 ( $M=16.4$ ,  $SD=1.3$ ) and had an FSIQ  $\geq 80$  ( $M=105.8$ ,  $SD=14.7$ ). ASD diagnoses were verified via school classification of ASD supported by the Social Communication Questionnaire ( $n=37$ ) and/or ADOS ( $n=21$ ). Outcome measures included masked classroom observations, parent-report on the ABAS-II and BRIEF-2 Shift scale, and a semi-structured interactional task tapping flexibility and planning skills (EFCT). Group change was evaluated via linear mixed-effects models of change scores (Post-Pre, 5 month Follow Up-Post), controlling for baseline score of the outcome measurement and FSIQ. School was treated as a random effect to account for cluster variation.

Results:

There were no group differences on gender, age, race, IQ, ASD symptomatology, medication status, and parent education. The UOT:HS group improved more than SAU at endpoint on classroom behavior ( $t=-2.33$ ,  $p=.019$ ,  $d=0.65$ , med-large effect), ABAS global composite ( $t=-3.40$ ,  $p=.0007$ ,  $d=1.03$ , large), ABAS Practical ( $t=-2.92$ ,  $p=.004$ ,  $d=.85$ , large), BRIEF Shift ( $t=1.88$ ,  $p=.06$ ,  $d=.55$ , med), and EFCT ( $t=2.66$ ,  $p=.008$ ,  $d=.76$ , large). Controlling for endpoint scores and IQ, there were no significant differences on these measures at follow-up.

Conclusions:

Data support the effectiveness of the first contextually-based EF intervention for high school students with ASD. Students taught UOT:HS improved more than the SAU group on classroom observations, direct measures of EF, and parent-report measures of adaptive behavior and EF with medium-large effect sizes. Next steps include testing UOT:HS in a larger RCT and evaluating change mechanisms.

## ORAL SESSION - 8B — COGNITION: ATTENTION, LEARNING, MEMORY

### 320 - Perception, Attention, Learning and Decision Making

**320.001 (Oral)** Re-Investigating 'fast' and 'slow' Processing in Autism

**Background:** Following the popularity of dual-process models in social and cognitive psychology, there is major interest in the possibility that Autism Spectrum Disorder (ASD) is associated with impaired 'fast' intuitive thinking but enhanced 'slow' or 'rational' deliberative thinking (see Rozenkrantz et al., 2021, *Trends in Cognitive Sciences*). If correct, this has great potential to help understand various strengths and difficulties characteristic of autism. Previous empirical investigations of this phenomenon, however, are marred by concerns about the measurement of intuitive and deliberative processing, as well as broader problems in clinical psychological science (e.g., small underpowered studies, lack of replication).

**Objectives:** Making a step change to previous research, we conducted 4 large-scale studies to re-examine intuitive and deliberative thinking in autism. This included a pre-registered comparison of 200 autistic and non-autistic adults, as well as the recruitment of larger, diverse samples, which were carefully informed by power analyses (Overall N = 1192).

**Methods:** In Studies 1-3, participants completed the Autism-Spectrum Quotient (AQ; Baron-Cohen et al., 2001) as a measure of autistic traits. In Study 4, 200 participants had a clinical diagnosis of autism, either as a child or adult, from an independent UK or US-based healthcare professional in a well-recognized clinical setting. Autistic participants were closely matched to 200 non-autistic adults who had indicated, at multiple time-points during a screening process, that they did not i) have a clinically diagnosed ASD, ii) self-identify as autistic, or iii) suspect they had a diagnosable ASD.

All participants completed widely used cognitive (e.g., Cognitive Reflection Test; Toplak et al., 2014; Sirota et al., 2020) and self-report measures (Rational-Experiential Inventory; Pacini & Epstein, 1999) of numerical and verbal intuitive and deliberative processing. They also completed a psychometrically robust measure of general cognitive ability (International Cognitive Ability Resource; Condon & Revelle, 2014).

**Results:** Except for a link between autism and lower self-reported intuitive thinking (all  $p < .001$ , all  $BF_{10} > 100$ ), we found no unique contributions of autism to intuitive or deliberative thinking across all 4 studies, as evidenced by frequentist and Bayesian analyses. This pattern of results was clear when, i) measuring autistic traits in non-clinical samples from the general population (Studies 1-3), ii) comparing large groups of age-, sex- and general cognitive ability-matched clinically diagnosed autistic and non-autistic people (Study 4a: see Figure), and iii) applying inclusion criteria based on AQ thresholds after pooling datasets (Study 4b).

**Conclusions:** Overall, these studies indicate that intuitive and deliberative thinking is neither enhanced nor particularly impaired in relation to autism. We deliberate on the implications of these findings for theories of autism and future investigation of strengths and difficulties in autistic people. We also discuss the wider implications of our methodology (e.g., pre-registration) for enhancing the replicability of future autism research.

### **320.002 (Oral) Practice Makes Perfect or Make Practice Perfect: The Contextual Interference Effect Facilitates Motor Learning and Transfer in Autism Spectrum Disorders**

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**Background:** The classic advice for anyone learning a new skill is "practice makes perfect". While this is a good general rule, it lacks any indication of what form of practice will efficiently maximize learning. Random practice (i.e., performing different skills) has frequently been shown to result in better retention and transfer compared to blocked practice (i.e., performing the same skill). This effect known as the contextual interference (CI) effect (Shea & Morgan, 1979) has been demonstrated on motor learning in numerous experiments in typical adults and children. Here we examined this effect in autistic children.

**Objectives:** (1) to examine CI in autistic children.

**Methods:** Thirty autistic (mean age: 11.3 (1.8) years.months; 6 female) and thirty matched neurotypical (mean age: 10.9 (1.6) years.months; 6 female) children volunteered for the study, which was approved by the local ethics committee. Children practised three different 3-segment motor sequences during an acquisition following either a HighCI (random) or LowCI (blocked) practice condition. Children then performed the practised sequences in two retention tests (random and blocked structures; 5 trials per sequence, 15 trials per test) and two transfer tests (novel 3-segment and 4-segment sequences; 5 trials per sequence). We quantified *reaction time (RT)*, *movement time (MT)* and *total time (TT)* from all children across the three phases. To examine the CI effect, children's motor behaviour (*RT/MT/TT*) during the retention and transfer tests was normalised by the final 5 trials of the acquisition phase. Retention data were submitted to separate 2 *diagnosis* (autism, neurotypical) x 2 *practice condition* (LowCI, HighCI) x 2 *test* (blocked, random) x 3 *phase* mixed design ANOVAs. Transfer data were submitted to separate 2 *diagnosis* (autism, neurotypical) x 2 *practice condition* (LowCI, HighCI) x 2 *test* (3-segment, 4-segment) mixed design ANOVAs.

**Results:** *RT* and *TT* were faster ( $ps < 0.05$ ) in retention following the HighCI practice condition regardless of diagnostic status. The LowCI practice condition specifically led to slower ( $p < 0.05$ ) *RT*, *MT* and *TT* in the random retention test. Whilst ASD children's *RT* were generally slower in the

transfer tests, *RT* and *TT* were faster in both tests following the HighCI practice condition for both ASD and neurotypical children. Overall, the added complexity of the 4-segment sequence was more impactful on ASD children, with them showing significantly greater *TT* on this test specifically.

**Conclusions:** ASD and neurotypical children that learned via the HighCI practice condition showed faster *RT* and *TT* in both retention and transfer. Whilst sensorimotor planning problems have often been reported (Rinehart et al., 2001) in autism, the present CI effect suggests that domain general elaborative cognitive planning processes are operational in autism and can be engaged (i.e., via random practice) to boost retention and flexibility to different task demands.

### **320.003** (Oral) Gender and Parent Reports of Childhood Joint Attention Related Symptoms

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**Background:** Joint attention symptoms are present early in the development of Autism Spectrum Disorders (ASD) and reflect problems in coordinating attention with other people to share a point of reference and experience. Joint attention is conceptualized as an infant behavior domain, but joint attention symptoms may also characterize the childhood phenotype of ASD. One previous report suggests that the Childhood Joint Attention Rating Scale (C-JARS) provides a valid measure of joint attention beyond infancy and preschool (Mundy, Novotny, Swain-Lerro, McIntyre, Zajic & Oswald, 2017).

**Objectives:** To provide additional information on the validity and psychometrics of the C-JARS in a large sample of 9 to 14-year-old children with ASD ( $N = 89$ ) who were heterogeneous with respect to co-morbid intellectual disabilities (Mean FSIQ = 85.2,  $SD = 27.2$ ) and age matched typical controls ( $N = 62$ ). To examine four hypotheses: 1) the diagnostic groups would differ on C-JARS scales; 2) C-JARS scales would display discriminant sensitivity and specificity for ASD; 3) C-JARS would provide comparable scores for girls and boys with ASD; 4) the ADOS SA scores from age 3 – 4 would predict C-JARS scores.

**Methods:** C-JARS data was collected in an outcome battery of a longitudinal study of the phenotypic development of ASD. The C-JARS is a 60-items parent report measure that provides a 46-item Prosocial Scale Score (PSC) that measures children's verbal and nonverbal spontaneous sharing of a point or reference and experience and a 14-item Asocial Scale Score (ASC) that primarily measures non-verbal problems in sharing attention and experience. Reliability estimates exceed  $\alpha = .80$  for both ASD and typical samples.

**Results:** Hypo 1: MANCOVA with FSIQ as the covariate revealed large effect Diagnostic Group differences on both the average PSC and ASC scales, PSC  $F(1,146) = 169.4$ ,  $p < .001$ ,  $p\text{-}\eta^2 = .64$ ; ASC  $F(1,146) = 85.1$ ,  $p < .001$ ,  $p\text{-}\eta^2 = .37$ . Hypo 2: A diagnostic group discriminant function analysis of PSC and ASC was significant,  $p < .001$ , with 97% and 88% of the ASD and TD groups correctly classified respectively. Hypo 3: There was as anticipated significant but modest Gender by DX group interaction for PSC,  $F(1,146) = 9.91$ ,  $p < .002$ ,  $p\text{-}\eta^2 = .06$ , whereby ASD girls scored lower than ASD boys on PSC, but TD girls rated higher than TD boys (see Fig. 1). Hypo 4: Age 3-4 ADOS SA scores predicted C-JARS ASC scores,  $r = .24$ ,  $p < .02$  but ADOS RRB scores did not,  $r = .14$ . However, both SA and RRB scores negatively predicted C-JARS,  $r = -.54$ ,  $-.46$ ,  $p < .001$ , respectively, from preschool to school-aged children.

**Conclusions:** In combination with the initial study (Mundy et al., 2017), these longitudinal and diagnostic data provide additional support and validity for gathering parent report data on the childhood development of joint attention symptoms in ASD. Post-hoc the gender difference finding suggests that differences in prosocial spontaneous sharing of experience behavior versus peers may play a role in ASD identification in girls that warrant examination.

### **320.004** (Oral) Autistic People Show Higher Susceptibility to the Postdictive Illusion of Choice.

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**Background:**

We often think we have made a conscious choice although, in reality, we have not. In experimental settings, this illusion occurs when we are asked to make a decision and we are presented with the outcome before the short interval that is required for the decision to become a conscious experience. As a result, we misperceive the outcome as a decision we have just made.

This so-called postdictive illusion taps on fundamental perceptual processes, such as attention, the formation of conscious percepts, the encoding of individual items into coherent ensembles, and confidence in judgements. Importantly, many theories suggest that these perceptual processes are different in autistic perception. It is, therefore, theoretically interesting to examine the susceptibility of autistic individuals to the postdictive choice illusion.

**Objectives:**

To examine the susceptibility of autistic individuals to the postdictive choice illusion.

**Methods:**

We tested 21 autistic people aged 20-62 ( $M = 43.58$ ,  $SD = 14.22$ ) and 20 neurotypical people of comparable age and cognitive ability. The participants completed a 162-trial experiment based on Bear & Bloom (2016). In each trial, participants chose between two options (two dots of different colour) and were presented with the choice outcome (a third dot which had the “correct” colour) after a short very time interval (50-1000ms). Subsequently, participants were asked to report whether or not they had chosen the dot with the correct colour (same as the outcome), with the option to report that they did not have time to make a choice. The participants also rated their confidence on their YES/NO responses (1-5 Likert scale). The postdictive illusion occurred when (i) participants reported they had chosen correctly more frequently than the 50% chance; and (ii) this effect manifested only in the shorter time intervals for the presentation of the outcome (i.e., it was not a uniform YES bias). The postdictive illusion effect was modeled with an asymptotic regression line ( $P(\text{YES}) = b \cdot (1/\text{time\_interval}) + a$ ) as a function of time interval, where  $P(\text{YES})$  is the probability of reporting a correct guess.

#### Results:

Both autistic and typical participants performed consistently with the postdictive illusion of choice, as the probability of reporting that they have made the correct choice was higher than 50% chance for shorter intervals, and converged to chance levels for longer intervals. Importantly, in the shorter time duration (50ms), the rate of these responses was higher for autistic than for typical participants ( $BF_{10} = 3.05$ , “moderate” evidence for a group difference). This effect could not be accounted for by overall number of YES ( $BF_{10} = 0.31$ , “moderate” evidence for no differences), NO ( $BF_{10} = 0.32$ ), and “NO TIME” ( $BF_{10} = 0.33$ ) responses, as well as confidence ratings ( $BF_{10} = 0.59$ ). The slope parameter (b) of the fitted regression lines were also different for autistic and typical participants (the 95% confidence intervals did not overlap).

#### Conclusions:

Our results suggest that autistic people are more susceptible to the postdictive choice illusion than neurotypical people. This finding has implications for theories of autistic perception.

## POSTER SESSION — COGNITION: ATTENTION, LEARNING, MEMORY

### 417 - Cognition: Attention, Learning, Memory

#### 417.065 (Poster) Inhibitory Control in Male and Female Adolescents with Autism Spectrum Disorder (ASD)

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**Background:** Recent research suggests that individuals with autism spectrum disorder (ASD) experience particular difficulty resisting interference from visual distractors (RIVD) relative to other aspects of inhibitory control (e.g., prepotent response inhibition and resistance to proactive interference). The literature further suggests that the ASD-related disruptions in inhibitory control may be age-related, such that RIVD difficulty may be more pronounced in young versus older adolescents. Much less is known, however, regarding potential sex-related differences in the inhibitory profile (i.e., strengths and weaknesses) in individuals with ASD.

**Objectives:** The present study was designed to further examine potential age- and sex-related differences in inhibitory ability in individuals with and without ASD.

**Methods:** A sample of 44 adolescents (25 males, 19 females) with ASD and 45 adolescents without ASD (22 males, 23 females) participated. Participants completed a computerized flanker visual filtering task and a go/no-go task, which assessed RIVD and prepotent response inhibition, respectively.

**Results:** No significant effect of group (ASD, non-ASD) was observed for the flanker task ( $F(1, 56) < 1$ ,  $p = 0.69$ ,  $\eta_p^2 = 0.003$ ) or the go/no-go task ( $F(1, 69) < 1$ ,  $p = 0.90$ ,  $\eta_p^2 < 0.001$ ). There was also no significant interaction between sex and group for either task ( $F < 1$ ,  $p > 0.43$ ,  $\eta_p^2 < 0.01$ , in both instances). However, a significant relationship between flanker performance and age was observed for the ASD group, with the older children showing smaller flanker effects (i.e., better inhibitory ability) as compared to the younger children ( $F(1, 24) = 9.57$ ,  $p = 0.005$ ,  $pr^2 = 0.29$ ).

**Conclusions:** Consistent with previous research (e.g., Christ et al., 2011), there was no evidence of ASD-related impairment in prepotent response inhibition as measured by the go/no-go task. Also consistent with past findings (e.g., Boland et al., 2019), age-related differences in RIVD ability were evident for the ASD group. Notably, we found no evidence of sex-related differences in the inhibitory profile of individuals with ASD.

#### 417.066 (Poster) Unexpected Salient Associations Prompt Attention Transfer to Subtler but More Predictive Cues: An Effect Influenced By Individual Differences

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**Background:** In the present associative learning study, we investigate the extent to which a salient and highly predictive cue can overshadow a subtler, but more predictive one. In line with error-based theories of learning, we hypothesize that the onset of unexpected events within a salient cue – outcome association should progressively draw attention to, and increase the learning of the subtler but more predictive cues. Considering recent

Bayesian models of autism which suggest that autistic and non-autistic individuals process prediction errors differently, as well as the well documented preference towards local processing in autism, we explore how, socio cognitive traits frequently reported in the condition may influence participant's associative learning.

#### Objectives:

Remaining agnostic as to the existence of 'autistic traits' in the general population; this study investigates whether participants with high scores to the Autism-Spectrum Quotient questionnaire (AQ) would display different gaze behaviour than participants with lower scores, either by spontaneously focusing on the subtle cues or by showing a greater learning update when presented with salient unexpected associations.

#### Methods:

In this eye-tracking study, forty participants (age  $m=20$ , and a F/M ratio of 33/7) were each presented with two sounds, predicting the animation of one of two visual stimuli displayed on a computer screen. These visual stimuli contained a salient feature (a shape) and a subtler feature (a filling pattern). In 20% of the trials, we swapped the pattern filling both shapes and animated the visual stimulus containing the pattern associated with the sound. Every 16 ms the presence or the absence of anticipatory fixations towards each stimulus were recorded, before the onset of the animation.

Results: Generalized Linear Mixed Models set to binomial logistic regression revealed a greater number of anticipatory fixations on the salient compared to the subtle cue during the oddball trials in all participants ( $z = -27.81, p < .001$ ). However, as shown in Fig. 1, these erroneous gaze anticipations gradually prompted participants to explore the subtler cue, while disregarding the uncertain salient cue ( $z = 2.11, p < .05$ ). Interestingly, as presented in Fig. 2, while all participants were subject to this overshadowing effect, we observed that participants with a higher AQ score updated their predictions in favor of the subtler and more predictive cues ( $z = -33.11, p < .001$ ) while participants with lower scores kept their priors unchanged ( $z = -2.43, p = .072$ ).

#### Conclusions:

While all participants were spontaneously biased by the salient cue, those with higher AQ scores progressively anticipated the outcome based on the subtle but highly predictive cue, whereas participants with lower AQ scores kept their predictions based on salient uncertain cues throughout the task. In line with recent work showing a positive correlation between autistic traits and a preference for predictability, these results also echo important frameworks of autism research that propose that neurotypical participants place more weight to their prior learnings when faced with unexpected events, whilst autistic individuals accord more weight to their prediction errors and therefore update their learnings more frequently.

#### **417.067 (Poster)** Autistic Individuals Show Less Grouping-Induced Underestimation Bias in Numerosity Judgments.

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#### Background:

Recent studies on the perception of numerosity have shown that when people are asked to judge the numerosity of a cloud of dots in which pairs of dots are connected with thin lines, they underestimate numerosity. This effect is referred to as grouping-induced underestimation bias and is thought to arise as dot-pairs are processed as an integrated whole rather than as individual items. We have recently shown that neurotypical individuals with higher levels of autistic symptomatology (Autism Quotient scores) show lower levels of grouping-induced underestimation bias, suggesting a weaker propensity for active grouping strategies compared to individuals with low autistic symptomatology.

#### Objectives:

In this study we examined whether the reduced grouping-induced underestimation bias generalizes to autistic individuals.

#### Methods:

Twenty-four adults with ASD and 24 age and cognitive ability matched neurotypical adults (TD) controls judged the numerosity of clouds of dots, which optionally included 20% of dot-pairs connected by thin lines. We focused on numerosities of 15 (moderate) and 100 (high), similar to our earlier study with neurotypical adults.

#### Results:

There were no significant group differences in precision in numerosity discrimination, suggesting that both groups were equally capable performing the task. However, for moderate numerosities ( $N = 15$ ), connecting pairs of dots induced an underestimation bias in the neurotypical but not the autistic groups. Moreover, the magnitude of the effect covaried strongly with AQ-defined autistic traits in the neurotypical range.

#### Conclusions:

Our results reflect a major difference between autistic and neurotypical numerosity perception with regards to the role of grouping. Furthermore, our findings suggest that the strength of the grouping is predicted by autistic symptomatology. Our findings provide strong support for theories of autistic perception that emphasize differences in global versus local processing. Our approach enabled us to tap grouping mechanisms indirectly, by asking participants to report judgements on apparent numerosity (and not on grouping or perceptual organization).

**417.068 (Poster)** Black-and-White Style Predictions in Autism: Findings from Electroencephalography (EEG)

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**Background:** Top-down predictions play an integral role in perception and behavior. Typically, one flexibly updates the strength of their predictions in a context-dependent manner. In autism, however, there is a firm adherence to routines without regard for context. This is clinically referred to as "resistance to change"; however, the basis of this maladaptive behavior is unknown. Recent theories posit impairments in the brain's ability to make and update predictions as a major source of autistic behavior.

**Objectives:** A prominent feature of predictive processing is flexibly tuning the level of certainty associated with predictions based on changes in stimulus statistics. We hypothesized that this is impaired in autism. To test this, we investigated how autistic adults (n=19) and non-autistic controls (n=20) adjust the certainty of their predictions upon parametric manipulation of cue validity.

**Methods:** Using a novel probabilistic task accompanied by electroencephalography (EEG) measures of brain activity, we parametrically manipulated cue validity at four levels: 100%, 84%, 66%, and 33%. Multiple stages of predictive processing were unpackaged by examining different time windows of the stimulus-locked activity: 1) ~100 ms before targets (to measure anticipation of upcoming inputs), 2) ~350 ms after targets (to measure registration of target statistics), 3) ~700 ms after targets (to measure updating of statistical models).

**Results:** While the control group showed a systematically graded modulation of potentials proportional to the level of cue-target validity as measured by the CNV and P300, the autism group showed a remarkable difference between the entirely predictable and slightly predictable conditions, which is compatible with the clinical autistic behavior of over-reaction to small perturbations. On the other hand, they showed reduced differences between unstable conditions compared to controls. Furthermore, responses to violation of predictions revealed two phases of activity with different time courses in the control group, suggestive of the engagement of two distinct neural networks and sets of processes. Strikingly, the later response was not modulated by probability in autism while showing sensitivity to statistics in controls. We speculate that the earlier response may reflect response inhibition and the recognition of the incongruity, whereas the latter may represent the re-evaluation of the predictive model based on outcomes.

**Conclusions:** Our results on CNV and P300 indicate that autistic individuals adopt a black-and-white style of predictions, predicting outcomes in a highly confident manner in stable environments while failing to adjust the level of confidence with respect to statistics in unstable settings. Moreover, lack of modulation of responses upon violation of predictions may indicate that the autistic brain does not update internal models after observing the outcome of predictions, despite successfully registering them in the first place. Overall, our findings offer novel insights into neurophysiological mechanisms of impaired adaptation to changes in autism, which may underlie the social communication issues and insistence on sameness, behavioral hallmarks of the spectrum.

**417.069 (Poster)** Causal Modeling of Large Psychological Datasets to Evaluate Cognitive Theories of ASD

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**Background:** Nearly 80 years since autism was first described, the cognitive/psychological basis for key symptoms is still an area of active research, particularly in the service of developing rational and targeted interventions. One challenge to progress is siloing of research programs; investigators often test a single hypothesis alone, rather than testing multiple hypotheses in direct competition, within the same cohort.

**Objectives:** To evaluate >1 cognitive explanatory models of the ASD phenotype within a single, large cohort. Literature review identified several cognitive hypotheses of ASD.

**Methods:** The Simons Powering Autism Research for Knowledge (SPARK) database contains rater-scale responses around a variety of symptoms of ASD for 10,000s of individuals with ASD. Elements collected via SPARK were appropriate to test two hypotheses. The first, proposed by Rutter, claims that a primary, pervasive communication disorder (ie, limitations in both verbal and non-verbal [NV] communication) cause aloofness. The second hypothesis, proposed by Richter, claims that primary aloofness results in altered development of verbal and NV communication skills.

Psychological constructs (verbal language, NV communication, aloofness) were defined based on theory, and items from the SPARK data dictionary were investigator-selected, prior to any analysis. Covariates included age, sex, family history, annual household income, broad cognitive development, and age of onset, among others. We selected cases from the SPARK database based on absence of missingness for all studied items and covariates. Directed causal models of the two hypotheses were defined and evaluated using linear regression with appropriate interaction and mediation terms.

**Results:** N<sub>(ASD)</sub>=13,903. NV communication and aloofness were strongly correlated ( $r^2=0.65$ ), a non-directional result that is consistent with both hypotheses. Verbal language and aloofness correlated far less strongly ( $r^2=0.03$ ). To further test the Rutter model, we examined the interaction of NV with verbal language when predicting aloofness. There was a significant interaction effect, however many individuals with relative strong verbal

language showed severe aloofness. To assess directionality of the relationship between aloofness on one hand and both NV and verbal language on the other, we regressed out aloofness (and other covariates) from the relationship between NV and verbal language. The results were consistent with aloofness causing both NV and verbal language variation and inconsistent with communication causing aloofness: both aspects of communication were statistically independent from each other once aloofness was regressed out (72% confidence).

**Conclusions:** The results were inconsistent with the Rutter model of a pervasive communication deficit causing aloofness. Results were however consistent with the Richter model showing aloofness causing deficits to a large degree in NV communication and, to a lesser degree, verbal communication. Significant limitations of the dataset for the current purpose should be considered: the data are not longitudinal; rater (rather than experimental/performance) data are likely associated with confounds that could spuriously increase covariance among the variables; these analyses only use data from individuals with ASD and therefore only assess inter-individual variation within the ASD spectrum rather than genesis of the ASD phenotype; analyses do not allow for the possibility that different causal paths are present in different individuals.

**417.070 (Poster)** Effects of Age on Verbal Memory and the Hippocampus in Adults with Autism Spectrum Disorder: Longitudinal Versus Cross-Sectional Findings

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**Background:** Research aimed at understanding aging in adults with autism spectrum disorder (ASD) is growing, but critical longitudinal work in middle-age and older adults has yet to emerge. Adults with ASD have difficulty with tasks involving verbal memory compared with neurotypical (NT) adults. This may be related to differences in volume or integrity of the hippocampus and its primary structural connectivity pathway, the fornix.

**Objectives:** The aim of this study was to explore cross-sectional and longitudinal age-related differences in verbal learning, and short-term and long-term verbal memory, the volume of hippocampus, and fornix fractional anisotropy (FA) in adults with ASD, compared with a matched NT group.

**Methods:** Participants were 194 adults with (n=106; 74 male, 32 female) and without (n=88; 52 male, 36 female) ASD, ages 18-71. Participants who were 40-70 years of age (n=45; 37 male, 8 female) were evaluated at two time points two to three years apart. Hippocampal volume was measured via T1-weighted MRI with FreeSurfer. Fornix FA was measured from diffusion tensor imaging (DTI). Verbal learning and memory were measured with the Rey Auditory Verbal Learning Test (AVLT). For cross-sectional relationships with age, multi-variable regression analyses were conducted with diagnosis, age, diagnosis by age interaction, and sex as a covariate. For longitudinal analyses in middle-age and older adults, repeated measures ANCOVA were conducted with sex as a covariate.

**Results:** Cross-sectional analyses revealed short-term verbal memory and total word learning diagnosis main effects, with adults with ASD recalling fewer items than NT adults. For short-term verbal memory there was also a diagnosis by age interaction, with increasing age associated with worsening recall in NT adults only. However, in longitudinal analyses only middle-age and older adults with ASD declined in short-term verbal memory performance. Middle-age and older adults with ASD also had faster hippocampal shrinkage, compared to matched NT adults.

**Conclusions:** These preliminary longitudinal findings suggest age-related vulnerabilities in short-term verbal memory and hippocampal volume in middle-age and older adults with ASD, while cross-sectional findings suggest ASD protection from age-related declines in short-term verbal memory. Divergent cross-sectional versus longitudinal aging results could be due to cohort effects, underscoring the importance of longitudinal aging research in adults with ASD.

**417.071 (Poster)** Executive Functioning and Sleep in Children with ASD and Neurotypical Development

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**Background:** In children with autism spectrum disorder (ASD), sleep disturbance is highly prevalent and related to multiple areas of daytime functioning (Souders et al., 2017). Executive functioning (EF) is frequently impaired in ASD (Eylen et al., 2015) and is thought to be particularly sensitive to sleep disturbance in childhood due to its prolonged developmental maturation (Turnball et al., 2013). Empirical examination of sleep quality and executive functioning in ASD is sparse and mixed, and studies have predominantly relied on parent-report metrics (Cremone-Caira et al., 2019; Holingue et al., 2021). Research is needed to better understand these links using a multimethod approach, and to explore whether such associations may be unique to ASD.

**Objectives:** This study sought to 1) replicate higher levels of sleep problems and EF difficulties in children with ASD compared to neurotypical development (NTD) 2) examine associations between sleep and EF across children with ASD and NTD using a multi-method approach (i.e., parent report and direct testing) and 3) determine whether sleep-EF associations differ for children with or without ASD.

**Methods:** Participants included children with diagnoses of ASD (n=26; Age M=7.50, SD=2.18; 23% female; IQ M=83.31, SD=19.82) and NTD (n=21; Age M=5.67, SD=1.68; 33% female; IQ M=110.43, SD=12.14). Sleep problems were measured using the Children's Sleep Habits Questionnaire, Abbreviated. Executive functioning was captured with the Behavior Rating Inventory of Executive Functioning, Global Executive Composite (BRIEF-GEC) and the Tower of London, Total Score (ToL).

**Results:** The ASD and NTD groups differed on age and IQ, which were both related to variables of interest (Table 1); therefore, IQ and age were controlled in subsequent group-based analyses. Analysis of covariance (ANCOVA) controlling for age and IQ, revealed that on average, compared to the group with NTD, the group with ASD had higher levels of sleep problems ( $p < 0.05$ ) and greater EF difficulties on the BRIEF-GEC ( $p < 0.05$ ), but not significantly different ToL performance. Bivariate correlations indicated that more sleep problems were significantly related to greater reported EF difficulties (BRIEF-GEC) and demonstrated a marginal inverse association with poorer EF performance on the ToL across all participants (Table 1). Regression analyses predicting the BRIEF-GEC indicated direct effects of group and sleep problems, controlling for child IQ and age; the interaction between group and sleep problems was not significant (Table 2). For the model predicting ToL, effects of group, sleep problems, and their interaction were not significant (Table 2).

**Conclusions:** Parent-reported EF, but not direct testing of EF, revealed significant impairment in ASD and was associated with sleep problems similarly for both children with and without ASD. Sleep problems may have more meaningful implications for broad EF challenges observed by parents in daily life than maximal performance on a direct EF test of organization, planning, and inhibitory control. Improving child sleep quality may be an important avenue to support such EF difficulties for children who struggle in these areas. These findings will be discussed in relation to measurement and discrepancies in EF assessments. Future work should explore other metrics and specific domains of EF.

**417.072 (Poster)** Executive Functioning in Everyday Life in Children and Adolescents with Attention-Deficit/Hyperactivity Disorder and Autism Spectrum Disorders: A Two-Year Longitudinal Study

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**Background:** Problems with everyday executive functions (EF) are considered a hallmark of Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD). Little is known, however, about the developmental pathway of everyday EF in these two groups, and whether the two groups follow a similar or different course.

**Objectives:** To examine and compare the developmental trajectories of parent-reported EF problems from childhood into adolescence among children and adolescents with ADHD, ASD, and typically developing children and adolescents (TDC).

**Methods:** In this longitudinal study, children and adolescents with ADHD ( $n = 84$ ,  $M_{age} = 11.6$ ,  $SD = 2.0$ ), ASD ( $n = 38$ ,  $M_{age} = 12.0$ ,  $SD = 2.3$ ), and TDC ( $n = 50$ ,  $M_{age} = 11.6$ ,  $SD = 2.0$ ) were diagnosed and assessed with parent-ratings of everyday EF at baseline and two-year follow-up (97% retention). Between baseline and follow-ups, the groups received treatment as usual. We conducted Linear Mixed Models for analysis of the developmental trajectories of everyday EF.

**Results:** The youth with ADHD and those with ASD displayed elevated levels of everyday EF problems relative to the TDC at baseline (Hedges  $g = 1.99$  to  $2.99$ ). Over the two-year period, everyday EF improved in the children and adolescents with ADHD relative to the TDC, whereas those with ASD displayed no improvement relative to the TDC. At two-year follow-up, both those with ADHD and those with ASD continued to display elevated levels of everyday EF problems relative to the TDC (Hedges  $g = 1.61$  to  $3.19$ ).

**Conclusions:** Despite improved everyday EF in the ADHD group across time, both the ADHD and the ASD groups continued to display elevated levels of everyday EF compared to TD youth. These findings suggest that everyday EF could be an important treatment target in children and adolescents with either ADHD or ASD. Assessment of everyday EF should be routine when diagnosing and treating children with ADHD or ASD, and the results should be shared with their caregivers and teachers.

**Keywords:** Attention-Deficit/Hyperactivity Disorder, Autism Spectrum Disorder, Children, Adolescents, Executive Functions, BRIEF.

**417.073 (Poster)** Executive Functions As Predictors of ASD Youth Mental Health during COVID-19

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## **Background:**

Children with autism spectrum disorder (ASD) are at an increased risk for experiencing adverse psychosocial consequences of COVID-19 lockdown and social distancing. Recent research suggests that disruptions to routines necessitated by pandemic response have led to significant increases in the prevalence of psychopathology among youth with ASD.

Executive function (EF) skills are impaired in children with ASD, however, the profile of EF in autism is characterized by extensive heterogeneity. EF, a collection of cognitive processes that direct one's attention and behavior, has been identified as a predictor of mental health problems among youth. Children with ASD who have greater EF and cognitive flexibility ability show reduced anxiety and depression. Consistent with the impaired disengagement hypothesis, EF deficits may heighten the risk for psychopathology by inhibiting disengagement from negative thoughts and compromising one's ability to redirect behavior in a positive manner.

## **Objectives:**



The current study sought to explore the extent to which pre-pandemic levels of EF are associated with psychosocial outcomes in TD children and children with ASD during the COVID-19 pandemic. It was hypothesized that EF deficits would be associated with adverse psychosocial outcomes.

## Methods:

57 participants between 10 and 16 years of age ( $n_{ASD} = 25$ ,  $n_{TD} = 31$ ), underwent neuropsychological assessments before the onset of the pandemic including the Wechsler Abbreviated Scale of Intelligence (WASI II), Autism Diagnostic Observation Schedule (ADOS-2), Behavior Assessment System for Children (BASC-2), and the Behavior Rating Inventory of Executive Function (BRIEF). In July 2020, at the height of South Florida stay-at-home orders, participants completed the Social Psychological Measurements of COVID-19, The Perceived Stress Scale for Children (PSS-C), Screen for Child Anxiety and Related Emotional Disorders (SCARED), Mood and Feeling Questionnaire (MFQ) and The Child and the Youth Resilience Measure (CYRM). Multiple linear regressions were performed to investigate if pre-existing EF abilities predict anxiety and depressive symptoms during COVID-19. In each regression the covariates of age, IQ, and SES were entered in the model as fixed effects

## Results:

Examination of baseline symptoms in youth with ASD, compared with matched controls, demonstrate significantly elevated depression symptoms for children with ASD. Additionally, children with ASD experienced significantly elevated anxiety ( $F(1,54)=14.42$ ,  $p=0.003$ ) and depressive symptoms ( $F(1,54)=7.45$ ,  $p=0.009$ ) during the pandemic.

Pre-COVID working memory, inhibition, and emotional control EF abilities did not significantly predict COVID-related anxiety or depression. However, multiple regression analysis used to test if baseline cognitive flexibility, as assessed with the BRIEF Shift subscale, significantly predicted parent ratings of child anxiety. The results of the regression indicated that baseline cognitive flexibility explains 82.24% of the variance ( $R^2 = .82$ ,  $F = 1.46$ ,  $p = 0.24$ ). It was found that cognitive flexibility skills predicted anxiety ( $\beta = 1.04$ ,  $p = 0.02$ ) and depression ( $\beta = 1.04$ ,  $p = 0.09$ ) during COVID-19 lockdown.

## Conclusions:

In line with previous research associating greater cognitive flexibility with resilience, this study suggests that the Shift component of EF is associated with mental health status during the pandemic. Specifically, cognitive flexibility may be a factor contributing to resilient mental health outcomes in children with ASD.

**417.074 (Poster)** How Reliable Are the Parental Reports on Academic and Attention Performance of Children with Autism Spectrum Disorder? *C. S. Paula<sup>1</sup>, C. Mevorach<sup>2</sup>, R. Lowenthal<sup>3</sup>, J. Magalhães<sup>4</sup>, M. C. Teixeira<sup>1</sup> and M. Muller Spaniol<sup>5</sup>, (1)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil, (2)School of Psychology, University of Birmingham, Birmingham, United Kingdom, (3)Santa Casa Hospital, Sao Paulo, Brazil, (4)Mackenzie Presbyterian University, São Paulo, Brazil, (5)Developmental Disorders Program, Mackenzie Presbyterian University, Sao Paulo, Brazil*

**Background:** In low and middle-income countries, most diagnoses for Autism Spectrum Disorder (ASD), surveys, and evaluation of intervention outcomes use subjective measures from reports and questionnaires filled out by parents. However, parents' ratings and child performance were not correlated, and parents view can be influenced by a variety of aspects.

Besides, one aspect that appears less researched in ASD is attention skills, although attention is often atypical in this population and is closely linked to academic attainment, one of the main priorities for parents of children with ASD.

**Objectives:** to assess the concordance of parents' subjective evaluations of academic and attention performance in ASD children and adolescents with objective evaluations.

**Methods:** 32 children and adolescents (8-14 years) with ASD and their parents participated in the study. All participants were users of a public outpatient clinic in São Paulo city, Brazil. The children/adolescents completed the (1) School Performance Test (SPT), measuring performance in math, writing, and reading, and the (2) Attention Cancellation Test (ACT), measuring selective and alternating attention. Parents responded to three questionnaires related to to measure their children: (a) autistic symptoms and severity (Autism Behavior Checklist [ABC]), (b) school and attentional performance (a structured 5-point Likert-scale interview), (c) attentional deficits (Swanson, Nolan and Pelham questionnaire [SNAP-IV]). Spearman correlation coefficients were calculated to determine the degree of relationship between variables. Significance level was set at  $p < .05$ .

## Results:

Results show that overall academic performance from the SPT was significantly correlated with parents' ratings: in math ( $r = .553$ ;  $p = .001$ ), reading ( $r = .546$ ;  $p = .001$ ) and writing ( $r = .455$ ;  $p = .009$ ). In contrast, there was no clear association between children/adolescent's attention performance and parental reports (SNAP-IV) (all  $p$ -values higher than .05).

**Conclusions:** Overall academic parental rates were good predictors for child/adolescent performance in school which indicates that parents are involved and accurately alert of their children's activities in the school environment. On the other hand, it seems that parents have difficulties in perceiving attention deficits in their children. Thus, our results point to the need for direct measures with children/adolescents to assist in the diagnosis and treatment of ASD, particularly related to attention.

**417.075 (Poster)** Longitudinal Development of Real-World Executive Function Skills in Preschoolers with Autism Spectrum Disorder

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**Background:** Executive functioning (EF) skills such as remembering multiple steps in a task, adjusting to new environments, and staying organized are impacted in children with autism spectrum disorder (ASD). Parent-reported concerns begin as young as preschool (Smithson et al., 2013) and increase during school-age (Rosenthal et al., 2013). Given that there are important changes in EF during preschool (Zelazo, 2011), longitudinal measurement during this time can reveal when and in what domains real-world EF concerns emerge for children with ASD relative to their peers with developmental delays (DD) and typical development (TD).

**Objectives:** 1) Assess the stability of real-world EF as measured by the Behavior Rating Inventory of Executive Function – Preschool Version (BRIEF-P; Gioia et al., 2003) from early to late preschool in a sample of preschoolers with ASD, DD and TD; 2) compare the proportion of children with clinically significant EF concerns by age and diagnosis; and 3) determine which EF domains are subject to change over preschool in children with ASD.

**Methods:** Primary caregivers completed the BRIEF-P at Time 1 ( $M_{age}=38.7mo$ ) and Time 2 ( $M_{age}=61.6mo$ ) for 68 preschoolers with ASD ( $n=40$ ), DD ( $n=12$ ) and TD ( $n=16$ ). We examined T-scores ( $M=50$ ,  $SD=10$ ) from the Global Executive Composite (GEC) and the five BRIEF-P subscales: Inhibit, Shift, Working Memory (WM), Plan/Organize (PO), and Emotional Control (EC). Pearson's  $r$  correlations examined the association between Time 1 and Time 2 T-scores for the full sample and ASD group. Proportions of children with clinically significant EF difficulties (GEC T-score $>65$ ) were compared using tests of proportion. Within-subjects t-tests assessed change in T-scores over time in the ASD group.

**Results:** GEC and all subscale scores were positively correlated from Time 1 to Time 2 in the full sample (all  $r>.46$ ,  $p<.001$ ) and in the ASD group (all  $r>.43$ ,  $p<.01$ ). The proportion of children with clinically significant EF scores differed between ASD and TD at each time (Time 1:  $p<.001$ ,  $h=1.47$ ; Time 2:  $p<.001$ ,  $h=1.22$ ), but not between ASD and DD, nor were within-group changes in these proportions significant across time (Table 1). Within-subjects t-tests revealed significant increases (indicating greater difficulties) from Time 1 to Time 2 in GEC scores ( $p=.045$ ,  $d=.328$ ) and several subscales: PO ( $p=.014$ ,  $d=.405$ ), EC ( $p=.002$ ,  $d=.522$ ), and a marginal increase in Inhibition ( $p=.058$ ,  $d=.308$ ; Figure 1).

**Conclusions:** These findings suggest that individual differences in real world EF skills are stable from early to late preschool in children with TD, DD and ASD. In both early and late preschool, approximately 50% of children with ASD fell in the clinically significant range, complementing prior findings which collapsed across preschool (Smithson et al., 2013). The extent of EF difficulties increased for children with ASD compared to the normative sample across preschool, driven by changes in planning, organizing and emotional control skills. Given that preschool EF skills are predictive of children's school readiness (Pellicano et al. 2017), designing specific supports for children with ASD to develop planning, organizing, inhibition, and emotional control skills may help mitigate any worsening and prepare children for school entry.

**417.076 (Poster)** Preliminary Results on the Role of Emotional Difficulties in the Academic Success of Adolescents with ASD

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**Background:** There is significant variability in the academic achievements of young people with autism spectrum disorder (ASD; Keen et al., 2016). Some perform as expected, given their symptomatology and IQ and might perform better in some tasks such as visual reasoning (Mayes-Dickerson & Calhoun, 2003). Many, however, perform worse academically than their IQ would predict (Manti et al., 2011). For those with ASD with high IQs, the variability in academic achievement is even higher, some perform well in mainstream schools, while others need to attend special education settings (Church et al., 2000). This variability in the academic success of people with ASD might be due to several external factors such as pedagogical practices and curriculum type (Keen et al., 2016) but may also be due to internal factors such as emotional difficulties. Indeed, emotional ability is closely linked to academic readiness (Blair, 2012) and even though not all people with ASD have emotional impairments, these are far more common among those with ASD than among typically developing (TD) people (Nuske et al. 2013).

**Objectives:** To analyze the relationship between the emotional ability of adolescents with ASD and their academic achievement.

**Methods:** 39 German-speaking parents (38 mothers) reported online on the emotional ability and academic achievement of their adolescent children (29 ASD, 10 TD). The adolescents were aged between 10 and 19 years ( $M_{age}=14.36$ ;  $SD_{age}=2.03$ ), 25 were male and 14 female. Parents indicated the diagnosis of their children and reported autistic traits using the Autism Spectrum Quotient (AQ) Adolescent version (Baron-Cohen et al., 2006). Parents reported on a 6-point Likert scale their children's academic performance in German (mother tongue), arithmetic or mathematics, general knowledge, history or social studies, science, and foreign languages. To assess the adolescents' emotional ability, parents answered the Emotionale-Kompetenz-Fragebogen (EKF; Rindermann (2009) [eng. Emotional Competence Questionnaire] and a German version of the Children's Alexithymia Measure (CAM; Way et al. 2010).

**Results:** The analyses showed that adolescents with ASD were reported by their parents as having more autistic traits [ $t(37)=9.64$ ,  $p<.001$ ], less overall emotional competence [ $t(37)=4.31$ ,  $p<.001$ ], and scoring higher in alexithymia [ $t(37)=3.10$ ,  $p<.001$ ] than TD adolescents. However, they did not differ in academic performance [ $t(35)=0.28$ ,  $p=.78$ ]. Regression analyses conducted to understand the contribution of emotional difficulties to academic performance revealed that alexithymia was the only significant predictor: being reported by the parents as having higher alexithymia significantly predicted lower academic performance (Table 1).

Conclusions: Adolescents with ASD were reported by their parents as having more emotional difficulties than TD adolescents but they did not differ in terms of academic performance. However, looking at predictors of academic performance, alexithymia revealed to be a significant contributor. These preliminary results, based on a small sample of parent reports suggests that difficulties with emotional awareness, which are common among people with ASD, might be an important aspect to consider in regards to understanding the academic achievement of youth with ASD and their frequently encountered difficulties in school.

**417.077 (Poster)** Puppets Facilitate Attention to Social Cues in Children with ASD

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**Background:**

Diminished visual attention to faces of social partners represents an early characteristic of ASD. Early intervention programs incorporate enhancing attention to social partners as one of their goals (Kasari et al., 2010; Rogers et al., 2012). Anecdotally, children with ASD are thought to be attracted to puppet characters, though visual attention to puppets has never been studied empirically. Here we examined how attention to puppets as social agents may differ from attention to human social agents in young children with ASD.

**Objectives:**

1) Examine attention to faces as a function of a speaker (puppet versus human) and diagnosis (ASD vs. typical development (TD)) in response to a video-recorded interaction between a puppet and a human speaker; 2) Evaluate links between speaker preference and severity of autism symptoms.

**Methods:**

Young children with ASD (N=37; M<sub>age</sub>=49.44 months) and TD (N=27; M<sub>age</sub>=40.66 months) viewed a video of a puppet and a human engaged in a conversation (Figure 1). Dwell time on these faces (%HumanFace, %PuppetFace) was quantified via eye-tracking and analyzed using group (2) by speaker identity condition (Human Speaker, Puppet Speaker) (2) linear mixed models (LMM). Speaker preference proportions were calculated and correlations with autism symptom severity (ADOS) were computed.

**Results:**

LMM analysis of %HumanFace indicated a significant group x condition interaction ( $p < 0.01$ ). The speaker effect on %Human Face was lower in ASD than in TD ( $p < 0.01$ ). In contrast, analysis of %PuppetFace showed only the expected speaker effect ( $p < 0.001$ ), but no significant group effect or interaction (Fig2b). These results suggest that attention to a human speaker's face was diminished in ASD but attention to a puppet speaker's face was comparable to that observed in TD peers. Furthermore, TD children showed a preference for both speakers' faces ( $ps < .001$ ); children with ASD only showed a preference when the puppet spoke ( $p < .001$ ) (Figure 2). In the Human Speaker condition, lower attention to the human's face was associated with higher autism symptom severity ( $r = 0.37, p = 0.024$ ) while in the Puppet Speaker condition, there were no significant associations between speaker preference proportion and ADOS severity.

**Conclusions:**

Unlike humans, expressive and verbal puppets attracted the attention of children with ASD at levels comparable to that of TD controls. There was no evidence that the preference for the puppet speaker was associated with severity of autism symptoms, suggesting that children more severely impacted by autism are just as likely to attend to puppets as those with less severe autism symptoms. Considering that puppets can engage in reciprocal interactions and deliver simplified, salient social-communicative cues, they may facilitate therapeutic efforts in children with ASD. Puppets could enhance motivation to engage in social exchanges and provide a bridge to understanding human social cues for all children with ASD, regardless of their level of impairment.

**417.078 (Poster)** Self-Regulation, Academic Learning Rates, and School Performance in Preschoolers with Autism Spectrum Disorder

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**Background:** Delay in self-regulation represents a significant challenge for children with autism spectrum disorder (ASD). They also demonstrate academic difficulties and underachievement compared to typically developing peers. It has been well-documented that typical children with greater self-regulation have better academic achievement (e.g., Blair & Razza, 2007). However, few studies have examined this association in individuals with ASD. Moreover, most previous work solely relied on standardized assessments to reflect children's temporary learning *outcomes* rather than their dynamic learning *process*. Little is known about how children's self-regulation is related to how they learn.

**Objectives:** This study examined how self-regulation in children with ASD, including executive function (EF) and effortful control (EC), was linked to their academic learning process and investigated the mechanisms underlying this association. Long-term school data of multiple literacy and mathematics programs were derived to reflect the dynamic learning process of children with ASD.

**Methods:** Thirty-two preschoolers with ASD from two specialized preschools in New York participated in this study ( $M_{age} = 51.35$  months,  $SD = 7.59$ , range from 36–68 months). Each participant had a clinical diagnosis of autism that was confirmed with the Autism Diagnostic Observation Schedule (Lord et al., 2012). Participants' EF skills were measured directly through the NIH Toolbox Cognition Battery (Gershon et al., 2013) and were reported by parents on the Behavior Rating Inventory of Executive Function-Preschool Version (Gioia et al., 2000). Parents also reported children's EC through the Child Behavior Questionnaire-Short Form (Putnam & Rothbart, 2006) and reward sensitivity through the Sensitivity to Punishment and Reward Questionnaire for Children (Colder & O'Connor, 2004). Teachers reported participants' school engagement on the Teacher Rating Scale of School Adjustment (Birch & Ladd, 1997) and adaptive behavior through the Vineland-3 Teacher Form (Sparrow et al., 2016).

**Results:** Children with higher overall EF levels demonstrated greater behavior engagement in school activities ( $r = .40$ ,  $p = .02$ ) and better adaptive behavior at school ( $r = .44$ ,  $p = .02$ ). Those with better inhibitory control and attention had better communication and reciprocal social interaction ( $r = .40$ ,  $p = .03$ ). Similarly, participants with better EC demonstrated better adaptive behavior ( $r = .45$ ,  $p = .02$ ) and socialization ( $r = .43$ ,  $p = .02$ ) at school. In terms of literacy learning, children with better emotional control achieved literacy learning objectives faster ( $r = -.42$ ,  $p = .03$ ). Those with better inhibitory control and attention learned new words faster ( $r = .60$ ,  $p = .02$ ). In terms of mathematics learning, children with higher overall EF levels achieved mathematics learning objectives faster ( $r = -.54$ ,  $p = .01$ ). Specifically, those with better working memory learned math concepts and mastered problem-solving skills faster ( $r = -.54$ ,  $p = .01$ ). See Table 1. Further analyses showed that the relation between self-regulation and academic learning was moderated by behavior school engagement and reward sensitivity. See Figure 1.

**Conclusions:** Self-regulation emerged as a potential protective factor for children with ASD in their school success in terms of engagement and adaptive level as well as academic learning rates. School engagement and reward sensitivity were two main factors that facilitated academic learning in children with ASD. Future interventions are recommended to focus on these areas to promote academic learning and school success in children with ASD.

**417.079 (Poster)** Short- and Long-Term Melodic Memory of Children on the Autism Spectrum of Varying Mental Ages.

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**Background:** Children on the autism spectrum (AS) display typical or better levels of music perception on tasks of pitch and melodic discrimination and identification, indicating strong processing of local-level information (pitch) without impairment of global processing (melody). These findings are congruent with the Enhanced Perceptual Functioning theory. The aim of the current study was to extend the long-term music memory findings from single notes (Heaton et al., 1998) and the long- and short-term music memory findings by Stanutz et al. (2014) on a pitch discrimination and melodic memory task. We tested participants' long-term ability to remember a melody in a specific key to differentiate between local and global processing in a melodic context.

**Objectives:** Investigate and compare pitch and melodic memory children on the AS with varying mental ages (MAs) and among typically developing (TD) children.

**Methods:** Three groups of children, aged 7–13 years, participated in this study. They included groups of children on the AS with lower ( $N = 9$ ) and higher ( $N = 10$ ) verbal, nonverbal, and auditory working memory MAs, and one comparison group of TD children ( $N = 14$ ) matched on verbal, nonverbal, and auditory working memory MAs to the AS subgroup with higher MAs. In the first session (Melodic Learning Task), the participants learned four melodies in specific keys that were each paired with a picture of a specific animal. One week later (Music Memory Task), they were presented each of the four melodies in the original key and two new transposed keys. The participants were then asked to identify 1) the key in which they originally learned each melody; and 2) the animal with which each melody was paired. MA was derived from WASI-II and WISC-V. Musical experience of participants was accounted for. Participants with AS were assessed with the Autism Diagnostic Observation Schedule, 2<sup>nd</sup> edition (ADOS-2) to confirm diagnosis. The parents completed the Social Responsiveness Scale, 2<sup>nd</sup> edition (SRS-2) and the Social Communication Questionnaire Lifetime version (SCQ-L) to describe the autism symptomatology among the participants on the AS and to ensure that the TD children did not present with signs of autism (below cut-off T-score of 60 on the SRS-2, or 11 on the SCQ).

**Results:** The analyses revealed 1) comparable accuracy at different points in the learning task and between groups, indicating comparable ability for all three groups to learn melodies (Figure 1); and 2) comparable performance in the retention of pitch and melody in long-term memory across all three groups (Figure 2).

**Conclusions:** We found comparable short-term melodic memory and melodic learning and long-term pitch and melodic memory between children on the AS and TD children. These findings also extend to children on the AS with lower MA, especially when verbal demands are minimized as in our long-term pitch memory task. The findings that children on the AS process music well supports both the increasing popularity of music education with this population and the importance of the inclusion of groups of different MAs in research on persons on the AS.

**417.080 (Poster)** The Relationship between Repetitive Behaviors and Concurrent Executive Function Demands in Children with Autism Spectrum Disorder

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**Background:** It has been previously theorized that impairments in executive function (EF) contribute to the manifestation of repetitive behaviors and restricted interests (RBRI) symptomatology in individuals with autism spectrum disorder (ASD). Past research examining this issue, however, has yielded mixed results. Prior studies that have utilized broad measures of EF have generally yielded positive results; whereas studies that employed measures thought to primarily tap an isolated component of EF often have not.

**Objectives:** Presently, we tested the hypothesis that the strength of the relationship between EF task performance and day-to-day manifestations of RBRI is moderated by the degree to the task places concurrent demands on multiple aspects of EF.

**Methods:** An eye movement task was used to evaluate inhibitory control and task switching ability (both together and in isolation) in a sample of 22 children and adolescents (mean age: 14.4 years) with ASD. The severity of RBRI symptoms exhibited by participants was assessed using the Repetitive Behavior Scale-Revised (RBS-R; Bodfish et al., 2000).

**Results:** A significant relationship was seen between RBS-R scores and task performance under conditions that placed simultaneous demands on multiple EF processes (both inhibitory control and task switching) [ $p^2 = 0.25$ ,  $t(16) = 2.32$ ,  $p = 0.03$ ]. No relationship, however, was seen between RBS-R scores and task performance when demands were placed on only one EF process, in the switching only condition [ $p^2 = 0.09$ ,  $t(16) = 1.27$ ,  $p = 0.22$ ] or inhibition only condition [ $p^2 = 0.04$ ,  $t(16) < 1$ ,  $p = 0.42$ ].

**Conclusions:** The present findings provide support for the theory that impairments in EF contribute to the manifestation of RBRI symptoms in individuals with ASD. Furthermore, they suggest that the strength of the relationship between these two phenomena is dependent on the multiplicity, rather than the magnitude, of the demands under which EF is assessed.

#### **417.081 (Poster)** The Role of Autism Core Features and Inhibitory Control in Parent-Child Interactions across FXS Versus ASD

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**Background:** Fragile X syndrome (FXS) is a single gene disorder characterized by high prevalence of autism spectrum disorder (ASD) and inhibitory control (IC) deficits. IC deficits are also indicated in individuals with idiopathic ASD. Both ASD symptoms and IC deficits contribute to difficulties with interpersonal communication. Our previous work has demonstrated child ASD symptoms and poor IC interact to predict dysfunctional parent-child interactions in families of children with FXS.

**Objectives:** This study examined whether ASD symptom domains, namely atypical social affect (SA) and restricted and repetitive behaviors (RRB), and IC differentially predict parent-child dysfunctional interactions (PCDI) in children with FXS compared to children with idiopathic ASD with developmental delay. Additionally, we explored the relation between IC and each ASD symptom domain in both groups.

**Methods:** Participants included 51 children with FXS (14 females;  $M(SD)$  age = 44.96(11.93) months) and 46 chronological age-matched children with idiopathic ASD (7 females;  $M(SD)$  age = 44.96(11.61) months) and their mothers. IC was measured via the Early Childhood Behavior Questionnaire (18-36 months) or the Children's Behavior Questionnaire (>36 months). PCDI was assessed via Parenting Stress Index-SF. SA and RRB domains were assessed via the Autism Diagnostic Observation Schedule-2. PCDI was log transformed and RRB was cubed. Three multiple linear regression models predicting PCDI were tested with group, child variable (i.e., IC, SA, RRB), and group\*child variable terms and FXS as the reference group. Nonverbal developmental quotient, derived from the Mullen Scales of Early Learning, was included in initial models however did not significantly predict PCDI and was therefore excluded from final models. Pearson's correlations between child variables were tested across groups separately.

**Results:** Results from the model testing whether IC predicted PCDI showed a significant main effect of IC, ( $t(88) = -5.29$ ,  $p < .001$ ,  $b = -0.22$ ), and a significant IC\*group interaction, ( $t(88) = -2.32$ ,  $p = .023$ ,  $b = -0.15$ ), accounting for 24% of variance in PCDI. Results from the model testing the effects of SA on PCDI indicated a significant main effect of SA ( $t(92) = 2.82$ ,  $p = .006$ ,  $b = 0.05$ , adjusted  $R^2 = .06$ ). Results from the model testing whether RRB predicted PCDI also identified a significant main effect of repetitive behaviors ( $t(92) = 4.17$ ,  $p < .001$ ,  $b = 0.0005$ , adjusted  $R^2 = .17$ ). Pearson's correlations indicated significant associations between IC and atypical social affect, ( $r(46) = -.42$ ,  $p = .003$ ), and IC and repetitive behaviors, ( $r(46) = -.54$ ,  $p < .001$ ), for the FXS group only.

**Conclusions:** Associations between greater IC with lower atypical social affect, repetitive behaviors, and parent-child dysfunctional interactions were specific to the FXS group, whereas greater repetitive behaviors were associated with greater parent-child dysfunctional interactions across FXS and ASD groups. These findings suggest that interventions targeting IC may be associated with broader positive outcomes for children with FXS and their families, including potential reduction of ASD symptoms and dysfunctional interactions. Rather, treatment focused directly on reduction of repetitive behaviors may contribute to more harmonious family dynamics in both groups. Findings suggest IC may have an important role in the characterization of ASD in FXS, though it may be less central to the expression of ASD symptoms in the general population.

### **VIRTUAL POSTER SESSION — COGNITION: ATTENTION, LEARNING, MEMORY**

#### **517 - Cognition: Attention, Learning, Memory --- (V)**

**517.062 (Virtual Poster)** A Follow-up Study on School-Age Outcomes of Children Born Very Preterm

#### Background:

An elevated likelihood to develop autism spectrum disorder (ASD) or the broader autism phenotype (BAP) has been observed in children born very preterm (VP; Vermeirsch et al., 2021). In addition, prevalence rates of cognitive impairment (Roze et al., 2021), executive dysfunctions (Mulder et al., 2011) and internalizing and externalizing problem behavior (Bhutta et al., 2002) are higher in VP- than in term-born (TB) children. It could be expected that these difficulties are even more pronounced in VP-children with more severe levels of ASD symptoms. Although prospective studies could provide valuable knowledge on this association and other early markers of school-age difficulties, longitudinal studies on the broad functioning of VP-children, while taking symptoms of ASD into account, have not yet been conducted.

#### Objectives:

To examine the cognitive-, behavioral and social-emotional functioning of VP-children at school-age, and to explore the predictive value of autism symptom severity at age three.

#### Methods:

67 VP-children and 36 TB-children without first-degree relative with ASD were previously followed from 5 to 36 months old. To date, 24% of them participated in a follow-up moment at school-age. More specifically, the current school-aged sample includes 16 VP-children (6 girls; mean age=8.90 years, sd=.30; mean gestational age=26.69 weeks, sd=1.25; mean birth weight=1028.44 g, sd=274.81) and 9 TB-children (6 girls, mean age=8.89 years, sd=.24). At the age of three, 2 of the VP-children (12.5%) had a BAP outcome, while 2 others (12.5%) received a best-estimate research diagnosis of ASD and/or had a clinical diagnosis at follow-up.

At school-age, the WISC-V intelligence test was administered and questionnaires on social-emotional wellbeing were filled out by the child. Executive functioning (planning, flexibility, inhibition and sustained attention) was assessed through the Color-Word Interference Test of the Delis-Kaplan Executive Function System (D-KEFS) and subtests of the Cambridge Neuropsychological Test Automated Battery (CANTAB).

#### Results:

First, the two groups were compared on all school-age outcomes. Preliminary results showed no significant differences in terms of depression, anxiety, self-esteem, number of friends, inhibition, total IQ or index scores (Verbal Comprehension, Visual Spatial index, Fluid Reasoning, Working Memory and Processing Speed). However, (marginally) significant differences in favor of the TB-group were detected on the CANTAB, more specifically on sustained attention (Rapid Visual Information Processing subtest;  $p=.025$ ), planning (Stockings of Cambridge subtest;  $p=.095$ ) and flexibility (Intra-Extra Dimensional Set Shift subtest;  $p=.057$ ). VP-children also reported to be bullied more often than TB-children ( $p=.079$ ).

Second, associations between ADOS-2 Calibrated Severity Scores of the VP-group at age three and the different school-age outcome variables were investigated. No correlations, however, could be observed.

#### Conclusions:

Although the VP-group scored slightly less favorable on all cognitive, social-emotional and behavioral outcomes, only the differences on executive functioning as assessed with the CANTAB were (marginally) significant. In this preliminary sample, severity of early autism symptoms was not predictive for school-age functioning.

At the conference, results of the full sample of 77 participants will be presented and clinical implications will be discussed. The results of the VP-children with ASD/BAP will furthermore be compared to those of the VP-children without ASD/BAP.

#### **517.063** (Virtual Poster) Category Learning Strategy in Autism Spectrum Disorders (ASD)

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#### Background:

Learning concepts that generalize to novel information, such as categories, is important for adaptive functioning. Difficulty with generalization in ASD has been attributed to a preference for detailed processing over integration or to rigidity in behavior; whether it is due to atypical learning has received less attention. While few, studies of category learning in ASD reveal mixed results, and provide little insight into why some children acquire generalizable category knowledge and others do not. Here, we explored variation in learning strategy by applying formal categorization models to

individual accuracy data in a perceptual category learning task, to fit models for representation of individual instances (exemplar-based) and their central tendency (prototype-based) in typically developing (TD) youth and those with ASD.

#### Objectives:

To characterize category learning strategies in autistic and typically developing youth.

#### Methods:

Participants were 46 youth with (n=24; males = 21) and without (n=22; males = 15) ASD, who were 14-18 years old (ASD M=15.77, SD=1.05; TD M=15.73, SD= .96) with normal intelligence (ASD M=105.92, SD=16.17; TD M=107.93, SD=10.14). Participants with autism met DSM-5 criteria based on the SCQ and/or ADOS-2, and those without autism had no diagnoses or active treatment for developmental or mental health conditions.

Over zoom, participants classified cartoon fish, bugs, or butterflies, into two “families” through feedback over 5 blocks in a training phase followed by a generalization phase with new exemplars. Training exemplars differed from prototypes by 2 features, whereas generalization exemplars differed from prototypes by 0, 1, 2, or 3 features. Accuracy was assessed with ANCOVAs including gender and age as covariates and between-subjects factor of group and within-subjects factor of block (1-5) at training and feature-away-from-prototype (0, 1, 2, 3) at generalization. For each participant, categorization models were fit to the generalization phase according to Bowman & Zeithamova (2018; J Neurosci, 38, 2605-2614). and superiority of prototype or exemplar fit was tested using Monte Carlo simulation; chi square assessed whether the number of participants with an exemplar, prototype, or no reliable strategy differed by group.

#### Results:

At training, accuracy was above chance in both groups for each block, and did not differ significantly between groups or by block. At generalization, Group X feature-away interaction approached significance ( $F(3, 39)= 3.91, p=.055$ ) such that the magnitude of group difference in accuracy was largest in the prototype condition – 0-feature-away (ASD M=72.1%; TD M=86.6%,  $t(44)=1.6, p=.049, d=.14$ ) and smallest in the 3-feature-away condition (ASD M=54.1%; TD M=59.3,  $p=.12, d=.05$ ); no other effects were significant. Further, 17 TD had a prototype-based learning strategy while only 10 ASD had a prototype-based strategy, these differences were shown at a significant level (chi square = 6.00,  $df=1, p=.01$ ).

#### Conclusions:

Results are suggestive of atypical prototype-based category learning in ASD based on qualitative observation of lower accuracy for prototype stimuli and fewer number of youth with superior model fits. This study is ongoing and larger samples will determine whether our observations are reliable.

#### **517.064** (Virtual Poster) Contextual Information Modulates Pupil Size in Autistic Children

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#### Background:

Recent Bayesian models suggest that perception is more “data-driven” and less dependent on contextual information in autistic individuals than others. However, experimental tests of this hypothesis have given mixed results, possibly due to the lack of objectivity of the self-report methods typically employed. Here we introduce an objective no-report paradigm based on pupillometry to assess the processing of contextual information in autistic children and a comparison clinical group.

#### Objectives:

In the present study, we used a no-report pupillometry paradigm to assess processing of contextual information in autistic children and a comparison group. Specifically, we tested whether a pictorial representation of the sun would lead to pupillary constriction when compared with control images.

#### Methods:

After validating (in a group of neurotypical adults) a child-friendly pupillometric paradigm, in which we embedded test images within an animation movie that participants watched passively, we compared pupillary response to images of the sun and meaningless control images in children with autism versus age- and IQ-matched children presenting developmental disorders unrelated to the autistic spectrum.

#### Results:

Both clinical groups showed stronger pupillary constriction for the sun images compared with control images, like the neurotypical adults. There was no detectable difference between autistic children and the comparison group (in spite of a significant difference in pupillary light responses, enhanced in the autistic group).

#### Conclusions:

Our report introduces an objective technique for studying perception in clinical samples and children. The lack of statistically significant group differences in our tests suggests that autistic children and the comparison group do not show large differences in perception of these stimuli. This opens the way to further studies testing contextual processing at other levels of perception.

#### **517.065 (Virtual Poster)** Executive Function As a Generalized Determinant of Psychopathology and Functional Outcome in School-Aged Autism Spectrum Disorder

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**Background:** Individuals with autism spectrum disorder (ASD) are challenged not only by the defining features of social-communication deficit and restricted repetitive behavior, but also by a myriad of psychopathology varying in severity that causes functional impairment. Different cognitive deficits mediate the development of psychopathology, which could be subjected to intervention to alter the course of the disorder. Understanding domain-specific mediating effects of cognition is essential to develop targeted intervention strategies. However, the high degree of inter-correlation among different cognitive functions hinders elucidation of individual effects.

**Objectives:** To investigate domain-specific mediating effects of neurocognition on dimensional psychopathology and functional level in school-aged ASD.

**Methods:** In the Philadelphia Neurodevelopmental Cohort (PNC), 218 individuals with ASD were identified to match with 872 non-ASD controls on sex, age and socioeconomic status. The participants of this cohort were deeply and broadly phenotyped on neurocognitive abilities and dimensional psychopathology. Using structural equation modelling, inter-correlation among cognitive domains were adjusted before mediation analysis on outcomes of multi-domain psychopathology and functional level.

**Results:** While social cognition, complex cognition and memory each had a unique pattern of mediating effect on psychopathology domains in ASD, none had a significant effect on functional level. In contrast, executive function was the only cognitive domain that exerted a generalized negative impact on every psychopathology domain (P factor, Anxious-Misery, Psychosis, Fear and Externalizing), as well as functional level (measured by Children's Global Assessment Scale).

**Conclusions:** Relative to other cognitive domains, executive function has a unique role in determining severity of comorbid psychopathology in ASD and could be a target of intervention. As executive dysfunction occurs variably in ASD, our result also supports the clinical utility of assessing executive function for prognostic purposes.

#### **517.066 (Virtual Poster)** Executive Function As a Predictor of Academic and Social Outcomes in Kindergarteners with ASD

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**Background:** Executive function (EF) refers to the ability to self-monitor and flexibly adapt one's behavior in response to changes in the internal or external environment. Previous studies have suggested that elements of EF, including response inhibition, predict later mathematics and reading performance. Investigating how the trajectories of EF affect the development of functional skills such as academic and social skills can inform interventions targeting EF skills as early as the preschool years.

**Objectives:** Examine how kindergarten-entry EF is associated with academic and social skills across the kindergarten year in young children with ASD.

**Methods:** Participants included 62 cognitively able children with ASD assessed at kindergarten-entry (13 females;  $M_{age} = 63.8$  months;  $SD_{age} = 5.1$  months). EF was measured using a child-friendly, tablet-based battery of executive function tasks (EF Touch; Willoughby et al., 2010), including Spatial Conflict Arrows (SCA; inhibitory control), Something's the Same (STS; attention shifting), and Pick the Picture (PTP; working memory). Subtests of the Woodcock Johnson III Tests of Achievement (WJ; Woodcock et al., 2001) were used to measure children's reading and math skills (i.e., Passage Comprehension; Applied Problems). Children's peer play interactions (i.e., Play Interaction) were assessed via caregiver report on the Penn Interactive Peer Play Scale (PIPPS; Fantuzzo & McWayne, 2002). Generalized linear mixed models were performed to evaluate the effects of EF as a predictor of academic achievement and social functioning over time while controlling for baseline cognitive ability (i.e., nonverbal IQ [NVIQ]). When significant predictors emerged, we subsequently conducted separate analyses for each EF construct and its interaction with time.

**Results:** Passage Comprehension performance was significantly predicted by time ( $F[1, 119]=69.08, p < .001$ ) and SCA ( $F[1, 119]=5.79, p=.018$ ). Performance on Applied Problems was significantly predicted by time ( $F[1, 119]=77.72, p < .001$ ), SCA ( $F[1, 119]=.006, p=.006$ ), STS ( $F[1, 119]=10.25, p=.002$ ), and baseline NVIQ ( $F[1, 119]=7.62, p=.007$ ). Play Interaction was significantly predicted by time ( $F[1, 117]=4.65, p=.033$ ). In



subsequent models with interaction terms included, we found a significant interaction between SCA and time ( $F[1, 118]=4.07, p=.046$ ) for Play Interaction; post hoc investigation with low vs. high SCA group (based on a median split) showed that children with lower SCA at kindergarten entry still made improvements in Play Interaction while children with higher SCA showed stability in their play skills over time.

**Conclusions:** Lower EF skills at kindergarten entry predict lower academic skills across the kindergarten year, even when accounting for baseline cognitive ability. The results suggest that targeting EF prior to school entry may encourage greater success in kindergarten for cognitively-able children with ASD. Furthermore, examining other protective factors for social development in children with ASD over the kindergarten year will be crucial as children with lower levels of inhibitory control at kindergarten entry still showed improvements over time with regard to play interaction.

**517.067 (Virtual Poster)** Gaze Behaviors in Children with Autism Spectrum Disorder and the Impact of Parental Gaze Behaviors on Joint Attention  
*E. S. Perkovich<sup>1</sup>, S. S. Mire<sup>2</sup>, L. Sun<sup>1</sup>, A. L. Laakman<sup>2</sup>, G. J. Sakyi<sup>2</sup>, U. Sakhuja<sup>1</sup>, S. Lagbenro<sup>1</sup> and H. Yoshida<sup>1</sup>, (1)Psychology, University of Houston, Houston, TX, (2)Psychological, Health, and Learning Sciences, University of Houston, Houston, TX*

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**Background:** Social communication difficulties in autism spectrum disorder (ASD) include limited attention to referential cues (including social gaze, gaze/point following, joint attention (JA), and gestures). Attentional behavior differences between children with ASD and typically-developing (TD) children are often studied during screen-based tasks without parental involvement; however, some researchers have suggested that child attentional experiences are scaffolded by parents' behaviors and should be studied in the context of this interaction. Limited research has examined this possibility, but parent-worn eye-trackers during play-sessions with their child may reveal subtle scaffolding behaviors that facilitate child attention.

**Objectives:** This study aims to assess 1) similarities and differences in attentional behaviors to targets between children with ASD and TD children, 2) similarities and differences in attentional behaviors to targets between parents of children with ASD and parents of TD children, and 3) to what extent parental gaze impacts child's JA during a natural task with head-mounted eye-trackers.

**Methods:** Thirteen ASD ( $M=68.26$  months,  $SD=20.61$  months, 3 females) and thirteen TD ( $M=53.41$  months,  $SD=11.75$  months, 7 females) parent-child dyads participated in 5.33-minute semi-naturalistic play-sessions while wearing head-mounted eye-trackers, generating 9804.837 frames on average for children and 10,006.919 frames on average for parents for statistical analyses. Gaze-to-target (objects, hands, face) data was coded for frequency and duration and annotated for saccades (<200 milliseconds), fixation (200-2000 milliseconds), and sustained attention (>2000 milliseconds), JA, and attention-shifting. Group comparisons were analyzed via t-tests and predictiveness between parent attention and child's JA was analyzed via linear regression.

**Results:** Child Attention: No significant group differences. Both groups distributed their attention similarly to the targets with that frequency order; objects>parent hands>parent face>child hands. Children in both groups most frequently exhibited saccades and spent the most time in fixation.

Parent Attention: TD parents demonstrated more fixations ( $p=0.025$ ), particularly to objects ( $p=0.011$ ), and longer looking time at objects ( $p=0.025$ ); they also made more attention shifts between their children's faces and objects ( $p=0.010$ ). ASD parents had a higher frequency of attention shifting between their own hands and their children ( $p=0.044$ ), particularly their children's faces ( $p=0.037$ ).

Parental Impact: Parents' target- ( $\beta=3.11, p=0.038$ ) and hand- ( $\beta=1.04, p=0.012$ ) looking frequency and object-looking ( $\beta=668.59, p=0.007$ ) duration are significantly predictive of their children's JA frequency; hand-looking frequency ( $\beta=.0059, p=0.030$ ) and object-looking duration ( $\beta=4.36, p=0.004$ ) are significantly predictive of their children's JA duration. ASD parents' child-looking frequency is significantly predictive of the frequency ( $\beta=.2, p=0.040$ ) and duration ( $\beta=24.94, p=0.027$ ) of their children's JA. TD parents' object-looking duration is significantly predictive of both the frequency ( $\beta=.0011, p=0.010$ ) and duration ( $\beta=.18, p=0.021$ ) of their children's JA.

**Conclusions:** While previous work on screen-based tasks suggests differences in gaze behaviors of children with ASD and TD children when using naturalistic interactive context, we observed similar gaze behaviors and that parental attention supports children's visual experiences. Specifically, we observed that ASD parents focused more on their children's faces and TD parents focused more on objects. Our work sheds light on the impact of social context and parental involvement on children's early attention, a facilitator of learning.

**517.068 (Virtual Poster)** Müller-Lyer Illusion Susceptibility Is Conditionally Predicted By Autistic Trait Expression  
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**Background:** The Müller-Lyer Illusion (ML) is a visual illusion that biases size estimation. ML figures feature central lines where each figure has two inward pointing, or two outward pointing arrows, on either end. Inward pointing arrows impose a perceptual bias where the line appears shorter, whereas outward pointing arrows impose a lengthening bias. Illusory bias can be assessed using a variety of methods inducing different degrees of bias. There is also some evidence that autistic individuals are less likely than neurotypicals to perceive illusory biases when the bias relies on environmental experience. It has also been suggested that autistic individuals, relative to neurotypicals, tend to rely on present stimuli more heavily over past stimuli. Varying levels of autistic trait expression have also been proposed to modulate susceptibility to illusions. The Autism Quotient (AQ) and Systemizing Quotient (SQ) questionnaires are validated self-report measures quantifying autistic trait expression and systemizing ability in neurotypicals.

**Objectives:** Taking the perspective that human perception and (inter)actions reciprocally influence one another, the current study aimed to determine if perceptions of illusory size bias in the ML negatively correlate with autistic trait expression in neurotypicals, and the extent to which varying methods of illusion presentation change both that relationship and the magnitude of illusory bias.

**Methods:** Thirty neurotypical adults (15 cis-female; 15 cis-male) completed both questionnaires and four size estimation tasks through a computer-based remotely conducted experiment. Tasks 1 and 2 featured 144 trials each and involved perceptual discrimination of ML figure sizes with concurrent and successive presentation. In Task 3, participants adjusted the length of a non-illusory line to match its length to an illusory target ML figure's central line over 128 trials. For Task 4, participants adjusted a composite ML figure to match its line size to a target ML figure's over 128 trials.

**Results:** Task 1 and 2 performance was determined by forced-choice biased selections, response time, and variability of response time. A stronger bias was found in the concurrent compared to successive figure presentation, with more biased figure selections and longer response times. Performance measures in Task 3 and 4 were magnitude of constant and variable error in figure adjustments. A stronger bias was found in composite ML figure adjustments compared to non-illusory figure adjustments. Task performance was generally not correlated with AQ or SQ. Two exceptions were positive correlations of constant and variable error to AQ when adjusting a composite illusory ML figure in Task 4. Participant sex was not a significant factor determining performance.

**Conclusions:** Simultaneous presentation of composite ML figures increases illusory size bias more than when figures are presented and perceived individually. Illusion susceptibility to the ML was reduced with increases in AQ, but only when the method of illusion measurement was adjustment of concurrently presented illusory figures. Thus, considering task details, including differences in the stimuli, instructions, and responses, can help explain the diversity of perceptual experiences that shape human (inter)actions. Future research will examine perceptual experiences across the autism spectrum(s) and the impact of perception on actions specifically.

**517.069 (Virtual Poster)** A Link between the Profiles of Attention and the Clinical Presentation of Autistic Females

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**Background:** Recent evidence has shown distinct profiles of autistic features in females, including domains such as social communication, with a more relevant use of social attention (i.e., the tendency to look at other people and parts of the body expressing social cues) compared to autistic males. Establishing a link between social attention in females' and clinical characteristics may help the implementation of diagnostics, procedures and interventions tailored for autistic females.

**Objectives:** We aimed to examine whether socio-communicative traits are linked to profiles of social attention in autistic females, based on the degree of difference from autistic males (sex differences) and neurotypical females (diagnostic differences).

**Methods:**

453 (123 females) autistic and 311 (107 females) non-autistic people participated in the Longitudinal European Autism Study (LEAP; see Table 1).

We built growth curve mixed models for females/males and autistic/non-autistic participants separately, with the proportional looking time (PLT) to the face across 3 eye-tracking tasks featuring static and dynamic social and nonsocial content (see Fig. 1A) as dependent variable, with sex, age and proportion of missing data as predictors. We extracted a) the random effects - i.e., individual coefficients and b) a difference score representing the degree to which social attention in an autistic female was more influenced by sex or diagnostic effects by subtracting/differencing the random effects of female participants in from the model that compared them to autistic males from that comparing them to and neurotypical females; both were used them as dependent variables in multiple linear regressions with ADOS Social Affect (SA) Calibrated Scores (CSS) and ADOS Repetitive Behaviour (RRB) CSS as predictors, in interaction with sex, with stimulus and age as covariates.

**Results:** In females only, higher ADOS SA-CSS (Coef. = -0.18, 95% CI = -0.28~-0.07) and ADOS RRB-CSS significantly linked to lower average PLT (Coef. = -0.22, 95% CI = -0.32~-0.11). A steeper decline of PLT linked to more symptoms in females, reflected in a distinct association between quadratic change and ADOS that differed from males (ADOS SA-CSS, Contr.=-0.28, SE=0.06, p-value<0.01; ADOS RRB-CSS, Quadratic, Contr.=-0.19, SE=0.06, p-value=0.01). In females, PLT was more influenced by sex than diagnosis when socio-communicative symptoms were lower, as indicated by the inverse relationship between ADOS SA-CSS and the difference score, both for average (Coef. = -0.001, 95% CI = -0.002~-0.0008) and quadratic change (Coef. = 0.0006, 95% CI = 0.00004~-0.001).

**Conclusions:** In females, more pronounced social attention and a relatively greater influence of sex-related differences relative to diagnostic group-related differences was related to fewer social communication difficulties. This finding suggests that the relation between social attention and social communicative function is stronger in autistic females. Social attention may provide autistic females with a tool for cultivating desired social interactions, and/or avoiding stressful ones, calling for longitudinal research investigating socio-communicative functions and autistic female experiences, such as camouflaging.

**517.070 (Virtual Poster) Adults with More Autistic Traits Are More Willing to Pay for “Useless” Information**

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**Background:**

Actively sampling information from the environment reduces uncertainty and is thus often instrumental for future outcomes, increasing the probability that a better action can be chosen. However, even when a piece of information is non-instrumental (i.e. does not influence future outcomes) and merely reduces uncertainty earlier, humans and non-human primates are still willing to pay for the information (Bennett et al., 2016), probably due to aversion to prolonged uncertainty. We hypothesize that as a consequence of intolerance of uncertainty (Hwang et al., 2019), the seeking of such “useless” information would be more common for people with autism spectrum disorders (ASD) or higher autistic traits.

**Objectives:**

The present study investigates whether and how autistic traits influence the willingness to pay for non-instrumental information in different outcome domains (i.e., loss vs. gain).

**Methods:**

Participants were 133 college students, who performed a non-instrumental information sampling task adapted from Bennett et al. (2016) on a computer with their eye movements recorded by a 300 Hz Tobii Spectrum. In each of 144 trials, participants faced a monetary lottery. In the beginning, they could choose between two decks of cards. An informative deck would cost 0, 1, or 3 game credits, and the other is always free but noninformative. Both decks consisted of five face-down cards that participants could click to flip them over to see. When participants chose the informative deck, the cards were predictive of winning or loss; when the noninformative deck, the cards were irrelevant to the lottery result. After participants flipped all five cards or decided to stop early, they must wait for five seconds before the final reveal of the result. In the gain domain, winning earned participants 20 credits and losing cost none; in the loss domain, winning gained them 0 credits but losing took 20 credits. Winning or losing was equiprobable and pseudo-randomly determined before the beginning of a trial. Two domains were pseudo-randomly assigned to 6 blocks, and three information costs were pseudo-randomly mixed within each block.

**Results:**

Bayesian multilevel models showed that participants with higher AQ scores were more willing to pay for costly information, specifically the most expensive one (3 credits), to foretell the good news (i.e., the gain domain) compared with the bad news (Fig. 1a). High AQ participants also made faster information choice decisions particularly in the high-cost condition compared to the zero-cost condition (Fig. 1b). Consistent with the behavioral results, the time-course analysis of eye-tracking data revealed that participants with higher AQ tended to look more at the costly informative choice for expectedly rewarding prediction (Fig. 1c), specifically from around 967 to 1267 ms from the onset of the choice stimuli (i.e., two decks of cards).

**Conclusions:**

Participants with different levels of autistic traits differed in their preference and valuation for non-instrumental information. To summarize, participants with higher AQ were less sensitive to the monetary cost of the information, especially for the possible good news.

**517.071 (Virtual Poster) Evaluating Gender Differences in Perceptual Profiles of Individuals with Autism Spectrum Disorder**

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**Background:** Autistic perception is traditionally characterized by a superior ability to process detailed, spatial visual information non-social in nature, with difficulties with social information, such as that conveyed by faces. Two main theories have been developed to explain this phenomenon: the Weak Central Theory and the Enhanced Perceptual Functioning. While both acknowledge a tendency to favour local analysis in Autism Spectrum Disorders (ASD), the former postulates deficits in global processing whereas the latter does not. Although the aforementioned perceptual profiles are typically used to describe strengths and weaknesses in ASD, it remains unknown whether they are comparable in both males and females with ASD. The reason for this void in knowledge is that the neurocognitive theories in ASD are based on studies assessing a disproportionate number of male participants.

**Objectives:** The aim of this study was to assess whether non-social perceptual profiles are equivalent in both males and females with ASD and comparable to that of neurotypicals, as measured by the performance on a visuospatial cognitive task. The first hypothesis was that individuals with ASD would show a performance peak with local processing compared to neurotypicals. The second hypothesis, pertaining to possible gender differences, was that males with ASD would show a more pronounced cognitive peak than females.

**Methods:** Forty-two participants with ASD (21 females, 21 males) and 38 typically developing (TD), neurotypicals (19 females and 19 males) matched on age and Full-Scale IQ, completed a reversed, match-to-sample block design task on a touch-sensitive screen. Response time (RT; in seconds) for correct responses was calculated as the dependent variable of interest. Conditions included block designs defined by either low or high perceptual cohesiveness (PC) that favoured a local or global processing strategy, respectively, as well as different matrix sizes (4, 9, or 16 blocks).

**Results:** As expected, RTs were significantly shorter in high PC conditions. However, no effect of gender was reported between PC conditions. The interaction of diagnosis and gender was also not significant, indicating that RTs were not significantly different across diagnosis and gender groups. The interaction of diagnosis and PC was found to be significant for the high PC condition at the nine- and 16-block matrix sizes, but not at the four-block matrix size or in the low PC condition.

**Conclusions:** ASD and TD groups performed similarly in a reversed block design task targeting both local (low PC) and global (high PC) visuospatial processing. This pattern of results indicates that the ASD group had access to both local and global analyses and could switch between the two modes depending on the situation, leading to the conclusion that individuals with ASD exhibit neither an enhanced local visual processing nor a deficit in global visual processing, compared to neurotypicals. Cohesiveness condition manipulations did not result in gender differences in ASD either, as they had the same effect on female and male ASD groups. This suggests no significant gender differences in non-social perceptual profiles in ASD, although a follow-up with a larger sample size may be warranted.

#### **517.072 (Virtual Poster)** Outcomes of Online Executive Functioning Support Videos for Caregivers of Children with Executive Function Difficulties during COVID-19

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#### **Background:**

Autism Spectrum Disorder (ASD) and ADHD are both neurodevelopmental disorders associated with executive functioning (EF) challenges and increased caregiver strain. The COVID-19 pandemic further increased caregiver strain as caregivers found themselves managing their child's EF difficulties at home with few supports.

#### **Objectives:**

This project aims to better understand the viability of basic and brief videos to support caregivers managing their child's EF difficulties at home during COVID-19. The series consists of 12 short videos (e.g., animations, expert, and caregiver interviews), that describe child EF and skills caregivers could use and model.

#### **Methods:**

Participants were comprised of caregivers ( $N = 73$ ) of children with symptoms consistent with ASD and/or ADHD and flexibility or planning/organizational problems. Caregivers were majority female (90.4%) and had an average age of 41.4 years ( $SD = 6.3$ ). Their children were between 8 and 11 years old ( $M = 9.7$ ,  $SD = 0.96$ ). A 5-point Likert scale assessed helpfulness and value of the videos, and another measure assessed knowledge of video content. Caregivers reported their child's observed EF with two global executive function questions, which assess the degree of interference from child EF behaviors at home and frequency of EF difficulties on a 10-point Likert scale; higher scores indicate greater EF problems. Caregiver strain was assessed using the Caregiver Strain Questionnaire-Short Form 7, a 7-item questionnaire gauging child-related caregiver strain with a 6-point Likert scale; higher composite scores indicate greater strain. Change scores were calculated for pre- and post-video series for child EF interference and frequency, and caregiver strain. Paired t-tests were used to evaluate pre- and post- outcome scores in order to capture the magnitude of the videos' effect.

#### **Results:**

Results indicate a significant reduction in both interference of child EF behaviors ( $t = 2.18$ ,  $p = .03$ ) and their frequency ( $t = 4.37$ ,  $p < .001$ ), with small to medium effect sizes (Cohen's  $d$ s: 0.22–0.49) after viewing the videos. Caregivers also reported that child-related strain decreased ( $t = 3.08$ ,  $p = .003$ ,  $d = 0.31$ ) with a medium effect size, and caregiver knowledge significantly increased ( $t = -13.19$ ,  $p < 0.001$ , 95% CIs [-2.93, -2.16],  $d = 1.54$ ) with a large effect size. Furthermore, caregivers found the videos helpful ( $M = 3.88$ ,  $SD = 0.81$ ) and valuable ( $M = 4.17$ ,  $SD = 0.82$ ).

#### **Conclusions:**

Caregivers report modest reductions in the interference and frequency of observed child EF difficulties, reductions in caregiver strain, and an increase in knowledge following a series of caregiver support videos. Caregivers also find the support the videos offer helpful and valuable. These findings suggest that even brief, online, and asynchronous caregiver support videos may be effective in improving both caregiver and child outcomes and offer valuable support to parents managing their child's EF difficulties at home. All outcomes were based on caregiver self-report and there was no control condition; thus, these are preliminary findings that require replication in a randomized-controlled trial. The findings, nonetheless, suggest that low-cost, highly accessible caregiver support tools may yield important benefits for both caregivers and children.

**517.073 (Virtual Poster)** Processing Speed, Executive Function and Social Impairment in a Puerto Rican Sample of Children with Autism Spectrum Disorder.

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**Background:** Autism spectrum disorder (ASD) is characterized by a myriad of strengths and weaknesses. Among those weaknesses, the literature has found deficits in cognitive domains such as processing speed and executive functions. However, it has not been studied how processing speed and executive function may relate to social impairment, particularly in a culturally diverse sample, such as a Puerto Rican sample of children with ASD. Following Mundy and Newell (2007) social cognition model, it is expected to find a significant relationship between these cognitive constructs and social impairment.

**Objectives:** Five main objectives were studied: 1) describe the pattern of scores in measures of intellectual skills, metacognition component of executive functions, and social impairment, 2) determine if processing speed index score is lesser than the other cognitive indices, 3) determine if there is a correlation between the processing speed index and metacognitive abilities of executive functions, 4) determine if there is a correlation between processing speed and social impairment symptoms, and, 5) determine if there is a correlation between metacognitive abilities of executive functions and social impairment symptoms.

**Methods:** The study followed a non-experimental transversal design correlational and exploratory type. A secondary data analysis was performed using a clinical database completed with previous neuropsychological assessment reports with a sample of Puerto Rican children. The sample consisted of 68 Puerto Rican children (57 [83.1%] males) with an ASD clinical diagnosis. The Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV), and the Behavior Rating Inventory of Executive Function (BRIEF), and Social Responsiveness Scales (SRS) parent forms inventories, respectively were analyzed. The Processing Speed Index (PSI) of the WISC-IV, the metacognitive index of the BRIEF and the SRS scores were analyzed following a partial least squares structural equation modeling (PLS-SEM).

**Results:** Consistent with the literature, the PSI appeared as the most affected measure when comparing other WISC-IV indices. The most significant Cronbach's Alpha are for the measures of executive function (.82) and social impairment (.88), while processing speed was within acceptable range (.60). The processing speed construct had a negative significance to social impairment ( $\beta = -.165$ ,  $p < .037$ ) and to executive function impairment ( $\beta = -.197$ ,  $p < .050$ ). However, executive function impairment had a positive significant relation to social impairment ( $\beta = .653$ ,  $p < .001$ ). When assessing the direct effect mediation of executive function impairment between processing speed and social impairment, the former mediated the relation in a negative significant way ( $-.165$ ,  $p < .045$ ). Regarding the indirect mediation effect of processing speed on executive function and social impairment, results showed a negative and significant mediation ( $-.129$ ;  $p < .045$ ). However, effect sizes for processing speed in relation to executive function ( $f^2 = .041$ ) and social impairment ( $f^2 = .052$ ) were small suggesting limited practical implications.

**Conclusions:** There appears to be a relationship between processing speed, executive functions, and social impairment in a Puerto Rican sample of children with ASD. Following Mundy and Newell (2007) social cognition model, deficits among cognitive abilities could impact social functionality, and processing speed could be mediating these weaknesses. Limitations and future directions are discussed.

**517.074 (Virtual Poster)** Role of Alpha Power during Selective Attention in Children with Autism Spectrum Disorder: A QEEG Study

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**Background:**

Attention is a process of selecting a relevant stimulus from available infinite number of objects/events, filtering out the irrelevant information. Previous researchers studied evoked potentials and reported impaired attention in individuals with Autism spectrum disorder (ASD). Differential attentional capacities and variation in sensitivity to cue types have also been suggested in ASD. Further, task related alpha power modulation has been suggested to predict performance on attention tasks in healthy individuals. Therefore, in the present study an attempt was made for the first time to investigate the alpha band power during attention task i.e. digit span forward task (DSFT) in children with ASD compared to typically developing children (control) by analyzing single trial EEG

**Objectives:**

To compare EEG alpha power between children with ASD and control during DSFT.

## Methods:

**DSFT task:** First examiner speaks a sequence of two numerical digits, then child was asked to repeat the sequence correctly and immediately, with increasingly longer sequences being tested in each trial to assess attention. The score was determined by the length of the longest correctly repeated sequence, ranging from zero to nine numbers. A total of three blocks of the task was performed.

## QEEG recording:

EEG was recorded during DSFT task using 128 channels sensor net in 61 children with ASD diagnosed by DSM 5 criteria and 48 age matched control. Raw EEG data were filtered (1-100 Hz band pass, 50Hz notch) followed by segmentation into 5 epochs of 1 second duration from each block i.e. total of 15 epochs of 1 second duration. Artifacts were removed using independent component analysis and average referencing was computed for the data. After exclusion of files with artifacts or corrupt files, EEG data of 19 children with ASD were analyzed. For comparison EEG data of 20 age matched control were used. Individual alpha frequency (IAF) was calculated using "Spectopo" EEGLAB function with window size of 256 data points and overlapping windows of 50% in order to classify the EEG frequency bands. Further, for spectral power analysis Fast Fourier Transform was performed in MATLAB using a custom made script. Results were plotted using EEGLAB topoplot function.

## Results:

Mean age of children with ASD ( $6.12 \pm 2.4$  years) and control ( $7.24 \pm 2.3$  years) was not significantly different. Changes in Alpha power during DSFT were computed and compared between children with ASD and control. Twenty-three electrodes showed significantly higher activity ( $p < 0.05$ ) in alpha band which was mainly distributed over frontal and temporal regions in children with ASD compared to control. Additionally, significant decrease in DSFT task score ( $p < 0.05$ ) was also observed suggesting impaired attention in children with ASD compared to control.

## Conclusions:

Higher alpha power during DSFT in children with ASD might reflect the role of alpha band in flexible recruitment of functional networks in order to meet cognitive demands. Previous studies have also reported a higher alpha power in regions processing the relevant stimulus and lower power in regions processing irrelevant stimuli in individuals with ASD suggesting a role of alpha power in attention allocation.

**517.075 (Virtual Poster)** The Association between Rhythm Perception and Phonological Awareness for Children on the Autism Spectrum  
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**Background:** Exploring non-linguistic predictors of early literacy, such as musical rhythm perception, is valuable for students who present with language difficulties and diverse support needs. Studies on the musical abilities of children on the autism spectrum show average or above-average musical production and auditory processing abilities.

**Objectives:** This study aims to investigate the use of a non-verbal stimuli (musical rhythm) as a potential screening tool for the early literacy skills of children on the autism spectrum by exploring the relationship between musical rhythm perception and phonological awareness skills.

**Methods:** A total of 21 participants on the autism spectrum between the ages of 6 to 11 years old ( $M = 8.9$ ,  $SD = 1.5$ ) completed a rhythm perception task, an adapted version of the Beat Alignment Test (BAT; Iversen & Patel, 2008). Phonological awareness skills were measured using the Phonological Processing subtest of the NEPSY-II (Korman et al., 2007).

**Results:** Results revealed that phonological awareness and rhythm abilities are positively correlated for children on the autism spectrum. Higher scores in phonological awareness skills were associated with a more accurate performance on the rhythm perception task, and that this relationship was strongest for the most challenging trials of the rhythm perception task.

**Conclusions:** Phonological awareness and rhythm perception may underlie a common auditory mechanism in the typical population, which seems to also be the case for children on the autism spectrum. The association between rhythm perception and phonological awareness holds significant clinical implications for the assessment of phonological awareness skills, as typical screening tools rely heavily on linguistic stimuli. Findings thus lend support to the use rhythm perception as a screening tool for early literacy skills for children with diverse support needs as an alternative to traditional verbal tasks that tend to underestimate the potential of children on the autism spectrum.

**517.076 (Virtual Poster)** Use and Compliance of a Computer Assistant Learning Program (Lexia) in Children with Autism Spectrum Disorder and Learning Disabilities in Reading in an Ethnically Diverse Community.  
**M. Valicenti-McDermott, E. Rivelis, M. J. Cardin, C. Bernstein and L. Shulman, Rose F. Kennedy Center, Children's Evaluation and Rehabilitation Center; Montefiore Medical Center, Bronx, NY**

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**Background:** Children with Autism Spectrum Disorder (ASD) often present with co-morbid developmental disabilities such as language impairment and learning disabilities(LD). Learning disabilities(LD) are lifelong conditions and with intervention, people with LD in reading can improve their abilities. Intensive individualized instruction, remediation, accommodations, and modifications are used as techniques for improving LD in reading but are not easy to access. In recent years, technology-based remedial approaches and blended learning have become increasingly popular, but

research to support its use with children with autism and LD is sparse. We are conducting a study to examine the impact of computer-assisted learning (CAL Lexia Learning, Concord, MA; [Lexialearning.com](http://Lexialearning.com)), to the treatment of children with ASD and LD in reading in the Bronx, NY in a rigorous way. As a first step, we examined feasibility and compliance with virtual use of Lexia, following publisher recommendations.

**Objectives:** to examine compliance and use of a CAL with children and adolescents with autism and LD in reading who attend an urban, multidisciplinary University affiliated center

**Methods:** Children and adolescents with LD in reading, who were on a waitlist for a remediation program at a multidisciplinary center were invited to participate in February, March, and April 2021. Families and patients met with a psychologist, who explained how the online Lexia program works. If needed, an iPad was lent to the family. If the child lived in a bilingual English/Spanish household, then the visit was done by a bilingual English/Spanish psychologist. Families were contacted on the phone 1 week, 2 weeks and 2 months after starting, and patients were encouraged to contact clinicians if difficulties arose. Initial assessment included reading measures (Woodcock-Johnson IV) and assessment of behavior (BASC-3); demographic and developmental data was also collected along with time spent engaged with the program. Statistics included chi-square, t-test.

**Results:** 54 children with LD in reading signed up for the program, 31 (57%) boys and 23 (43%) girls, age  $11 \pm 2$  y.o., 26 (50%) came from bilingual English/Spanish households. Of the 54, 4 (7%) children had a previous diagnosis of ASD, 3 boys/1 girl, mean age  $11 \pm 2$  y.o., Overall, children participated in the program for  $605 \pm 132$  minutes and of the 54, 23 (42%) discontinued the program before 6-month assessment. Children with autism were more likely to continue the program for at least 6 months (4/4 100% vs. 27/50 54%  $p=0.07$ ) and used it for more minutes ( $1136 \pm 726$  min vs.  $388 \pm 780$  min  $p=0.02$ ) than children without autism. There were no significant difference in demographics and academic skills, but, as expected, children with autism scored higher on the BASC-3 withdrawn subscale ( $76 \pm 19$  vs.  $55 \pm 13$   $p=0.008$ ) and development/social ( $69 \pm 9$  vs.  $56 \pm 10$   $p=0.03$ ) than children without autism.

**Conclusions:** In an urban, ethnically diverse group, a small sample of children and adolescents with autism and LD in reading were compliant with an online computer-assisted reading program. As a next step, information on efficacy of these programs in academics is needed, as it may represent a positive intervention for children with autism.

#### **517.077 (Virtual Poster) Vocabulary, Decoding, and Memory in Autistic Children with a Discrepant Reading Profile**

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**Background:** Children's baseline vocabulary and word reading (i.e., *decoding*) capabilities play a significant role in their reading comprehension. However, constructing a cohesive representation of read information also requires integrating and recalling both visual and verbal material (Wooley, 2010; Cain, 2006). Many autistic children excel at decoding but struggle to integrate the words into context (Huemer & Mann, 2010; Nation et al., 2006), leading to reading comprehension deficits. This is described as the *discrepant poor comprehender* reading profile (Davidson, 2021). Verbal and visual *working* memory have been shown to predict reading comprehension beyond vocabulary and decoding in typical development (Pham & Hasson, 2014; Cain, Oakhill & Bryant, 2004), while vocabulary is suggested to be a stronger predictor in autism (Davidson et al., 2018). However, the role of *general* visual and verbal memory on reading comprehension has not been examined within the discrepant poor comprehender profile in autism.

**Objectives:** The aim of this study is to investigate whether general verbal and visual memory predict reading comprehension beyond vocabulary and decoding within a group of autistic children categorized in the discrepant poor comprehender reading profile.

**Methods:** Fifteen autistic children with the discrepant poor comprehender reading profile (GORT-5 < 37<sup>th</sup> percentile and SORT-R3 > 36<sup>th</sup> percentile) between the ages of 7 and 13 years ( $M=10.95$ ) participated in this study (data collection is ongoing). Participants completed a battery of assessments including the Gray Oral Reading Test (GORT-5), the Slosson Oral Reading Test (SORT-R3), the Peabody Picture Vocabulary Test (PPVT-4), the Expressive Vocabulary Test (EVT-2), and the Wide Range Assessment of Memory and Learning (WRAML-2). Hierarchical linear regression was conducted with GORT-5 Comprehension Scaled Score as the dependent variable. SORT-R3 Scaled Scores were entered at stage one to control for word decoding ability. PPVT-4 and EVT-2 Standard Scores were entered at stage two to control for vocabulary. Finally, verbal and visual memory index scores on the WRAML-2 were entered at stage three to determine the contribution of general memory abilities beyond decoding and vocabulary.

**Results:** Decoding significantly predicted reading comprehension scores,  $F(1,13)=6.30$ ,  $p=.026$ , and accounted for 32.6% of the variance in performance on a reading comprehension task. The contribution of expressive and receptive vocabulary beyond word reading was trending toward significance,  $F(2,11)=3.56$ ,  $p=.064$ , accounting for 26.5% of the variance. Visual and verbal memory did not significantly predict reading comprehension above and beyond the other variables,  $F(2,9)=1.23$ ,  $p=.338$ .

**Conclusions:** These preliminary results suggest that decoding and vocabulary, rather than general memory, play vital role in predicting reading comprehension in autistic children with the discrepant poor comprehender profile. Therefore, children with this reading profile may benefit from interventions focused on building vocabulary and word-reading skills. Additionally, the relationship between memory and reading comprehension might depend on the type of task and whether the comprehension questions require inferencing (Lucas & Norbury, 2015; Tirado & Saladaña, 2016). As data collection is ongoing, we plan to examine this relationship after children complete the Visualizing and Verbalizing (V/V) intervention (Bell, 1991), which teaches children to use visual imagery to improve reading comprehension.

#### **517.078 (Virtual Poster) Working Memory in Preschool Children with Autism Spectrum Disorder: An Eye-Tracking Study**

**Background:** Older children with Autism Spectrum Disorder (ASD) have been shown to exhibit difficulties with working memory (WM). Research conducted on preschool children with ASD has generated inconsistent findings. One of the reasons may be that the WM tasks are either too demanding for preschoolers or that children's developmental level has surpassed the task's requirements and the performance is at or near ceiling.

**Objectives:** The aim of the current study is to investigate and compare the WM performance of preschool age typically developing (TD) children and children with ASD on the novel eye-tracking A-not-B task. In addition, the current study examined whether there is a relationship between nonverbal mental age (NVMA) and the ASD and TD children's performance on the A-not-B task.

**Methods:** Twelve children (M = 53.08 months, SD = 11.59, range = 31 – 68, 83.3 % boys) with a confirmed ICD – 10 diagnosis of ASD and twenty-three TD children (M = 49.50 months, SD = 6, range = 37 – 59, 45.8 % boys) viewed animations of the moving train. The A-not-B task is purported to measure WM. The "A" trials consisted of the train moving into the left tunnel. The "B" trials had two conditions (short = 10200msec, long = 15200msec). During the "B" trials the train was moving into the right tunnel. The comparison statistics were performed on "B" trials only. The dependent variables were the looking times (in milliseconds) at the left and the right tunnels during a 5-second period before the reappearance of the train. Mullen Scales of Early Learning was used to measure NVMA.

**Results:** The ASD and TD groups spent more time looking at the right tunnel (ASD: M = 2036, SD = 1110; TD: M = 2020, SD = 868) than the left tunnel (ASD: M = 1069, SD = 471; TD: M = 975, SD = 620) during the "B" trials with short waiting period. The groups did not differ in looking times at the right tunnel ( $t(34) = 0.044$ ,  $p = 0.965$ , 95% CI[-320 – 507]). The ASD and TD groups spent more time looking at the right tunnel (ASD: M = 1720, SD = 1109; TD: M = 1788, SD = 992) than the left tunnel (ASD: M = 987, SD = 1028; TD: M = 839, SD = 487) during the "B" trials with long waiting period. The groups did not differ in looking times at the right tunnel ( $t(34) = -0.186$ ,  $p = 0.853$ , 95% CI[-809 – 673]). NVMA was lower in the ASD group (M = 31.58, SD = 10.26) as compared with TD group (48.96, SD = 8.57) ( $t(34) = -5.37$ ,  $p < 0.001$ , 95% CI[-23.95 – -10.79]). No correlations between NVMA and the performance on two "B" trial types were found for ASD and TD groups.

**Conclusions:** The results suggest that despite the large NVMA variation in ASD group, the current task may not be suitable for the age range of the current sample and may better suit even younger children with ASD.

**517.079 (Virtual Poster) Cognitive Heterogeneity in School-Aged Children with High-Functioning Autism Spectrum Disorder: Theory of Mind and Executive Function**

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**Background:** 'Theory of Mind' (ToM) deficits, 'Executive Functions' (EF) deficits were the two most widely discussed accounts to the impairment of Autism Spectrum Disorder (ASD). Happé, Ronald, and Plomin (2006) proposed the concept of "multiple cognitive atypicalities" and emphasized that the combination of the core cognitive abilities could better depict the cognitive profile of ASD, and explained the distinct aspects of the behavioral phenotype.

**Objectives:** The aim of this study was to portray the cognitive atypicalities of ToM and EF in school-aged children with High-functioning Autism Spectrum Disorder (HFASD) and to investigate their relationships with autism severity and adaptive function.

**Methods:** Sixty-six children with HFASD and 41 children with typically development (TD) aged 7-12 years were recruited in large Taipei area of Taiwan and matched on chronological and verbal mental ages. Participants were assessed on a battery of tasks measuring (1) irony and metaphor tasks in ToM, developed by Deng (2018); (2) inhibition control (using Flanker task) and cognitive flexibility (using Animal Sorting in NEPSY-II) in EF; (3) IQ using Wechsler Intelligence Scale for Children- Third Edition in Traditional Chinese Version (WISC-III); (4) autism severity (using ADOS and ADI-R); and (5) adaptive function (using Vineland adaptive behavior scales, 2<sup>nd</sup> Edition).

**Results:** The results showed that (1) The means and standard deviations of the TD were used to calculate the Z score of ToM and EF measures. The Z scores of the reaction time and error rate were reversed to obtain a higher Z score, indicating a better performance on the task. Following the criteria of Pellicano (2007), cognitive atypicality is defined as one standard deviation higher/lower than the average TD. Based on this criterion, 38% children demonstrated intact on both of ToM and EF, 18% children were atypicality on both of ToM and EF, while 22% children were either atypicality on ToM or EF; (2) the children with double cognitive atypicalities showed significant higher score on communication than the children with single cognitive atypicality and no atypicality in ADOS ( $p < .01$ ), however, no difference were revealed among the three groups on adaptive function in VABS-II.

**Conclusions:** Considering ToM and EF concurrently would give a better portray of the heterogeneity of ASD at cognitive level. The clinical implications could be addressed in the assessment and intervention for the school-aged children with HFASD.

**517.080 (Virtual Poster) Intact Self-Bias on Perception in Adults with Autism**

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Background: Self-related information is consistently processed more quickly and accurately than other-related information. This effect – known as the *self-bias* – has a critical role for social functioning. An altered self-bias can hamper the ability of understanding one's own social surroundings (Nijhof & Bird, 2019). Studies have reported decreased or absent self-bias in individuals with autism, however findings are not conclusive, as intact self-bias has also been reported. Williams et al. (2018) used the “shape-label matching task” task developed by Sui and colleagues (2012), to test self-prioritization effects on perception, in which participants have to judge whether shape-label pairings matched. Self-related pairings were prioritized, but equally in both groups. More research is warranted to test the robustness of this finding.

Objectives: The main goal of our study is to investigate the impact of the self-bias on perception using the shape-label matching task in both adults with autism and neurotypicals.

Methods: Thirty-six participants with an ASD diagnosis and thirty age- and IQ-matched neurotypicals performed a shape-label matching task. In a first ‘association’ phase, participants learned to associate three distinct shapes (i.e. circle, square, triangle) with three different labels (i.e. self, close other, stranger). In a second ‘matching’ phase, participants were presented with a series of shape-label pairings, and asked whether the shape matched or mismatched the label in question. In addition, participants completed two self-report questionnaires (i.e. AQ and SRS-A) to measure the extent of autistic traits. EEG was also recorded, in order to test which information processing stages are affected by the self-bias.

Results: We replicated the findings by Williams et al. (2018). Self-related pairings were prioritized, but equally in both groups. For both groups, repeated measures ANOVAs revealed faster and more accurate responses for self-related than either close other- or stranger-related associations. Adults with autism responded slower in general, yet this did not interact with condition. Results from correlational analyses further showed no significant relationship between ASD symptomatology and the size of the self-bias effect in either group. Findings from the EEG data analysis will be presented at the conference.

Conclusions: In line with prior research, no atypical behavioural pattern in making perceptual judgments involving self-related information was observed in individuals with autism, and no significant association between ASD symptomatology and self-bias magnitude was found within our sample. This suggests an intact self-bias on perception in autism. Further studies are warranted to directly compare different types of self-biases in autism.

## Combined Topics

### PANEL — COMBINED TOPICS

#### 203 - The Lancet Commission on the Future of Care and Clinical Research in Autism

**Panel Chairs:** Catherine Lord, *UCLA Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA*

**Tony Charman**, *Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, Department of Psychology, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, Department of Psychology, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

**Discussant:** James Cusack, *Autistica, London, United Kingdom of Great Britain and Northern Ireland*

**203.001 (Panel)** A New Stepped Care and Personalised Health Model for Delivering Services and Monitoring Effectiveness

**C. Lord**, *UCLA Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA*

Background: Autism is a heterogeneous condition that affects people across the lifespan in different ways at different times. Interventions and services often involve not only the autistic person but the entire family and depend on the individual's and families' preferences and resources. Most treatments do not work for everyone; some treatments are inappropriate or unnecessary for some people and helpful for others. However, goals of happiness, purpose, health and greater independence are obtainable for all autistic people.

Objectives: We need cost-effective ways of prioritizing interventions and services for autistic persons that begin with the person and the family, and that consider the particular needs from a person-centered point of view that also includes families and what is possible within a community, not just from the perspective of the health and social support systems.

Methods: We propose a stepped-care, personalized health model that begins with a needs assessment, but also requires consideration of specific aspects of individual and family functioning. A diagnosis of autism is only the beginning. Information about the individual's and family's preferences and specific strengths and difficulties, including co-occurring conditions is critical. With better data about what interventions are most beneficial for whom, when and with what intensity, and with systems that obtain individualized information about the autistic child, adolescent or adult and the family and community in which they live, we could build probabilistic models, combined with individual and family preferences, that would allow us to better design individual service plans.

Results: A stepped care, personalized health model is outlined, including both an example of assessment data and examples of how such a model might work in intervention and service planning for a young, minimally verbal boy with autism in a LMIC and an adolescent girl with autism and

severe social anxiety with strengths in academic skills in a HIC. Such models could use existing and new research about effectiveness to address needs of autistic individuals in both LMIC and HIC and support integration across systems of services and support.

**Conclusions:** We need planful systematic research across systems that allows comparisons of different interventions for different needs within autism. The Lancet Commission presented a model of stepped care, personalized health that we hope can be used as a start in the development of a more person-centered, cost-effective approach to service provision within different cultural contexts.

### **203.002 (Panel) Care of Co-Occurring Medical and Mental Health Conditions**

**P. Carbone**, *Univeristy of Utah, Salt Lake City, UT*

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**Background:** An important aspect of the heterogeneity of autism is the presence of co-occurring medical, behavioral and psychiatric conditions. These conditions vary in presentation throughout the lifespan and have profound effects on life outcomes. Common co-occurring conditions seen in individuals with autism include sleep disorders, gastrointestinal conditions, overweight/ obesity, epilepsy, attention-deficit hyperactivity disorder, anxiety and depression. Robust evidence for most of these co-occurring conditions indicate that rates are higher in autistic people compared with the general population. Profound autism can be associated with the same co-occurring conditions, but they may be more complex with regards to identification and treatment.

**Objectives:** Early and timely identification of co-occurring conditions is important because evidence-based treatment can result in increased wellbeing for autistic people and their families and can enable better access to other services and supports. Symptoms of these conditions might be missed because of an atypical presentation in autistic individuals. Specifically, clinicians should avoid either attributing all maladaptive behaviors to autism or, on the other hand, neglect to take into account the role of core aspects of autism in identifying co-occurring conditions.

**Methods:** Therefore, a clinical environment with a knowledgeable provider, that is culturally appropriate, adapted to the needs of the stakeholders, and that allows sufficient time for assessment, discussion, and participatory decision making is necessary to support a successful diagnostic evaluation of co-occurring conditions.

**Results:** Once identified, a stepped care and personalized healthcare model can be effective in addressing co-occurring conditions. Use of this model can adapt existing treatment guidelines to account for the widely varying needs, skills, circumstances, and preferences of the autistic child, adolescent and respective family. Modification to existing evidence-based treatments helps to optimize behavioral, psychological and medical approaches for co-occurring conditions in autism and improves effectiveness and participation.

**Conclusions:** Access to functioning systems of care is necessary to address co-occurring conditions. Successful treatment of co-occurring conditions often will involve collaboration between caregivers and providers across environments. Treatment interventions for co-occurring conditions cannot depend on delivery only by autism experts. Yet, poor knowledge regarding the health care of autistic children and adults among primary care providers, especially in rural or low resource settings, threatens their long-term health outcomes. Furthermore, many community mental health systems are not sufficiently equipped to assist people with both mental health issues and autism, which again leaves people with autism deprived of support from existing systems of care. Therefore, we call for systematic efforts to reach primary care providers and non-autism specialty therapists and mental health providers with information about identification and treatment of co-occurring conditions in order to ensure equitable access to needed healthcare services across the lifespan.

### **203.003 (Panel) Global and Cultural Diversity: Addressing the Needs of Autistic People in LMICs, Low Resource Settings and Those Social Excluded**

**G. Divan**, *Child Development Group, Sangath, New Delhi, India*

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**Background:** Assuming a minimum prevalence of 1% an estimated minimum of 78 million individuals worldwide have autism. Outside urban areas in most countries, families have virtually no access to either assessments or evidence-based interventions. The assessment and intervention gap seen across the world is compounded by a knowledge gap in LMICs and other low-resource settings. 95% of all children under the age of 5 years with developmental disabilities (including autism) live in LMICs; and yet, little research is done outside of HICs. The needs of families who live with autism worldwide are universal: to understand their child's developmental differences; to seek support that can improve and optimise outcomes; to be included as active members of society; and to receive appropriate support to empower their child's journey into and throughout adulthood.

**Objectives:** Cultural diversity encompasses broad social constructs including sex, race and ethnicity, class, income, language, religion, sexual orientation, and gender identity. Many autistic individuals will have a so-called minority or non-dominant status across several of these social and cultural factors, and recognition is growing that the intersectionality of these factors makes individuals vulnerable to both discrimination and exclusion from appropriate services.

**Methods:** Making services scalable should not compromise standards of evidence, meaningful outcomes, and efficacy. In LMICs, there is a great need for task-sharing approaches where specialists train and supervise community-based healthcare and education workers to optimise their inputs to individuals with more complex support needs.

**Results:** Research about what is colloquially described as home-grown versus transported models of intervention in children's mental health generally suggests that transported models can be adapted and implemented in different cultural contexts with good clinical outcomes. However, such implementation requires sustained attention to adaptation processes, supervision to maintain fidelity over time, and a clear understanding of implementation challenges. Capacity building and implementation of evidence-based programmes of care in LMICs is crucial to support the rights of

people with autism and other neurodevelopmental disorders to have their needs met within the context of the Universal Declaration of Human Rights, UN Convention on the Rights of the Child, and Sustainable Development Goals.

**Conclusions:** Many of the priorities for global action have been highlighted during this Commission. These priorities include engaging families as key stakeholders; remembering that most autistic people are adults; addressing the need, particularly in LMICs, to find scalable models to raise awareness, identification, assessment, and care that will, in most cases, take place across a lifetime; recognising the importance of systems and economic implications; and acknowledging the continual need to take into account heterogeneity and diversity not just in individuals with autism but in their cultures, contexts, and personal preferences.

#### **203.004** (Panel) Neurodiversity and Valuing Autism

**A. Plank**, *Wrong Planet, Los Angeles, CA*

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**Background:** Neurodiversity refers to the natural variability within human brains and minds. Recognition of human diversity helps us to better understand autistic individuals in ways that have far-reaching effects. These effects cut across issues as broad as human rights, equity and social justice, respect for difference, and the need to take individual and family preferences into account. Valuing neurodiversity has the potential to create stronger and wiser communities and positive social values.

**Objectives:** N/A

**Methods:** N/A

**Results:** The concept of neurodiversity is also the basis of an international civil rights movement that arose primarily as a response to the marginalisation of autistic people. The neurodiversity movement considers autism as a neurological difference rather than a disorder and is sometimes associated with opposition to efforts to find a cause or cure. Individuals prefer to self-identify as a member of the neurodiverse community rather than with psychiatric and medical diagnoses that highlight impairment and disorder. Not all autistic people and stakeholders identify with the neurodiversity movement. Controversy exists about how those with the highest support needs, including those with substantial intellectual disabilities and limited functional communication and who are unable to advocate for themselves are represented by a non-medical model. Many autistic people struggle with their difficulties and feel excluded from society; some might seek a cure whereas others embrace autism as part of their identity, thankful for some aspects of who they are despite the challenges that come with difference; most are somewhere in the middle. A sometimes overlooked aspect in ongoing debates about neurodiversity in the autism community is that experiences, views, and attitudes vary across stakeholder groups. In fact, holding a plurality of views at one time is possible. Another consideration is that the current debates on medical versus social models of disability can be quite different across social, cultural, and global communities.

**Conclusions:** Individuals with autism and other neurodevelopmental disorders are a valued part of our society and represent a prototype of neurodiversity. At the same time, many individuals with autism have high levels of need and are vulnerable, and societal attitudes to difference, inclusion and equity will impact their life experiences and outcomes. Autistic individuals and their families can show amazing strengths and persistence, patience and perception that can change development as well. Respect for this diversity and heterogeneity is key, as well as respect for the power of development and the possibility of change. All developmental conditions induce society to reflect on the degree to which those with the highest levels of need are supported, on including people who are different, and on making an effort to build communities and institutions that function well for all citizens. Valuing autism and neurodiversity benefits society as a whole.

#### **203.005** (Panel) Policy and Research Priorities and Implications

**T. Charman**, *Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

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**Background:** At least 78 million people worldwide have autism; the majority do not receive support from, or have access to, adequate health-care, education, and social care services.

**Objectives:** We call for governments and funding organisations to prioritise systematic research that goes beyond biology and small-scale studies of single short-term interventions, to address the issues of for whom, when, how much, how long and when interventions can change outcomes in ways that acknowledge the heterogeneity of families, cultural contexts and autistic individuals and the need to integrate care across systems and time. People with autism have complex needs; meeting these needs requires government coordination between health-care, education, finance, and social sectors across the life span, and active inclusion and participation of autistic people and their families.

**Methods:** Research that will result in immediate improvements in the lives of people with autism and their families should be prioritised. National and international infrastructures should be developed to help such projects to move beyond single investigator-led (albeit multi-site) studies to more integrated attempts that take into account individual differences within autism. Infrastructures should also support studies that build on each other and provide evidence for broader community implementation and effectiveness, rather than simply showing that an intervention is better than a waiting list or treatment as usual. High-quality research in LMICs is possible; support for such studies is crucial and should address implementation and feasibility as well as outcomes

**Results:** Governments and services should monitor access to provision to ensure that underserved groups, including those who are minimally verbal, girls and women, minority ethnic groups, from socially disadvantaged backgrounds, or with severe co-occurring conditions, have equitable access to appropriate services.

Conclusions: Our message is one of hope in that research has shown us that there is great potential for change, which can be built upon through future research and policies for autistic people and their families across the globe.

## ORAL SESSION - 5B — COMBINED TOPICS

### 311 - Biomarkers and Intervention Trials

**311.001** (Oral) Identification of Metabolic Dysregulation Associated with Autism Spectrum Disorder (ASD) through Continued Development of a Precision Medicine Approach to Blood Plasma Based Metabolic Tests

**A. M. Smith<sup>1</sup>**, E. Donley<sup>1</sup>, M. Ludwig<sup>1</sup>, L. Feuling<sup>1</sup>, M. Natowicz<sup>2</sup>, D. G. Amaral<sup>3</sup> and R. Burrier<sup>1</sup>, (1)Stemina Biomarker Discovery, Madison, WI, (2)Pathology & Laboratory Medicine Institute, Cleveland Clinic, LL-3, Cleveland, OH, (3)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA

#### Background:

Individuals with ASD display a diverse array of behaviors and co-occurring conditions leading to a heterogeneous disorder that complicates diagnosis and interventions. Discovery of biochemical phenotypes (metabotypes) based on quantification of blood plasma metabolites can be used to stratify individuals with ASD into subpopulations based on shared mechanisms of metabolic dysregulation. Previously we reported on metabolic stratification of ASD participants enrolled in the Children's Autism Metabolome Project (CAMP, ClinicalTrials.gov Identifier: NCT02548442) based on ratios of plasma metabolites that may identify dysregulation of metabolism. This can lead to the development of laboratory tests useful in precision medicine-based approaches to screening and treatment of ASD. In this work, we assayed metabolites associated with the microbiome and acylcarnitine metabolism to identify novel metabotypes. The novel metabotypes were then clustered and optimized into a test battery that included previously identified metabotypes.

#### Objectives:

Stratify CAMP ASD participants into distinct metabotypes based on alterations of a wide array of biochemical processes that can be used to develop clinically actionable biomarker-based tests and paired therapies.

#### Methods:

CAMP enrolled children, age 18-48 months, from 8 centers across the USA and employed the Autism Diagnostic Observation Schedule, Second Edition performed by research reliable clinicians to confirm ASD diagnoses. Three quantitative mass spectrometry-based assays were used to measure the concentrations of 54 metabolites from plasma samples of 499 children with ASD and 209 typically developing (TYP) children. Metabotype tests were created by setting a diagnostic threshold to identify a subpopulation of CAMP participants primarily composed of children with ASD. Metabotype tests that identified subpopulations with a sensitivity  $\geq 5\%$  and specificity  $\geq 95\%$  following 4-fold repeated cross validation were clustered based on the common participants in the subpopulations. These metabotype tests were then used to create a test battery to increase sensitivity of the overall screening approach.

#### Results:

Metabotyping of CAMP participants identified 153 metabotype tests where 83% of ASD participants were identified by at least 1 metabotype. The metabotype tests had average sensitivities of 5-11% and specificities of 97-100%. Metabotypes associated with ratios of metabolites containing an acylcarnitine as a numerator or denominator identified 30 novel tests. Clustering of metabotype tests identified three novel clusters primarily associated with ratios of metabolites with a numerator or denominator that was a medium chain acylcarnitine. The medium chain acylcarnitine associated metabotypes clusters had two distinct patterns of distributions where acylcarnitines were either increased or decreased relative to the participants lacking a metabotype. These metabotype tests could be optimized into a battery of tests that identified CAMP participants with 71% sensitivity and 90% specificity.

#### Conclusions:

Discovery of metabolic biomarkers associated with ASD can lead to the development of laboratory tests useful in screening children with ASD for altered metabolism. This approach has identified novel metabotypes associated with dysregulation of medium chain acylcarnitine metabolites. This research provides a pathway for precision medicine in diagnosing and treating autism by pairing subjects with metabolically characterized subtypes of autism with targeted therapies that address the specific biochemistry of the dysregulation.

**311.002** (Oral) Metabolic Support Therapy with Q10 Ubiquinol, Vitamin E and Polyvitamin B: Results of a Retrospective Chart Review in Neurodevelopmental Disorders and of a Double-Blind, Randomized Cross-over Study in Phelan-McDermid Syndrome

**A. M. Persico<sup>1</sup>**, A. Ricciardello<sup>2</sup>, L. Turriziani<sup>3</sup>, F. Cucinotta<sup>4</sup>, G. Calabrese<sup>3</sup>, P. Tomaiuolo<sup>3</sup>, A. Mancini<sup>3</sup>, T. Di Bella<sup>3</sup>, F. Bellomo<sup>3</sup>, M. Boncoddò<sup>3</sup>, G. Turturo<sup>3</sup>, S. Mirabelli<sup>3</sup>, R. Keller<sup>3</sup>, V. Porcelli<sup>3</sup> and L. Palmieri<sup>3</sup>, (1)Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy, (2)Villa Miralago, Center for the treatment of eating disorders, Cuasso al Monte, Italy, (3)Interdepartmental Program "Autism 0-90", "G. Martino" University Hospital, University of Messina, Messina, Italy, (4)IRCCS Centro Neurolesi "Bonino-Pulejo",

**Background:** Defective mitochondrial functioning and increased oxidative stress have been well documented in ASD and in neurodevelopmental disorders (NDDs). Studies of antioxidants and supplements are often limited by the co-administration of several dozen compounds.

**Objectives:** (1) To study the efficacy of a “metabolic support therapy” (MST) including Q10 ubiquinol, vitamin E and polyvitamin B, in NDDs and in Phelan-McDermid syndrome (PMS), a syndromic form of ASD; (2) to begin dissecting the selective contribution of Q10 ubiquinol vs vitamins.

**Methods:**

(1) Retrospective chart review: records of patients with any NDD (2016-2020), treated with MST for a minimum of three months were reviewed by a Child Neuropsychiatrist not involved in their clinical management, scoring CGI-S and CGI-I.

(2) Double-blind, randomized, active comparator-controlled, cross-over study: patients with PMS received Q10 ubiquinol (50/100 mg b.i.d.) + Vit.E (60 mg/d) + polyvitamin B for 4 months (active drug) vs only Vit. E and B for 4 months (active comparator). Primary outcome measures include VABS, CARS, CGI-I and VAS; secondary outcome measures include measures of cognitive function, autism, problem behaviors, quality of life (QoL), communication, comorbidities, and measures of oxidative stress (clinicaltrials.gov id. NCT04312152).

**Results:**

(1) records of 53 patients with NDDs (16 ASD, 13 ID/DD, 16 ASD+ID/DD, 5 PMS, 3 ADHD) identified 40 (75.5%) responders and 13 (24.5%) non-responders to MST. Most frequently improved were adaptive function and cognition (41-43% of cases), followed by social interaction, motor coordination, attention and language (20-32%). Mild hyperactivity and early insomnia were observed in 11-17% of patients. In two MST responders with ID, pre-/post-treatment IQ testing documented a 20 pt improvement;

(2) We recruited 31 PMS patients, (3-37 yrs, M:F ratio=1.06:1), all but one with ID and 13 (39.4%) with co-morbid ASD. Q10+vit. yielded “much” or “minimal” CGI improvement in 10/31 (32.3%) and 14/31 (45.2%) cases, respectively, vs 6/31 (19.4%) and 16/31 (51.6%) with vitamins only. Non-responders to either treatment were 7/31 (22.6%). VABS motor skills, VAS stereotypies and shared play improved more with Q10+vit. over vit. only ( $P<0.05$ ). CGI-I scores were superimposable when Q10+vit was administered during the first quadrimester, but significantly better when administered during the second quadrimester (time x treatment interaction in Fig. 1). Maternal WHO-QOL scores displayed a striking 4.7 pt improvement with Q10+vit. over vit. only ( $P=0.0079$ ), and paternal scores showed a similar trend ( $P=0.075$ ). Side effects (hyperactivity, insomnia and irritability) were mild, rare and did not differ between treatments.

**Conclusions:** MST seemingly produces small-to-moderate improvement especially in cognitive and adaptive skills, in up to 70% of cases with ASD, ID, DD or PMS. This improvement is sufficient to improve parental QoL. Vitamins E and B seemingly exert some beneficial effect (Fig. 1, left panel) and promote greater efficacy by Q10 over time (Fig. 1, right panel). A targeted confirmatory cross-over RCT contrasting [Q10+vit] vs placebo can now be undertaken.

### **311.003 (Oral)** Phenotypic Characterization of Individuals with Autism Spectrum Disorder Based upon Serotonin Blood Levels.

**A. M. Persico<sup>1</sup>, F. Cucinotta<sup>2</sup>, A. Ricciardello<sup>3</sup>, L. Turriziani<sup>4</sup>, P. Tomaiuolo<sup>4</sup>, G. Calabrese<sup>4</sup>, F. Bellomo<sup>4</sup>, M. Boncoddo<sup>4</sup>, G. Turturo<sup>4</sup>, S. Mirabelli<sup>4</sup>, R. Sacco<sup>5</sup>, S. Gabriele<sup>5</sup> and M. Canali<sup>5</sup>,** (1)Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy, (2)IRCCS Centro Neurolesi "Bonino-Pulejo", Messina, Italy, (3)Villa Miralago, Center for the treatment of eating disorders, Cuasso al Monte, Italy, (4)Interdepartmental Program "Autism 0-90", "G. Martino" University Hospital, University of Messina, Messina, Italy, (5)Service for Neurodevelopmental Disorders & Laboratory of Molecular Psychiatry and Neurogenetics, University "Campus Bio-Medico", Rome, Italy

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**Background:** Hyperserotonemia was the first biomarker identified in autism research. Platelet serotonin (5-HT) is elevated in approximately 25% of autistic children, but displays a broad distribution in ASD. Its neurochemical basis, behavioral correlates and underlying mechanisms remain unclear.

**Objectives:** To characterize the phenotypic and behavioral correlates of serotonin blood levels in a large sample of ASD patients.

**Methods:** Serotonin levels were measured from platelet-rich plasma by HPLC in triplicate and categorized in two ways, either as “low/normal/high” applying thresholds at 102 and 279 ng/ml, or by quartiles. Significant results using both approaches are reported and additional multivariate analyses are under way. A total of 667 patients with non-syndromic ASD were analyzed, following the exclusion of 21 SSRI-treated patients. Phenotypic variables include (a) demographic and parent-reported patient/family-history, (b) medical, neurological, behavioral and comorbidities derived from direct observation, and (c) tests/questionnaires. Some phenotypic variables are available only for a subgroup including 232 of the 667 patients.

**Results:** Significantly associated with high 5-HT and less frequent in low 5-HT patients are “difficulties at weaning” ( $P<0.05$ ,  $N=242$ ), “delayed motor development” ( $P<0.05$ ,  $N=244$ ), “presence of facial dysmorphisms” ( $P<0.05$ ,  $N=243$ ). On the contrary, significantly associated with low 5-HT and less frequent in high 5-HT patients are “self-injurious behavior” ( $P<0.001$ ,  $N=604$ ), “presence of sleep disorders” ( $P<1.5 \times 10^{-4}$ ,  $N=602$ ), “pediatric or infectious disease coincident with autism onset” ( $P=5.9 \times 10^{-5}$ ,  $N=634$ ), “autoimmune disorders in II degree relatives” ( $P=6.5 \times 10^{-9}$ ,  $N=589$ ) with a similar trend for I degree relatives.

Conclusions: Increased 5-HT blood levels appear associated with deficits in weaning and motor development, consistent with known roles of 5-HT in development and control of rhythmic movements like chewing and locomotion. Also a greater incidence of facial dysmorphisms appears compatible with 5-HT roles in craniofacial morphogenesis. Instead, low 5-HT blood levels are associated in our sample with self-injurious behavior and with sleep disorders, in line with 5-HT involvement in impulse control and sleep regulation. The surprising and strongly skewed distribution of “pediatric or infectious disease observed at autism onset” and familial loading for autoimmune diseases points toward protective effects of 5-HT against both peripherally-triggered neuroinflammation and autoimmunity, in line with known 5-HT influences in keeping microglia in a resting, anti-inflammatory state, and in preventing autoimmunity by promoting the expansion of Tregs cell. Importantly, these data confirm that platelet 5-HT does not merely represent a peripheral biomarker, but rather reflects both peripheral and central phenomena. These results thus spur further interest into elucidating the mechanisms underlying serotonergic imbalances in ASD.

**311.004 (Oral)** Long-Term Safety and Sustained Efficacy of ZYN002 Cannabidiol Transdermal Gel in Children and Adolescents with Fragile X Syndrome (ZYN2-CL-017)

N. Tich<sup>1</sup>, A. Thibodeau<sup>1</sup>, T. Sebre<sup>1</sup>, T. Dobbins<sup>2</sup>, J. M. Palumbo<sup>1</sup> and S. O'Quinn<sup>1</sup>, (1)Zynerba Pharmaceuticals, Devon, PA, (2)The Griesser Group, Conshohocken, PA

Background: ZYN002 is a pharmaceutically produced transdermal cannabidiol gel in development for the behavioral symptoms in Fragile X syndrome (FXS). ZYN2-CL-017 is an ongoing, long-term, open-label extension (OLE) of CONNECT-FX (ZYN2-CL-016). CONNECT-FX was a randomized, double-blind trial assessing safety and efficacy of ZYN002 in children and adolescents with full *FMR1* gene mutation. Patients with complete, 100% *FMR1* gene methylation treated with ZYN002 had significant improvements as compared to placebo on multiple endpoints.

Objectives: To assess the long-term safety and efficacy of ZYN002 in patients age 3 through 17 years with FXS.

Methods: Interim analyses of data collected through 21-May-2021. Safety data for all patients, up to 30 months, and efficacy data through 6 months of treatment for patients with 100% *FMR1* gene methylation who completed CONNECT-FX are reported. Patients screened for CONNECT-FX were eligible for entry, including patients ineligible to continue in the trial, and patients who were randomized to 12-weeks of ZYN002 (250 mg or 500 mg daily [weight-based]) or placebo. Patients from an earlier open-label trial (ZYN2-CL-009) also entered the OLE trial. Patients who completed CONNECT-FX remain blinded to the treatment received in CONNECT-FX. Safety assessments included adverse events, vital signs, laboratories, and electrocardiograms (ECGs). The primary efficacy endpoint was change in the Social Avoidance (SA) subscale of the Aberrant Behavior Checklist–Community FXS (ABC–CFXS).

Results: 240 patients were enrolled; 197 who completed CONNECT-FX, 12 screen failures and 21 patients ineligible to continue from CONNECT-FX and 10 patients from ZYN2-CL-009. 110 patients received ZYN002 prior to entry. Mean age was 9.7 years and 76.3% were male. 156 patients (70.3%) for whom methylation status was determined had 100% *FMR1* methylation. 210 patients completed at least 6 months of open-label treatment (median of 21 months). 131 patients were continuing at this interim analysis. Treatment emergent adverse events (TEAEs) were reported by 62.2% of patients; 97.7% were mild to moderate severity. TEAEs reported by  $\geq 5\%$  of patients included: upper respiratory infection (15.4%) and application site pain (6.6%). 13.3% of patients reported a TEAE possibly related to treatment. Six patients experienced 7 serious adverse events; none were considered treatment-related. Seven patients discontinued due to an adverse event. No clinically significant changes in vital signs, laboratories or ECGs were reported. At the end of CONNECT-FX, completely methylated patients treated with ZYN002 had a median improvement of 40% in SA versus 20% ( $p=0.027$ ) in patients treated with placebo. After six months of treatment with ZYN002, patients reported a median improvement of 50% in SA whether originally treated with ZYN002 in CONNECT-FX (3 months OLE) or newly treated with ZYN002 in the OLE trial.

Conclusions: ZYN002 was safe and well tolerated when administered over a median of 21 months. In patients with complete *FMR1* gene methylation, ZYN002 led to sustained improvement in Social Avoidance, a key behavioral symptom of Fragile X syndrome, following initial improvement seen after 12 weeks of double-blind therapy. The results from this OLE trial continues to support the effectiveness of ZYN002 in patients with complete *FMR1* gene methylation.

## POSTER SESSION — COMBINED TOPICS

### 407 - Combined Topics

**407.167 (Poster)** Effects of a Whole-Body General Movement and Exercise Intervention on Social Communication and Behavioral-Affective Skills of Children with ASD

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Background: Children with Autism Spectrum Disorder (ASD) demonstrate poor verbal and non-verbal communication, impaired affective regulation, and repetitive and maladaptive behaviors. Our past work has demonstrated that rhythmic movement interventions provided in a small group can promote motor skills, joint attention, spontaneous communication, and on-task behaviors in children with ASD.

Objectives: The current study extends our work by comparing the effects of a whole-body general movement (GM) intervention compared to a conventional seated play (SP) intervention on social communication and behavioral-affective skills of children with ASD. The study will also allow a

comparison between face-to-face and telehealth-based intervention delivery, since this research team had to transition from in-person to virtual research in the midst of the COVID-19 pandemic.

**Methods:** 30 children with ASD between 6 and 14 years were seen as part of this 10-week study. Pretests and posttests were conducted in the first and last weeks and training was provided 2 times/week in the intermediate 8 weeks. Training sessions involved interactions between the child, an expert trainer, and an adult model. Specifically, the GM group engaged in turn taking-based, goal-directed, movement games and exercises with an emphasis on promoting muscle strength (upper, lower, and trunk), endurance, movement speed, agility, bilateral coordination, and executive function. In contrast, the SP group engaged in seated activities such as reading, building, and art-craft that focused on promoting fine motor and academic skills. Outcome measures included the standardized Joint Attention Test (JTAT) assessed at pretest and posttest as well as training-specific measures of the amount of socially-directed verbalization, duration of positive/interested affect, and frequencies of repetitive and maladaptive behaviors measured during early and late training sessions.

**Results:** Preliminary data from 5 children seen via telehealth in the GM group suggest a trend for improvement in overall JTAT scores from pretest to posttest. Moreover, all children showed an increase in socially-directed verbalization (Mean(SE) - Early:7.4(1.0), Late: 12.4(2.2)) from an early to a late training session. Engaging in movement games in a turn taking format afforded greater spontaneous, socially-directed speech (7.8(1.3)) compared to responsive verbalization (2.2(0.5)) during sessions. Moreover, children increased the amount of spontaneous speech as well as appropriate responding towards the trainers across training weeks. All children generally showed high levels of compliance with the training and in fact decreased the frequencies of negative/maladaptive behaviors from an early (5.2(3.0)) to a late (3.5(2.7)) training session. We hypothesize that overall the GM training will afford higher levels of engagement, socially-directed speech, and task compliance as well as lower levels of repetitive behaviors compared to the SP training.

**Conclusions:** Our preliminary findings suggest that whole-body movement interventions focused on promoting strength, agility, coordination, and motor planning in small group formats provide excellent opportunities to facilitate social communication and behavioral-affective skills in children with ASD. Goal-directed movement games foster social monitoring, turn taking, cooperation, rule following, imitation, and motor planning, all of which are impaired in children with ASD.

**407.168 (Poster)** Comparing Telehealth and Face-to-Face (F2F) Videos of Standardized Motor Assessments from a Pilot Randomized Controlled Trial in Children with Autism Spectrum Disorder (ASD)

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**Background:** In the past, we have established preliminary evidence for creative movement (CM) interventions to promote solo/social-motor skills in children with Autism Spectrum Disorder (ASD) (Srinivasan et al., 2015, 2016, 2018). This study builds on past studies to compare the effects of a whole-body, play intervention versus a seated play intervention in children with ASD.

**Objectives:** At the onset of the pandemic, our ongoing randomized controlled trial design transformed from a face-to-face (F2F) intervention to a virtual/telehealth (TH) format for both intervention types (Play, Seated play). By the end of the study, we will have an equal number of children observed in both groups (F2F and TH, N=15 per group, 30 total). The poster will compare F2F versus TH-based administration of standardized motor assessments. We will obtain feedback from caregivers, test administrators, and test coders regarding their experiences with both delivery modes.

**Methods:** 30 children with ASD between 6 and 14 years participated over 10 weeks with pretests and posttests conducted during the first and tenth weeks. We administered several standardized tests of motor performance including the Bruininks Oseretsky Test of Motor Proficiency, Test of Gross Motor Development, Sensory Integration and Praxis Tests, Timed Up and Go test, and 2-minute walk test as well as custom-developed paradigms to assess imitation and interpersonal synchrony during the tests. All testing sessions were videotaped for further coding. Following pretests, children were randomly assigned to receive either play or seated play training. While the play training focused on whole-body music, dance, and yoga-based activities, the seated play involved table-top activities such as reading, building, and art-craft. Each stakeholder group completed a survey with 5-point, Likert type questions (too difficult to too Easy, etc.). Caregivers were asked about the testing burden with regard to prep time, their efforts to engage the child during sessions, ease of equipment and space setup, etc. Test administrators were asked to compare their experience with F2F vs. TH delivery in terms of ease of instruction and setup, time required for tests, and communication with child/family. Coders were asked about ease of scoring tests and challenges faced in scoring due to delivery mode.

**Results:** Preliminary analysis of surveys suggest that irrespective of mode of test delivery, caregivers found the test preparation optimal, test supplies easy to use, and tester instructions/demonstrations appropriate and clear. Over 75% caregivers said that the test sessions were slightly long and a little over 30% felt that the sessions were somewhat demanding for caregivers in terms of time and effort. We hypothesize that while both formats will be acceptable, TH-based testing barriers include space-related constraints associated with test administration, need for greater caregiver efforts, more tester prompting, audio-visual lags that impair synchrony/imitation testing and coding, as well as greater variability in test administration compared to the F2F mode.

**Conclusions:** We will add to the pre-pandemic evidence on efficacy of telehealth-based clinical assessments and their feasibility, acceptability, challenges, and test validity. In the future, OTs/PTs may consider conducting certain types of clinical motor assessments via telehealth.

**407.169 (Poster)** Effects of a Whole-Body General Movement Interventions on Motor Performance, Agility, and Locomotor Skills of Children with ASD

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**Background:** Conventional treatment approaches for Autism Spectrum Disorder (ASD) focus primarily on addressing core impairments in social communication & behavioral domains. However, it was recently reported that 87% of children with ASD are at risk for motor impairments (Bhat, 2020, 2021). Our past work suggests that rhythm and yoga-based interventions can help promote motor performance, social communication, and behavioral-affective skills in children with ASD (Srinivasan et al., 2015; Kaur & Bhat, 2019).

**Objectives:** The present study expands this work by comparing the effects of a whole-body General Movement (GM) intervention to a standard-of-care, Sedentary Play (SP) intervention on gross motor performance, agility, and locomotor skills of children with ASD. A subset of the children in the study were seen via telehealth due to the ongoing COVID-19 pandemic.

**Methods:** The study lasted for 10 weeks with pretests and posttests conducted during the first and the tenth weeks respectively. 30 children between 6-14 years were matched on age, gender, and level of functioning and then randomly assigned to the GM or SP groups. Each child received 8 weeks of training with 2 sessions conducted per week. The GM group engaged in dynamic, whole-body activities that promoted visuo-motor, bilateral, and dual-limb coordination, strength, and agility skills. The SP group engaged in tabletop activities such as reading, building, and art-crafts to promote social interactions and fine motor skills. The balance, bilateral coordination, upper limb coordination, and running speed subtests of the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) and the locomotor subtest of the Test of Gross-motor development (TGMD) were administered at pretest and posttest. In addition, task-specific games involving locomotor skills such as hopping, leaping, sliding, running, etc. were assessed during early and late training sessions to evaluate changes in movement form and accuracy.

**Results:** Preliminary data from the GM group suggest that 8 out of 11 children showed improvements in locomotor skills as assessed using standard scores on the TGMD (Mean(SE): Pretest= 5.72(1.02), Posttest= 7.81(0.95)). Moreover, 86% children also showed improvements in raw scores on the balance (Pretest= 24.28(2.17), Posttest= 32(1.35)), upper-limb coordination (Pretest= 25.71(3.14), Posttest= 30.57(2.43)), and running speed (Pretest= 19(4.68), Posttest= 23.81(3.73)) subtests of the BOT-2. In terms of task-specific tests, around 70% children improved in movement form on multiple locomotor skills such as fast feet running, hop-skotch, sliding, bunny jumps, and side stepping from an early to a late training session. Moreover, 86% children also reduced the amount of prompting required to complete the task-specific tests during sessions. We hypothesize that irrespective of the mode of intervention delivery the GM group will demonstrate greater improvements in gross motor performance, agility, and locomotor skills compared to the SP group.

**Conclusions:** Our preliminary data suggest that dynamic, whole-body movement-based interventions can be used to promote gross motor skills, agility, and coordination in school-age children with ASD. Given the high prevalence of motor impairments in this population, our work calls for the inclusion of whole-body movement games and activities in the plan of care of children with ASD.

**407.170 (Poster)** Difficulties of Brazilian Families in Choosing the Best Intervention Option for Children with Autism Spectrum Disorder.

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**Background:**

The Autism Spectrum Disorder (ASD) is a developmental disorder that primarily affects social communication and behaviour. The impact on the family of individuals with ASD is high. Since it is a disorder that there is no single treatment, the main recommendation is to invest in interventions for a better prognosis and symptom improvement, focusing mainly on autonomy and adaptive functioning. However, there are several types of intervention and one of the difficulties of families is choosing the best option.

**Objectives:**

The objective of this study is to characterize the health service use by children with ASD in Brazil.

**Methods:**

The participants were 184 mothers of children with ASD between 6 and 12 years old; 49.50% of them had private health insurance, while 17.4% used exclusively the public health system. They answered an online questionnaire through the Google Form platform. This protocol consisted of 3 instruments: (1) Socioeconomic Questionnaire, developed by the authors, (2) Revised Illness-Perception Questionnaire modified for autism - IPQ - RA and (3) Maternal Autism Knowledge Questionnaire (MAKQ).

**Results:**

Treatment choice (defined by the therapy that the child is undergoing, and the mother is satisfied plus the therapy that the child does not do but she would like him/her to do) was predominately Behavioral Interventions (77.2%). Mothers who had the perception that ASD of their child brought negative consequences in their lives tended to choose a higher number of simultaneous treatments for their children. Also, there were a significant



correlation higher scores in the MAKQ with the use of scientific publications as the principal source of information ( $r=0.379$  e  $p<0.01$ ); in other words, mothers who knew more about ASD symptomatology preferred to look for ASD information on scientific journals. Another correlation found in the study was that mothers who felt more strongly emotional negative impacts of the ASD had higher odds to use other families with children with ASD as the main source of information ( $r=0.175$ ;  $p=0.017$ ). Finally, mothers who had the perception that their behavior could affect the trajectory of the ASD of their child tended to consider their children's therapists as a reliable source of information ( $r=0.228$  e  $p=0.002$ ).

#### Conclusions:

The results are relevant for improving the comprehension of the trajectory of Brazilian mothers of children with ASD in the search for interventions. Maternal perceptions and knowledge of ASD were associated with their sources of information to learn about the condition, as well as with the therapeutical types that they chose for their children.

#### **407.171 (Poster) Voices from the Field: Informing Research and Practice on Capacity Building Strategies in Mongolia**

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#### **Background:**

Although global prevalence of autism has grown substantially, researchers still report inequity in access to evidence-based interventions (EBI) in many low-resource setting (LRS). As a field, there is still much to be learned about the strategies stakeholders in LRS use to build capacity in response to the low level of resources. Capacity building refers to the advancement of knowledge and skills among stakeholders and the development of cohesiveness among stakeholders in the community. Although autism researchers highlight the needs in research in LRS, the field knows very little about what stakeholders of children with autism in LRS suggest as effective strategies for capacity building in their communities, which may have significant implications for novel interventions.

#### **Objectives:**

As a middle-income Asian country, Mongolia can serve as an example to other LRS because of the geographical and cultural proximity to other nations. Furthermore, there is very limited autism research in Mongolia, which has led to invisibility and limited access to EBI. To develop socially valid and sustainable interventions, it is crucial to understand what stakeholders of children with autism report as effective strategies to address the limited resources in their country. Therefore, the purpose of this study was to examine perceptions of the stakeholders related to strategies for capacity building in Mongolia.

#### **Methods:**

We conducted qualitative research including five focus groups with 30 Mongolian caregivers of children with autism and individual interviews with 15 professionals who work with children with autism and their families in Mongolia. We incorporated the principles of community partnered participatory research, in which several local community stakeholders were involved in different aspects of this study, including identifying priorities, study planning, logistics, data collection, analysis, and dissemination. A constant comparative method was used for data analysis, which formed codes, categories, and themes.

#### **Results:**

Three main themes were identified as strategies for capacity building, including (a) partnership, (b) advocacy, and (c) empowerment. Two categories formed the theme of *partnership*, including enhancing collaboration among stakeholders and collaborating with international development agencies in Mongolia. Through these categories, stakeholders emphasized the importance of close collaboration of all relevant agencies and stakeholders to create a more cohesive autism community. The theme *advocacy* consisted of two categories, including parental advocacy and legislative advocacy. Stakeholders stressed the significance of increasing autism awareness and using cascading model to disseminate information, such as using parent peer support. Legislative advocacy was another commonly mentioned category, which refers to increasing awareness of relevant legislation and caregivers' collective efforts to advocate for each other. In *empowerment*, stakeholders highlighted the value of providing more opportunities to disseminate information to caregivers and other stakeholders, such as school administrators.

#### **Conclusions:**

It is imperative that the reach of autism research expands to traditionally underserved, underrepresented populations globally. Through this qualitative inquiry with 45 stakeholders of children with autism in Mongolia, we found several strategies that empower them by increasing their capacity to respond to the low level of resources. Furthermore, the findings from this study may suggest important implications for future intervention research.

#### **407.172 (Poster) Capacity Building of Parents of Children with ASD in Mongolia, a Low-Resource Setting**

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## Background:

Parents of children with autism have reported significant hardships in raising their children, likely due to their limited capacity to respond to their children's unique needs. These hardships are exacerbated in low-resource settings (LRS) where parents are reported to have inequitable access to evidence-based interventions (EBI) for their young children. Furthermore, although careful considerations are warranted when conducting novel, experimental applied research in a LRS with little extant research, autism research in LRS is still underrepresented. Therefore, this study was conducted with families in Mongolia, an example of LRS. A previous qualitative study with Mongolian parents provided rationale for this study, where parents expressed barriers and needs to increase their capacity to support their children.

## Objectives:

The purpose of this study was to examine the effects of the Parent Peer Coaching program with Mongolian parents of children with autism to build the capacity within the community of parents and address the inequitable service access in Mongolia.

## Methods:

This experimental single-case research using multiple probe design included three phases of baseline, intervention and maintenance. A local research assistant (RA), four parent mentors (PM) and five parent peers (PP) and their children with autism participated in this study. A cascading intervention model was used in this study to examine capacity building process in LRS, in which synchronous coaching occurred across all stakeholders in a stepwise fashion. The independent variable was the Parent Peer Coaching program comprised of online training modules and telepractice coaching. Participants received access to the training, which consisted of modules covering behavior management and social-communication teaching strategies. Coaching first occurred between the RA and each PM, then PM to each PP, and consisted of (a) preobservation (planning for the observation), (b) observation of the coachee's actions, and (c) postobservation (reflection and feedback). All interactions between participants occurred via telepractice to examine its feasibility in LRS.

## Results:

The main dependent variable in this study was the PMs' coaching fidelity with PPs, which was measured by an observational measure that quantifies coaches' adherence. Visual analysis revealed functional relation between the intervention package and increase in each PM's coaching fidelity. In addition, effect size was calculated to quantify magnitude of the functional relations between phases across each tier using the log response ratio, which revealed large percentage changes. Furthermore, we conducted semi-structured individual social validity interviews, which revealed the acceptability, effectiveness, and potential sustainability of both intervention contents and implementation.

## Conclusions:

There are several implications from this study. First, more research is warranted to explore how such cascading intervention (parent-to-parent) can help increase other non-specialists' coaching skills in different content areas (e.g., teachers, therapists). Such examination would allow us to utilize diverse stakeholders of children with autism to deliver EBI in many LRS. Also, future research should also examine how to adapt interventions to be culturally relevant in underrepresented settings with marginalized and minoritized populations to increase equity in access to EBI. The results of this study suggest feasibility, acceptability, and effectiveness of delivering interventions with and to stakeholders in LRS.

## 407.173 (Poster) Cultural Adaptation Checklist: Enhancing Implementation and Sustainment of Autism Interventions

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## Background:

In implementation science, systematic uptake of evidence-based interventions (EBI) is critical to improve the quality and effectiveness. Due to the increasing global prevalence of autism, it is crucial that the field enhances service access for stakeholders of individuals with autism. Although cultural adaptation of an EBI for autism may be crucial to address the global inequity in research with populations in low-resource settings, very few systematic tools or theoretical frameworks are used by autism researchers to guide these adaptations. When these interventions are not properly adapted with sufficient considerations for the unique cultural characteristics of a group, it may result in implementation failure and exacerbate the research-to-practice gaps.

## Objectives:

With this gap in mind, we developed the Cultural Adaptation Checklist with primary purposes to (a) guide research and practice on the cultural adaptation of existing EBI with minoritized and marginalized populations, and (b) systematically appraise the quality of cultural adaptation conducted in autism literature. In this presentation, we will showcase the Checklist, its development, and an example of its use in reviewing extant research in autism literature.

## Methods:

There are seven dimensions with 33 items on this Checklist, which are largely adapted and modified from broader mental health literature, including the ecological validity model (EVM) by Bernal et al. (1995). The dimensions include *language, persons, content, goals, methods, context*, and *process*. It was developed through an iterative process with feedback from experts in autism research and implementation science. To promote more accurate evaluation, we have further divided each dimension into two pillars, adaptation planning and implementation process, which allowed us to examine both aspects of an intervention. This process also allowed us to examine the characteristics of each dimension, critically analyze the literature, and provide specific guidelines. The 33 items across the seven dimensions and a detailed rubric for each item were developed to increase accuracy in quality appraisal of the literature. A total of 12 studies from a prior literature review on parent-mediated interventions for children with autism in low-resource settings internationally were appraised using the Checklist.

## Results:

In our preliminary analysis of the literature using the Checklist, it was revealed that all studies reported some level of adaptations to an existing EBI in autism (i.e., parent-mediated intervention) to target outcomes of both child and parent levels. While many of these studies reported practices on linguistic translations (i.e., language dimension), most did not report adaptations in other dimensions or described how adapted interventions were implemented in the community.

## Conclusions:

Future research is warranted to examine the mechanisms of how interventions are culturally adapted to be delivered for minoritized and marginalized population in low resource settings internationally. Furthermore, there are limited reports of cultural adaptation in extant literature as indicated in our literature review, which indicate the needs for future research to examine how to better facilitate the process. With more systematic guidance for cultural adaptation of both research and practice, the field may enhance uptake of EBI across the world.

# Communication and Language

## PANEL — COMMUNICATION AND LANGUAGE

### 207 - Quantification of Language and Communication in Minimally Verbal Individuals

**Panel Chair:** **Kristina Johnson**, *Rosamund Stone Zander Translational Neuroscience Center, Boston Children's Hospital/Harvard Medical School, Boston, MA, MIT, Cambridge, MA, Rosamund Stone Zander Translational Neuroscience Center, Boston Children's Hospital/Harvard Medical School, Boston, MA, MIT, Cambridge, MA*

**Discussant:** **Amanda O'Brien**, *Harvard University, Cambridge, MA*

**207.001** (Panel) Phonemic Content of Nonverbal Vocalizations from Individuals with 0-10 Spoken Words

**K. T. Johnson<sup>1</sup>**, **J. Narain<sup>2</sup>**, **A. M. O'Brien<sup>3</sup>**, **A. Kershenbaum<sup>4</sup>**, **T. Quatieri<sup>4</sup>** and **R. W. Picard<sup>3</sup>**, (1)*Boston Children's Hospital, Cambridge, MA*, (2)*MIT, Cambridge, MA*, (3)*Harvard University, Cambridge, MA*, (4)*MIT Lincoln Laboratory, Lexington, MA*

**Background:** Little is known about the vocal communication of individuals with few spoken words or word approximations. Even without typical verbal speech, these individuals employ vocalizations that are rich with affective and communicative information (Johnson & Narain et al. 2020). While the developmental trajectory of speech production and language development has been well-characterized in young children, even infants, who are developing "typically" (e.g., Oller 2000), little is known about the development of communicative but non-speech vocalizations in mvASD individuals.

**Objectives:** This research aims to develop sensitive and quantitative developmental markers for the mvASD population – particularly subtle language and communication progressions for those with no or few spoken words. Here, we generate repertoires of produced sounds from minimally verbal individuals and compare that to typical acquisition of vowels and consonants. We also discuss key perceptual or acoustic differences between vocalization types, such as what sounds might more readily indicate an affective state like frustration compared to a directed communication exchange like a request.

**Methods:** Vocalizations were captured in the wild during daily activities and labeled in the moment by family members or care providers who knew the mvASD communicator well (see Narain & Johnson et al. 2020 for a detailed discussion of the data acquisition methods). These labeled vocalizations were then isolated and analyzed for their phonemic content (see Figure 1). Consonant and vowel inventories were procured for each of five participants (4 male, 1 female; ages 9-23) across two vocalization types (Frustration and Request). Three participants had zero spoken words/approximations, while two vocally produced 3-4 spoken words/approximations, per parent report. Vowel production was normalized by age and gender, and consonant production was examined following the typical order of acquisition of English consonants (Sander 1972; Crowe and McLeod 2020). Other expressive features, such as mean vocalization length, mean vowel durations, and metrics of linguistic complexity, were calculated for each participant across multiple vocalization types.

**Results:** Early consonant sounds like 'm' and 'h' were well represented (see Figure 2 for a representative example); however, other common early sounds like 'b', 'p', and 'n' were produced surprisingly rarely, if at all, in this sample. Although sample sizes were small, individuals with more spoken words were found to have occurrences of later developmental sounds, such as 'l', supporting the expansion of sound diversity with word

development. Both vocalizations and vowels associated with expressions of frustration were consistently longer than those associated with a request, suggesting quantifiable perceptual differences between different types of vocalizations. In addition, request vocalizations showed lower vowel durations combined with a lower number of vowels per consonant, suggesting greater linguistic structure.

**Conclusions:** These results suggest that individuals with few or no spoken words produce measurable repertoires of phonemes that may serve as sensitive developmental markers or intervention targets for this population. Importantly, this approach to quantifying language and development in mvASD individuals emphasizes the ways in which they **succeed** in communicating and expressing different needs and desires even without typical verbal speech.

#### **207.002 (Panel) Linguistic Analyses of Expressive Language from Minimally Verbal Children with ASD**

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##### **Background:**

Little is known about the expressive language abilities of the almost one-third of the ASD population who remain minimally or low verbal (MLV) as until recently, they have not been the focus of scientific investigations. In typically developing children there are clear benchmarks for defining stages of language development with respect to number of sounds and words used, composition of vocabulary and how these relate to emerging grammatical abilities evident in word combination and early morphosyntax. It remains unknown whether these benchmarks apply to expressive language in children and adolescents with MLV ASD.

##### **Objectives:**

1. Identify the stages and language benchmarks in a group of MLV ASD children and adolescents.
2. Investigate the relationship between vocabulary size (number of different words; NDW) and composition of vocabulary, particularly nouns and verbs.
3. Investigate the relationship between NDW and the emergence of combinatorial language.

##### **Methods:**

Transcripts were derived using SALT conventions from the ADOS administration to 49 (11 females) English-speaking children and adolescents (age range 6-21 years) who were MV (ADOS Module 1 – N=33) or LV (ADOS Module 2 – N=16). All participants had a minimum of 1 word (and a maximum of 200). Only intelligible/partially intelligible non-stereotyped language was coded from the first 20 minutes of the transcripts. SALT provided measures of NDW, total number of words, nouns, verbs, and mean length of utterance in morphemes (MLUm). Participants were coded into language stages using Tager-Flusberg et al.'s (2009) benchmarks: preverbal (fewer than 5 NDW or 20 word tokens); first words (over 5 NDW and 20 tokens; word combinations (over 30 different words and MLUm 1.8).

##### **Results:**

1. Almost half the participants (45%) were preverbal with almost 2/3 using few different and total words; 39% were in the first words stage and 16% met criteria for word combinations.
2. Figure 1 shows the proportion of nouns verbs and other word categories used by participants in the different language stages. AS NDW grows, the proportion of nouns and verbs increase but a linear regression model did not find that NDW was a significant predictor.
3. Figure 2 shows the relationship between NDW and MLUm. In the linear regression model, NDW was a significant predictor of MLUm ( $\beta = 78.9, SE = 5.69, t = 13.87, p < .001$ ), while age and nonverbal IQ were not.

##### **Conclusions:**

The findings confirm the heterogeneity of linguistic profiles in MLV ASD, and suggest that their language falls on a continuum, although traditional definitions of developmental stages do not apply so clearly. This has important implications for clinical practice as, unlike in typical development, even individuals with fewer than 10 words are able to combine words in their spontaneous speech, which may be used to bootstrap further growth in linguistic abilities.

#### **207.003 (Panel) Quantifying the Complexity of Vocal Expression Using Articulatory Coordination**

*T. Quatieri<sup>1</sup>, T. Talker<sup>1,2</sup>, K. T. Johnson<sup>3,4</sup>, J. Narain<sup>1</sup> and R. W. Picard<sup>1</sup>, (1)MIT Lincoln Laboratory, Lexington, MA, (2)Harvard University, Cambridge, MA, (3)Rosamund Stone Zander Translational Neuroscience Center, Boston Children's Hospital/Harvard Medical School, Boston, MA, (4)MIT, Cambridge, MA*

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**Background:** Autism Spectrum Disorder (ASD) is a developmental condition characterized by difficulty in communication, typically accompanied by neuromotor challenges. In this current work, we address minimally-verbal ASD individuals who have twenty or fewer spoken words or word approximations (designated by mv\*). Though limited in their expressive vocabulary, mv\* individuals exhibit a rich repertoire of vocalizations with

meaning, including grunts, yells, sighs, and sequences of phonemes and syllables. These vocalizations are used among other modalities to express needs, desires, affections, and emotions.

**Objectives:** Because mv\* individuals can exhibit limited neuromotor skills, we were motivated to explore the neurophysiological coordination associated with the clusters of vocalizations that represent various sound classes. Our data is taken from the *Commalla* study, where audio is captured using a wearable microphone in natural settings (Johnson & Narain et al., 2020). Common sound classes (request, dysregulation, delight, frustration, self-talk, social) are labeled in real-time by a parent or caregiver. Through a case study of one participant, we investigated the relative *complexity of coordination* within two motor subsystems: phonation and articulation.

**Methods:** Our metric of complexity leverages previous work in using speech motor coordination measures to detect and track a variety of neurological and stress conditions including verbal ASD, depression, Parkinson's disease, traumatic brain injury, and fatigue (Quatieri et al., 2017; Talkar et al., 2020). Although these previous studies involved verbal speech, we can use the coordination method to quantify the complexity of a vocalization even without typical speech, making it a valuable metric to tracking vocal complexity as mv\* individuals grow and develop. We first extract a set of low-level speech features: fundamental frequency (F0, pitch) during phonation and formant frequencies (F1-F3, vocal tract resonances) to characterize articulation. Cross-correlations of the acoustic low-level features were then used as a proxy for motor coordination across articulatory and laryngeal speech production systems.

**Results:** In this case study, we investigated the relative complexity of three Commalla vocalization classes: dysregulation, request, and delight for one male of age 19. With dysregulation as the reference, we found effect sizes of correlation measures in the range of ~0.2 to -0.8 for F0 and between ~0.8 to -0.8 for the first three formant frequencies (see Figure 1). Moreover, the morphology of the effect sizes indicated lower complexity of coordination in dysregulated utterances as compared to request or delighted utterances. These quantitative findings are consistent with qualitative observations of harmonic and formant structure in spectrographic analysis, which are both more constrained in the dysregulated state.

**Conclusions:** In ongoing work, this pilot case study will be expanded to all six vocalization classes and across the full (8) subject pool. Also ongoing is mapping acoustic parameters (fundamental and formant frequencies) for a more direct connection to neurophysiological coordination toward a richer understanding of the nature of coordination complexity in the mv\* ASD population. Our long-term goal is a neuromotor-based feature representation that translates to an enhanced machine-based recognition of classes – as discussed separately in the panel – and also aids in more effective intervention.

#### **207.004 (Panel) Acoustic Features and Models to Classify Affect and Communicative Intent of Nonverbal Vocalizations from Minimally Speaking Individuals with Autism**

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**Background:** Non- and minimally speaking individuals with autism convey important affective and communicative information through nonverbal vocalizations. Nonverbal vocalizations can vary in pitch, tone, and other acoustic parameters depending on their function. Prior work has included speech analyses for diagnosing developmental differences but not on characterizing the acoustics of affective and communicative nonverbal vocalizations from minimally speaking children and adults with autism.

**Objectives:** Our objective was to evaluate and develop acoustic feature sets and machine learning models that enable the classification of communicative and affective nonverbal vocalizations from individuals with autism, contributing to a deeper understanding of vocal communication by this population.

**Methods:** We collected vocalization data with seven individuals with autism who are minimally speaking and have limited expressive language through speech and writing. Data was collected in real-world environments. Communicative or affective labels for vocalizations were provided by a caregiver in real-time. Labels in the analyses included: "delighted", "dysregulated", "frustrated", "social", "request", and "self-talk". Data was collected longitudinally for 4-64 weeks, varying based on the data collection rate and availability of each participating family.

We evaluated the performance of acoustic feature sets commonly used for modeling affect in verbal speech: the extended Geneva minimalistic acoustic parameter set (eGeMAPs), mel and gammatone cepstral coefficients, and mel and ERB-based filter bank values. We also developed a custom feature set based on our observations, consultation with clinicians, and related explorations in the literature. Our custom feature set included parameters describing the pitch contour, formants, voice quality, and spectral and cepstral characteristics of the vocalization. Both speaker independent and personalized multi-class models were trained and evaluated for each participant. We evaluated random forest models, linear support vector machines with stochastic gradient descent training, and support vector machines with a nonlinear radial basis kernel function.

**Results:** With the fully personalized modeling approach, F1-scores were markedly above chance for each participant, indicating that vocalizations could be well classified using acoustic features. Speaker-dependent models generally had F1-scores below chance, indicating that nonverbal communication practices varied significantly from person-to-person in the evaluated dataset. The custom feature set was the best performing feature set for five of the seven participants. Nonlinear models outperformed linear models for six of the seven participants. Unlike the cepstral coefficients and filter bank features, the custom feature set and eGeMAPs feature sets both contained parameters related to pitch, formants, and voice quality. The custom feature was unique in that it applied functionals related to the pitch contour of the vocalization and values of sustained formants.

**Conclusions:** Acoustic characteristics were used to classify affective and communicative functions of nonverbal vocalizations from seven minimally speaking individuals with autism with F1-scores above chance. This work suggests that the function of nonverbal vocalizations from non- and minimally speaking individuals with autism can be characterized audio alone. Our custom feature set outperformed other commonly used feature sets for the classification task, highlighting the unique nature of nonverbal speech from the studied population and the need for specialized analyses methods as presented here.

## ORAL SESSION - 2B — COMMUNICATION AND LANGUAGE

### 308 - Using Parent-Child Interactions to Learn About Language

**308.001** (Oral) Describing (pre-)Linguistic Oral Productions in Young Autistic Children: A Cluster Analysis

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**Background:** Investigation of naturalistic speech sample as an estimate of (pre-)verbal production have highlighted the fact that, very early on, autistic children produce at lower rates than typically developing (TD) peers and experience delays in the acquisition of all typical milestones of language development (e.g., preverbal vocalizations, canonical babbling, first words). Few studies have tried to describe oral production patterns of autistic children after the age of 3. However, speech emergence is very likely to happen after this age. Moreover, while language acquisition and development are marked by a great heterogeneity in autism, studies have mostly focused on between-group differences with control groups, rather than within-group differences in a group of autistic children.

**Objectives:** Using manually transcribed speech samples of 59 3- to 5-year-old autistic children, we seek to qualitatively delineate different profiles of (pre-)linguistic behaviors and to document those profiles in terms of language, psychometric and demographic measures.

**Methods:** Speech samples were retrieved during a parent-child interaction and the administration of the ADOS-2 and were then manually coded and transcribed. Each child's production was assigned one of seven "type of production" codes: vocalic preverbal, nonvocalic preverbal, syllabic, proto-word, isolated word, word combination, phrase. In order to find subgroups of oral production behaviors, hierarchical clustering was conducted on ratios of each type of production. Between-cluster differences on a series of measures of interest were then investigated using linear regression.

**Results:** The analysis yielded a clustering solution of five clusters, each corresponding to a different profile of types of oral productions. Cluster 1 and 4, identified as verbal, produced mainly phrases and isolated words, respectively. Cluster 2, 3 and 5 were identified as preverbal. Cluster 2 produced barely anything. Cluster 3 produced a fair amount of preverbal and syllabic productions. Cluster 5 produced a lot of syllabic productions, especially. Age was not related to cluster membership, suggesting that children in preverbal clusters were not younger than those of verbal clusters ( $F(54, 4) = 1.23, p = .31$ ). Scores on the ADOS-2 ( $F(53, 4) = 8.37, p < .001$ ), as well as verbal ( $F(23, 4) = 4.79, p = .006$ ) and nonverbal IQ scores ( $F(38, 4) = 9.56, p < .001$ ), however, were found to be related to cluster membership. Overall, children in verbal clusters had higher cognitive abilities and milder autistic symptomatology than children in preverbal clusters. Finally, children in cluster 4, i.e. verbal children that do not produce a lot of phrase speech, were the only ones to display a significant increase in expressive vocabulary between the time of the study and one year poststudy ( $\beta = -182.29, p = .007$ ), suggesting that those children were in the process of developing language.

**Conclusions:** There are different profiles of both verbal and minimally verbal children in a sample of autistic preschoolers. It is very likely that the causes for the success or failure to acquire language by that point differ between clusters. Predictors of different profiles of language production and development should be investigated.

**308.002** (Oral) What Role Does the Environment Play in Language Development? SES, Parent Language Input, and Language Abilities in Children with ASD

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**Background:** Language development in children with ASD is influenced by both proximal (e.g., parent language input) and distal (e.g., socioeconomic status) environmental factors. Several studies have found that "rich and responsive" parent language input supports language development in children with ASD (Swanson, 2020), and newer work has reported a positive relation between socioeconomic status (SES) and language abilities in this population (Olson et al., 2021). While less is known about how these variables interact to shape language development, Swanson and colleagues (2019) found that parent language input mediated the relation between maternal education level, a measure of SES, and language abilities in 24-month-old infants with ASD. However, no studies have explored the relation among these variables in older children with ASD.

**Objectives:** (1) Investigate the relation between SES, parent language input, and language abilities in children with ASD. (2) Explore whether parent language input mediates the relation between SES and child language abilities.

**Methods:** Our sample included  $N=41$  (32M, 9F) children with ASD, 50- to 94-months-old, recruited from SPARK. Parent-child interactions (PCIs) were conducted at home and recording through Zoom. Parents were directed to play with their child for 15-minutes. PCIs were transcribed offline and processed using SALT (Miller & Iglesias, 2012) to obtain number of different words (NDWs) produced by the parent, number of conversational

turns (CTs) between the parent and child, and parent mean length of utterance (MLU) in morphemes. The Vineland Adaptive Behavior Scales, Third Edition Comprehensive Interview Form (Sparrow et al., 2016) was used to assess children's expressive language (EL) and receptive language (RL) abilities. Information about SES (parent education level and annual household income) was collected using an online parent-report demographics form.

**Results:** Spearman's rho correlations were conducted among variables of interest (Table1). Child EL v-scores were positively correlated with parent MLU ( $r_s=.380, p=.014$ ) and CTs ( $r_s=.469, p=.002$ ). The correlation between child EL v-scores and caregiver education level was positive but did not reach significance ( $r_s=.263, p=.097$ ). Child RL v-scores were positively correlated with CTs ( $r_s=.426, p=.005$ ). To investigate whether parent MLU mediated the relation between parent education level and child EL v-scores, path model with robust maximum likelihood estimation was explored in Mplus (Muthen & Muthen, 1998-2017; Figure1). This model showed that while parent MLU was significantly related to child EL v-scores ( $B=2.413, SE=.939, p=.010$ ), parent education level was not significantly related to parent MLU ( $B=.018, SE=.077, p=.817$ ). The indirect effect of parent education level on child EL v-scores via parent MLU was non-significant ( $B=.043, SE=.191, p=.822$ ). The direct effect of parent education level on child EL v-scores was significant ( $B=.758, SE=.328, p=.021$ ).

**Conclusions:** Findings suggest that both proximal and distal environmental factors are related to expressive language abilities in children with ASD. However, parent MLU did not explain the relation between parent education level and children's EL v-scores in the current sample. Future studies should identify which variables within the child's proximal environment significantly mediate this relation, and further explore the bidirectional relation between parent language input and child language abilities.

**308.003 (Oral)** Remote Natural Language Sampling for Children with ASD: Role of Parent-Selected Activities and Child Language Level  
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#### Background:

Natural language samples (NLS) provide an optimal approach for examining expressive language in minimally verbal (MV) children with ASD (Barokova & Tager-Flusberg, 2018). Remote data collection has provided researchers the opportunity to collect an NLS at home while children interact with their parents. Using a semi-structured protocol, Barokova et al. (2020) found that children produced more speech, conversational turns, and number of different words when interacting with parents at home compared to interactions with examiners in the lab. One open question is what kinds of activities do parents select when they are given the opportunity to choose the context for a home-based language sample?

#### Objectives:

1. What activities do parents choose in a remote parent-child interaction?
2. Is the number of different activities related to the child's language level?
3. Is the type of activity associated with the child's language level?

#### Methods:

Remote NLSs of 38 parent-child dyads (child age: 3-7 years, 8 female) were collected. Families were recruited from SPARK, and an autism diagnosis was confirmed using the *Social Communication Questionnaire* (Rutter et al., 2003) (Corsello et al., 2007). Parents completed the *Vineland Adaptive Behavior Scales, Third Edition Comprehensive Interview* (Sparrow et al., 2016). The Expressive Language v-scale score from the VABS was used as a measure of the child's expressive language (EL). Parents were asked to select 2-4 activities to promote communication with their child. A 15-minute parent-child interaction was recorded over Zoom.

#### Results:

1. Parent-selected activities fell into 11 different categories: 1) coloring and art, 2) conversation only, 3) cooking and baking, 4) educational (literacy, math), 5) turn-taking games and puzzles, 6) object play (manipulatives and figures), 7) screen time, 8) sensory-motor, 9) book reading, 10) singing and reciting, and 11) snack. Sensory-motor, object play, conversation only and coloring/art activities occurred the most frequently (Figure 1).
2. Vineland EL v-scale scores significantly predicted the number of different activity types ( $B=-.13, t=-3.75, p<.001$ ), with lower child EL associated with a higher number of activity types (Figure 2).
3. Vineland EL v-scale scores did not differ significantly by type of activity.

#### Conclusions:

Our results support the feasibility of remote in-home NLS with children with ASD including those who have low language levels for whom in-home NLS with a parent (vs. lab-based with an experimenter) allows them to demonstrate higher EL skills. Parents of children with more difficulties in EL employed additional activities as a strategy to elicit more language. These results suggest that approaches exploring activities during parent-child

interactions in the home can allow for a richer and ecologically valid assessment of children's expressive language (Costanza-Smith, 2010).

### **308.004 (Oral) Play Skills As a Predictor of Sentence Diversity in Young Children with Autism Spectrum Disorder**

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**Background:** Play skills have been shown to facilitate language development in young children. Children with ASD show varying degrees of impairments in both play and language skills. However, no studies have yet examined the relation between play skills and sentence diversity, which is predictive of later grammatical outcomes (Hadley et al., 2018), as well as how play skills facilitate language development over the course of early intervention in children with ASD.

**Objectives:** (1) To determine how play skills, measured both by parent reports as well as observations, are related to sentence diversity in children with ASD; and (2) to examine whether baseline play skills predict growth in sentence diversity over Naturalistic Developmental Behavioral Interventions (NDBIs).

**Methods:** Participants included 50 children with ASD (2-4 years) who were receiving NDBIs and their caregivers. Child speech was coded for child sentence diversity, based on two 10-minute video-recorded caregiver-child play interactions, conducted six months apart during which all children received NDBIs (Baseline and 6-months after the baseline). Specifically, unique subject-verb combinations (SV) were coded using the Systematic Analysis of Language Transcripts (SALT) software. Baseline functional play skills were measured using the Play with Objects item on the Brief Observation of Social Communication Change (BOSCC), a new observational treatment outcome measure, and caregiver reports based on the Vineland Adaptive Behaviors Scale (VABS-2) Play and Leisure subdomain V-scale scores. Generalized Linear Mixed Models were used to examine the effects of baseline play skills, timepoint, and the interaction between play and timepoint, on sentence diversity while controlling for age, gender, and Non-Verbal IQ (NVIQ). Following up on the significant interaction effects, posthoc t-tests were conducted to examine whether changes in SV were significantly different between the low vs. high play level groups based on the median BOSCC and VABS-2 scores.

**Results:** The main effects of time ( $B=16.85$ ,  $p<.001$ ) and baseline BOSCC play skills ( $B=30.22$ ,  $p<.001$ ) on SV emerged. The interaction effect between BOSCC baseline play level and time also emerged ( $B=7.19$ ,  $p=.009$ ). For the VABS-2 play skills, there was a significant interaction effect of baseline play skills and time ( $B=7.808$ ,  $p=.006$ ). All of these effects were significant even after controlling for the effects of age, gender, and NVIQ. As seen in Figures 1 and 2, posthoc analyses revealed that the high play level groups showed significantly larger improvements in SV compared to the low play level groups (BOSCC  $t=-3.866$ ,  $p<.001$ ; VABS  $t=-2.036$ ,  $p=.048$ ).

**Conclusions:** More mature play skills at baseline were associated with a greater increase in sentence diversity over the course of NDBIs, suggesting that early play skills may facilitate the gains in language skills over the NDBIs. Given that early functional use of language has been shown to be a strong predictor of positive long-term outcomes in children with ASD, these results indicate that targeting both play and language skills early on can have cascading effects on long-term outcomes.

## **ORAL SESSION - 12B — COMMUNICATION AND LANGUAGE**

### **324 - Beyond Standard Scores: New Approaches for Exploring Linguistic Heterogeneity**

#### **324.001 (Oral) Multisensory Integration and Adaptive Communication in Autistic and Non-Autistic Youth**

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**Background:** Neural and behavioral data show that multisensory integration (MSI) develops later in autistic as compared to non-autistic individuals. Additionally, caregivers rate autistic individuals without co-occurring intellectual disability (ID) as having lower adaptive functioning than their non-autistic cohorts. Methods to measure these phenomena include the Audio-Visual Speech-In-Noise (AV-SIN) paradigm and the Vineland Adaptive Behavior Scales (Vineland), respectively.

The AV-SIN paradigm demonstrates the effect of MSI on speech perception. During AV-SIN, speech is presented within an increasingly noisy background, obstructing intelligibility. When mouth movements are presented, speech intelligibility improves. This “gain” score (audiovisual – audio) is the amount of improved perception allowed by visual articulation. Previous research shows autistic children express a lower gain score than non-autistic, indicating lower MSI. As they reach adolescence, autistic and non-autistic individuals demonstrate a similar gain score, thus indicating delayed MSI in autistic individuals in childhood which resolves during adolescence.

The Vineland measures independent communication, socialization, and daily living skills. The Vineland Communication domain (Communication) includes Receptive, Expressive, and Written subscales. Robust literature indicates autistic individuals without ID have lower Vineland scores than IQ scores.



**Objectives:** We predicted autistic adolescents' language perception would improve as improved MSI ability allows visual articulation to strengthen auditory perception. We hypothesized autistic adolescents would show improving Communication scores mirroring improved gain scores in the AV-SIN paradigm. Communication scores for autistic individuals were not expected to reach the same level as non-autistic individuals; however, we expected a general trend to higher Communication scores correlating with improved MSI functioning.

**Methods:** The dataset included 55 autistic participants (ASD) ages 6-19 and 60 non-autistic participants (Control) ages 6-17, who completed the AV-SIN paradigm and Vineland within a year. To assess the effects of MSI, age, and Verbal-IQ (VIQ) on Communication, a hierarchical linear regression was conducted with age, VIQ, gain, and group entered sequentially, with Communication as the dependent variable.

**Results:** When controlling for age and VIQ effects, gain scores were a significant predictor of Communication ( $B=.38$ ,  $t(113)=2.10$ ,  $p=.038$ ), and the model was significant ( $F(3,110)=10.7$ ,  $p<.001$ ), accounting for 22.7% of variance. When group was added to the model, it accounted for an additional 44.9% of variance in the model ( $F(4,109)=56.8$ ,  $p<.001$ ), ( $B=-33.2$ ,  $t(113)=-12.3$ ,  $p<.001$ ). Gain coefficient was not significant ( $B=-.11$ ,  $t(113)=-.90$ ,  $p=.37$ ), indicating when group differences are factored in, MSI gain, when considered with age and VIQ effects, does not significantly contribute to Communication.

**Conclusions:** The AV-SIN paradigm showed the ASD group's improved ability to use mouth movements to understand auditory inputs at ages 12-13 years, but there was no correlating improvement in Communication scores. Thus, autistic individuals demonstrated improved MSI ability without improved listening and language comprehension skills. We are left with important questions: if improved MSI ability in autistic individuals does not lead to improved listening and language comprehension ability, what is the practical effect of improved MSI ability? What are the everyday benefits of increased MSI functioning? Further research should identify or develop instruments that adequately measure the impact of improved MSI ability on daily functioning of autistic individuals.

**324.002 (Oral)** Discovering Novel Predictors of Minimally Verbal Outcomes in Autism through Computational Modeling  
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## **Background:**

As many as a third of individuals with autism spectrum disorder (ASD) remain minimally verbal (MV), producing few if any spoken words. Significant gaps remain in our ability to predict which children will remain MV. Current approaches typically rely on measures taken at a single time point to predict language growth or outcome. In contrast, Continuous-Time Hidden Markov Models (CT-HMMs) make it possible to model early linguistic development as a series of stages corresponding to developmental milestones. Doing so allows the developmental trajectories themselves to become potential predictors of communication outcomes.

## **Objectives:**

We aim to demonstrate the feasibility for using CT-HMMs for modeling early linguistic development of children with ASD as a step in identifying novel predictors of MV outcomes. One potential clinical use for inflection point-derived risk markers would be in identifying the appropriate timing for interventions. Inadequate progress for a child with ASD would be a basis for altering the intensity and/or type of intervention.

## **Methods:**

Eight-seven children with ASD with MV skills (mean age = 35.2 months) were observed at five time points across 16 months (Yoder et al., 2015). We created CT-HMMs for total words said (MacArthur Communicative Development Inventory [MCDIPV]) and weighted raw score for words (Communication and Symbolic Behavior Scales [CSBSWDS]) for the whole group and when divided by MV status.

## **Results:**

Some children made steady simultaneous gains in word production on both measures (Figure 1; diagonal left to right paths), whereas others made gains based on the CSBSWDS but not on the MCDIPV (horizontal left to right paths). A sizeable number of children remained in the initial vocabulary state (0 words) on both measures (large purple node in the upper left-hand corner) or made minimal gains up to 10 words (upper left-hand quadrant) before plateauing on both measures.

We then divided the sample by MV status at the final time point. Except for one participant, the trajectories of children who remained MV ( $n = 45$ ;  $<5$  words in language sample; Figure 2; left panel) are entirely confined to the upper left-hand quadrant of the state space, suggesting these children either remained in an initial state of 0 words or made minimal gains up to an average of 10 words. In contrast, children who were deemed verbal by study outcome ( $n = 33$ ; Figure 2; right panel) were more heterogeneous. Some made steady simultaneous gains in word production on both measures. Others made gains based on clinician observation, but not based on caregiver report.

## **Conclusions:**

These findings support the promise of CT-HMMs for revealing developmental progressions that differentiate children by MV status. For example, we observed that the average dwell time for verbally developed children in state (1,1) was 4.69 months, whereas the average dwelling time for MV

children was 8.08 months. It follows that children who remain in this state beyond 4.69 months are exhibiting below average progress, which could be the basis for making intervention changes. With continued development, a CT-HMM could be used in clinical settings to inform intervention decisions.

**324.003 (Oral)** When Cut-Off Scores Don't Cut It: Children with ASD Who Test As Having 'Normal' Language Make Twice As Many Language Errors As NT Peers

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**Background:** There are reasons to suspect that standardized language tests may not effectively capture the way that individuals with ASD use language in interactional contexts (see Eigsti and Schuh, 2016, for review). For instance, the context of standardized testing is less social, less time-pressured, and more predictable than spontaneous, natural interaction. Thus, it is possible that, for children with ASD, standardized language scores within the normal range may belie subtle, but important underlying weaknesses, that can become apparent in spontaneous language.

**Objectives:** To determine whether children with and without ASD with statistically equivalent scores on standardized language tests will show significant differences in frequencies of language errors in a spontaneous language sample.

**Methods:** Eighteen older children with ASD (m=13:6) and 20 neurotypical (NT) peers (m=13:1) participated. All participants' standard scores on the CELF-5 fell above one standard deviation below the mean (ASD m=110; NT m=113,  $p=0.61$ ). Participants engaged in a semi-structured conversation, which was video-recorded and transcribed. We then coded all written transcripts for language (not pragmatic) errors. All coding was completed blind to diagnosis. Each of the three coders independently read all transcripts and marked any language error produced by the participant. We compared error codes and included only those in the final dataset that were identified by two or more coders. We then categorized agreed-upon errors as semantic (e.g., inappropriate word choice) or morphosyntactic (e.g., subject-verb disagreement). Semantic and morphosyntactic error counts were then converted to proportions of utterances, and we used hierarchical mixed linear models with Group (ASD vs. NT), Error Type (morphosyntactic vs. semantic), and CELF scores as fixed effects, and with Participant as a random effect. Significance of fixed effects was assessed by performing likelihood ratio tests in which we compared a model containing the effect to another otherwise identical model.

**Results:** ASD participants made more semantic ( $n=16.00$ ; 10.93% of utterances) and morphosyntactic errors ( $n=13.38$ ; 9.34% of utterances) than NT participants ( $n=6.70$  [5.51%];  $n=6.75$  [5.11%]). See Figure. Regressions revealed a main effect of Group ( $X^2=11.54$ ,  $p<0.001$ ), where participants with ASD made significantly more errors than NT participants ( $\beta=0.04$ ,  $SE=0.01$ ,  $p=0.001$ ). Neither the fixed effect of CELF scores ( $p=0.12$ ) nor error type ( $p=0.17$ ) was significant, nor was any interaction.

**Conclusions:** Despite statistically equivalent scores on the CELF-5, older children with ASD made twice as many language errors than their NT peers during a conversation. This result, combined with the fact that CELF scores do not significantly predict error rates, suggest that the use of standardized measures may not accurately capture functional, interactional language in ASD. Researchers and clinicians should use other measures to determine language functioning, rather than relying on standardized test scores, which may miss differences that could be revealed in analysis of spontaneous language use.

**324.004 (Oral)** Phonological and Morphosyntactic Skills in Arabic-Speaking Children with and without Autism Spectrum Disorder (ASD):

Evidence from Non-Word and Sentence Repetition Tasks

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**Background:** Structural language deficit (e.g., phonological and morphosyntactic) is not a core phenotype of Autism Spectrum Disorder (ASD), yet some children with ASD manifest significant impairment in this domain (Kjelgaard & Tager-Flusberg, 2001). Non-word (NWR) repetition as a measure of phonological memory and Sentence repetition (SRep) as a measure of morphosyntactic skills have been consistently shown to be reliable tools for diagnosing structural language impairment (Conti-Ramsden et al., 2001; Armon-Lotem & Meir, 2016).

**Objectives:** The current study aimed to assess structural language skills of Palestinian-Arabic speaking children with and without ASD using NWR and SRep tasks. The Arabic language is the mother tongue of over 313 million people in the Middle East and North Africa and the fifth most spoken language globally (Simons & Fennig, 2018). Although there is an increasing interest in the research on language acquisition in Arabic-speaking children with ASD, research is still rather limited.

**Methods:** A total of 164 children aged 4 -11 participated in the study: 76 children with ASD and 88 children with typical language development (TLD). Children in the two groups were matched for chronological age, and they all scored within the normal range on non-verbal IQ. We used two tasks to assess structural language skills: NWR to evaluate phonological skills (Saiegh-Haddad & Ghawi-Dakwar, 2017) and SRep to evaluate morphosyntactic skills (Saiegh-Haddad, Halabi, & Armon-Lotem, 2019). Items in both tasks varied in length and linguistic complexity.

**Results:** As a group, children with ASD scored significantly lower than their peers with TLD on both tasks. However, there was a large variability in the performance within the ASD group. 26% of the children with ASD showed intact structural language skills and scored within the normal range in both tasks, while 74% of children showed an impairment in one or both domains (5% scored within the at-risk range for phonological impairment; 33% within the at-risk range for morphosyntactic impairment, and 36% scored within the at-risk in both domains). Using Mixed-Effects Binomial

Logistic Regressions, the study also examined the effects of the stimuli length and the linguistic complexity on children's performance in each task. Children with ASD who scored within the at-risk range for phonological impairment were affected by the length of the non-words regardless of the linguistic complexity (the presence of clusters). Children who scored within the at-risk range for morphosyntactic impairment showed particular difficulties when repeating sentences with *who/which* object questions and *object relative* clauses.

**Conclusions:** The results of the current study confirm the heterogeneity of profiles in children with ASD: those with intact language abilities who perform within the TLD range and those with additional structural language impairments in at least one of the domains. Beyond the theoretical contribution, shedding light on the loci of linguistic difficulties, the documentation of various profiles of children with ASD would enable clinicians and educators develop tailor-made intervention programs for these children. Finally, we conclude that NWR and SRep tasks are valuable tools for detecting structural language difficulties in Palestinian-Arabic-speaking children with ASD.

## POSTER SESSION — COMMUNICATION AND LANGUAGE

### 408 - Communication and Language

#### 408.001 (Poster) Language Measures and ASD Risk Sensitivity: Utility of the Language Use Inventory Assessment

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**Background:** Children with a variety of developmental disorders may present with language delays and benefit from targeted interventions. However, language delays in children with autism are typically a co-occurring deficit or cascade effect of joint attention delays and social motivation differences, warranting a unique assessment and intervention approach and language measures with a pragmatic focus (Rogers et al., 2020). At present, standardized measures to assess autism symptoms such as the ADOS often require intensive training and are less accessible for many families. As the prevalence of autism continues to rise, the increased use of less time-consuming and widely accessible pragmatic language measures could serve to expedite the necessity of pursuing a more rigorous autism symptom assessment protocol.

**Objectives:** This study examines how scores on language measures are associated with concurrent evaluation of ASD symptoms, as measured by the *Autism Diagnostic Observation Schedule* (ADOS-2, Lord et al., 2000). We hypothesized that a measure focusing on pragmatic communication, the *Language Use Inventory* (LUI, O'Neill, 2009), would be more strongly associated with ADOS-2 scores than the more general language/communication subscales of the *Mullen Scales of Early Learning* (MSEL, Mullen, 1995) and *Vineland Adaptive Behavior Scales* (VABS, Sparrow et al., 2005).

**Methods:** This investigation utilized a sample of participants (175 male, 106 female) from a larger longitudinal study of younger siblings of children with ASD (high-risk group, n = 164) or typical development (low-risk group, n = 99). Participants were administered an array of developmental assessments at multiple ages; this analysis focused on the 36-month data. Bivariate correlations were estimated between ADOS-2 comparison scores and LUI total scores and T-scores from the language subscales of the MSEL and VABS.

**Results:** Scores on the three language measures were strongly correlated (see Table 1). LUI scores were highly and significantly associated with ADOS-2 comparison scores ( $r = -.661, p < .001$ ). Application of Fisher's Z transformation indicated that the correlation between the LUI and ADOS-2 was significantly stronger than the correlations between ADOS-2 and VABS Communication scores ( $z = -2.95, p < .001$ ), as well as MSEL Expressive ( $z = -3.79, p < .001$ ) and Receptive ( $z = -4.72, p < .001$ ) Language scores.

**Conclusions:** Our findings indicate that the LUI, a feasible and efficient parent-report measure of pragmatic language, yields child language scores consistent with directly administered language measures (e.g., MSEL), other parent-report measures of functional communication skills (e.g., VABS), and the gold standard assessment of autism symptoms (e.g., ADOS). While previous empirical studies have already identified the LUI as relevant for use with young children with or without autism risk (Miller et al., 2015; Pesco & O'Neill, 2012; Tager-Flusberg et al., 2009), the associations identified in the present study suggest parent-report measures such as the LUI could be a practical tool to prompt administration of more comprehensive autism assessment measures. Follow-up analyses will evaluate within-group and between group-differences on the LUI (ASD v. typical development outcomes), in addition to discriminant validity between the LUI and non-language measures.

#### 408.002 (Poster) Are Real-Time Coded Measures of Verbal Communicative Competence Sensitive to Capturing Change in Minimally Verbal Children with ASD in the Context of the Jasper Intervention?

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Background:

Expressive language is one of the strongest predictors of future outcomes for children with ASD (Friedman et al., 2019). Thus, language and communication represent important targets for intervention (Tager-Flusberg & Kasari, 2013). Previous work used real-time coded natural language

samples (NLS) to derive general measures of verbal communicative competence (Barokova & Tager-Flusberg, 2018), providing an optimal approach for the assessment of children with ASD who are minimally verbal (MV; Barokova et al., 2021). These measures hold the potential to efficiently chart change in intervention research.

#### Objectives:

In a sample of MV children with ASD, we examined 1) whether our measures of verbal communicative competence, frequency of utterances (FreqU) and conversational turns per minute (CT), are sensitive to capturing change from entry to exit JASPER+EMT intervention using real-time coded NLS; and 2) how these measures validate against the Clinical Global Impression-Improvement scale (CGI-I).

#### Methods:

Twenty-eight MV children with ASD (22 males; ages 53-98mo.) completed assessments at entry (week 1) and exit (week 18) JASPER+EMT intervention. JASPER, an NDBI, focused on teaching joint attention, play skills, and promoting communication during semi-structured play sessions with trained clinicians (Kasari et al., 2021) blended with Enhanced Milieu Teaching (Kaiser et al., 2000; JASPER+EMT). A 20-minute NLS (adult-child interaction with specified toys; Kaiser et al., 2014) and CGI-I (Guy, 1976; assesses global change in social communication) were used. CGI-I scores ranged from 7 (very much worse) through 1 (very much improved). The NLS was coded in real-time in ELAN (Lausberg & Sloetjes, 2009) to derive FreqU and CT. FreqU was computed by dividing the total number of segmented utterances by NLS length in minutes. Speech utterances were defined as vocalizations with a syllable structure that consists of vowels and consonants (Barokova et al., 2021). CT was computed by exporting the ELAN file containing the start and end time of each utterance into an excel document and applying a count formula. CT was defined as one or more consecutive utterance(s) produced by the same speaker (Miller et al., 2011).

#### Results:

1) Analyses involved a paired samples t-test or non-parametric equivalent. A statistically significant improvement was found in FreqU (median difference=1.53;  $V=342, p=0.0009657$ ) and CT ( $MD=.94; t(27)=3.55, p=0.00145$ ) from entry to exit JASPER+EMT intervention (Figures 1A-1B). 2) Analyses explored associations between CGI-I ratings and change scores (exit-entry) in FreqU and FreqCT. Twenty-one participants who were rated as "improved" on the CGI-I (very much improved, much improved, or minimally improved) also had positive change scores for FreqU and CT ( $n=23$ ; Figures 2A-2B).

#### Conclusions:

Our general measures of verbal communicative competence, FreqU and CT, using real-time coded NLS were sensitive to capturing change in the context of a JASPER+EMT intervention. Findings provide preliminary support for the implementation of these measures in intervention-based studies to efficiently track changes in participant's spoken language and communication over time and to inform individualized goals and targets. A majority of participants who showed improvement on the CGI-I also showcased positive change in FreqU and CT, providing initial support for the validation of our measures against clinical global impression.

**408.003 (Poster)** Autism Subtypes and Language Ability in Males with Co-Occurring Fragile X Syndrome and Autism Spectrum Disorder  
**C. Moser<sup>1</sup>, A. Campanelli<sup>2</sup>, L. Friedman<sup>3</sup>, A. J. Thurman<sup>1</sup>, L. Abbeduto<sup>4</sup> and J. Klusek<sup>5</sup>,** (1)Communication Sciences & Disorders, University of South Carolina, Columbia, SC, (2)University of South Carolina School of Medicine, Columbia, SC, (3)University of South Carolina, Columbia, SC, (4)M.I.N.D. Institute, UC Davis, Sacramento, CA, (5)Communication Sciences and Disorders, University of South Carolina, Columbia, SC

Background: Exploring subtypes of autism spectrum disorders (ASD) based on social interaction styles<sup>1</sup> has helped elucidate targeted treatments and inform various within-syndrome profiles. For instance, language abilities and treatment response vary by ASD subtype. The two main subtypes based on work by Wing & Gould (1979) are 'aloof/passive' and 'active-but-odd.' We have chosen to update these terms to avoid potential negative perceptions of ASD features and will instead use 'passive' and 'active'. The passive subtype is characterized by a lack of social approach. The active subtype is characterized by spontaneous social approach that tends to be repetitive and one-sided<sup>1</sup>. Like non-syndromic ASD, there is considerable within-syndrome variability in fragile X syndrome (FXS; the most common known single-gene cause of ASD); however, ASD subtypes have not been explored in this population. Characterizing subtypes in males with ASD secondary to FXS could lead to a more nuanced understanding of syndromic forms of ASD. For instance, grammatical abilities are impaired relative to cognitive expectations in those with FXS, and factors such as ASD subtype may underscore individual differences in grammatical abilities.

Objectives: To examine how grammatical abilities vary across ASD subtypes in males with ASD associated with FXS.

Methods: The present study included 42 males with FXS with ASD ( $M(SD)$  age=18.19(2.03) years). Risi et al. (2006) criteria were used to determine ASD diagnosis. Social interaction style was coded from video recordings of the ADOS-2 based on subtypes identified by Wing & Gould (1979) via consensus of two raters; reliability prior to consensus was substantial (Cohen's kappa= .64). Grammatical abilities were indexed by mean length of utterance in morphemes (MLU) during two sampling contexts: conversation and narration.

Results: Twenty-one participants were classified as active and 21 as passive. The subtypes did not differ in age ( $p=.912$ ), nonverbal IQ ( $p=.778$ ), daily living skills ( $p=.838$ ), or ASD severity ( $p=.909$ ). A random intercepts linear mixed model was fit testing the effect of ASD subtype, language sampling context, and their interaction. The interaction between ASD subtype and language sampling context was significant ( $F(1,40)=9.44, p=.004$ ).

Follow-up tests indicated ASD subtypes differed on MLU in the conversation context ( $p=.037$ ), such that the passive subtype produced significantly lower MLU than the active subtype. There was no significant difference in MLU for the narration context ( $p=.773$ ).

**Conclusions:** The identification of ASD subtypes in FXS may help explain phenotypic variability in syndromic forms of ASD. Our findings align with research in non-syndromic ASD, such that the active subtype displayed more complex grammar. However, differences across subtypes were only found in the conversation context. Thus, elicitation of language abilities is likely to relate to contextual differences in language samples. For instance, reduced grammatical complexity during the conversation compared to the narration context for those classified as passive could be due to the social demands of the conversation context. These findings, along with research focused on additional factors that may differentiate ASD subtypes within FXS, could lead to the development of more personalized interventions to improve outcomes of those with syndromic forms of ASD.

#### **408.004 (Poster)** Case Studies of Non-Interactive Bilingualism in ASD

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#### **Background:**

One of the core characteristic of Autism Spectrum Disorder (ASD) is difficulties in verbal and non-verbal communication (American Psychiatric Association, 2015). These language disabilities are often traced back to atypicalities in processing social information, because of the importance of cooperative communication in typical language development (Luyster et al., 2008; Anderson et al., 2009; Wodka et al., 2013). For instance, a landmark and since then replicated study showed that typical infants need active interaction, as opposed to passive exposure to television, to acquire novel phonological categories (Kuhl et al., 2003). However, non-interactive language acquisition has been documented in ASD, both in the literature on 'linguistic savants' (Vulchanova et al., 2012) or in children (Kissine et al., 2019).

**Objectives:** Our objective was to further attest such non-interactive language acquisition.

**Methods:** We looked for cases of non-interactive bilingualism in the French speaking part of Belgium. In this paper we report the cases of three autistic boys (9-12) who have acquired English through passive exposure. All of them were in a French speaking environment both at school and home and some of them ( $n=1$ ) developed English before French. Data were collected during a language assessment with the Clinical Evaluation of Language Fundamentals (CELF-5) in English and French. Two analysis were carried out on their speech productions to attest to the existence of the development of distinct phonological categories for both languages: the Voice Onset Time (VOT) of stops consonants and the formants (F1 and F2) analysis of tense and lax vowels. Voiced stops (/b/, /d/, /g/) exhibit a short lag VOT in English, but a lead VOT in French. Voiceless stops (/p/, /t/, /k/) have a lead VOT in English and a short lag VOT in French (Caramazza et al., 1973; Kessinger & Blumstein, 1997; Sundara, 2005). Furthermore, the vowel system of English differs greatly from the one in French with the presence of lax (/ɪ/, /ʊ/) and tense vowels (/i:/, /u:/). French speaking speakers tend to neutralise this contrast and produce the French phonemes (/i/, /u/) instead (Capliez, 2011).

**Results:** Regarding the language assessment, one participant scored higher in English (86) than in French (50) showing a better mastery of English, one of them showed the same average level in both languages (64-62) and one of them showed better mastery in French (86-99). Multiple regressions analysis were used for the VOT and formants analysis. One child showed a significant difference for voiceless ( $p=.001$ ) and voiced stops ( $p=.006$ ) in French and English, one showed only a significant difference for voiceless stops ( $p=.03$ ) in French and English and one showed no difference. The formants analysis shows a significant difference for either F1 or F2 values for the distinction between lax and tense vowels in English and between the vowels of French and the lax ones of English for all the children.

**Conclusions:** These results suggest the development and the use of different phonological categories for each language and that passive exposure to non-interactive media enabled this development in the case of these children.

#### **408.005 (Poster)** Cluster Scores on the CSBS Reveal Widespread Social Communication Deficits in 12-Month-Old Infants Who Are Later Diagnosed with Autism

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#### **Background:**

Autistic children demonstrate deficits in social communication skills from an early age, and these deficits have a cascading effect on later language skills (Delehanty et al., 2018; Wetherby et al., 2007; Yoder et al., 2015). Increased understanding of the associations between early social communication skills and later language is needed to enhance our ability to choose high-priority early intervention goals that support receptive and expressive language development.

## Objectives:

This study aimed to examine longitudinal development of social communication between 12-to-24-months, measure group differences in social communication skills, and explore associations between social communication and later language.

## Methods:

Infant participants (N=511) were part of the Infant Brain Imaging Study (IBIS). The Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 2002) was administered at 12, 15, and 24-months to measure social communication skills across three groups: low familial risk typically developing infants (LR-Neg; n=165), high familial risk infants without autism (HR-Neg; n=295), and high familial risk infants with autism (HR-ASD; n=87). HR-ASD infants met Clinical Best-Estimate criteria for autism using the DSM-IV-TR at 24-months, and HR-Neg infants did not. LR-Neg infants did not meet criteria for autism or language delay (Table 1). Individual cluster raw scores were extracted from the CSBS. Raw scores were used to avoid floor effects in standard scores. The longitudinal statistical model included the effects of group, time (chronological age), and a group by time interaction. The Mullen Scale of Early Learning (MSEL; Mullen, 1995) was used to evaluate language skills at 24-months. For the statistical model analyzing the effects of 12-month social communication scores on later language skills, MSEL receptive and expressive language age equivalent scores were dependent variables. The analyses included social communication scores, group, and social communication scores\*group. Sex of the infant, maternal education, and site were included as covariates in all models.

## Results:

Longitudinal analyses using mixed linear models indicated significant main effects for group\*time ( $p < .01$ ) for all CSBS scores (Table 1). HR-ASD infants made fewer gains on all social communication skills between 12-24 months and had significantly lower scores on all clusters except words and understanding at 12-months of age (Table 1) when compared to HR-Neg and LR-Neg infants. Results from the language analyses revealed significant main effects for all CSBS scores ( $p < .01$ ). The cluster scores \*group effect was not significant for all social communication skills. Follow-up group analyses indicated that the effect of CSBS scores on later language was not significant for the HR-ASD infants, except for understanding, which was significantly associated with receptive language (Table 2).

## Conclusions:

Results indicate that HR-ASD infants demonstrate deficits in social communication as early as 12-months of age, well before autism diagnoses are considered stable. HR-ASD infants did not demonstrate the same associations between early social communication and later language that was seen in infants who did not meet criteria for autism. This could be due to delayed acquisition of social communication skills that were associated to later language. These findings have implications for identifying early intervention treatment targets that will impact later language.

## **408.006** (Poster) Comparing Social Communication and Language Patterns between Adults with and without Autism

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Background: Support needs of adults on the autism spectrum remain largely unmet (Shattuck et al., 2012; Wright et al., 2019), one of which is communication needs. Communication difficulties that autistic adults face can significantly impact their daily functioning due to difficulties accessing, sharing or contesting information. Difficulties can also lead to a lack of engagement with local surroundings, and feelings of embarrassment which may result in isolation and withdrawal from society (Cummins et al., 2020). Multiple reasons contribute to autistic adults' communication difficulties, including a lack of understanding of communication styles of both autistic and non-autistic individuals stemming from the double empathy problem (Mitchell et al., 2021; Santhanam & Hewitt, 2020). Yet these communication differences in adults have yet to be fully elucidated.

Objectives: Since identifying differences can aid understanding and improve communication and interactions, an examination of communication differences between autistic and non-autistic adults is warranted. Our research questions are: 1. How do social communication and language patterns differ between adults with and without autism during conversation with an unfamiliar peer? and 2. To what extent do social communication and language patterns contribute to self-reported impairments in social interaction across both groups?

Methods: We had 46 adult participants (mean age=26 years), where 23 were diagnosed with autism and 20 were not. For language samples, we transcribed two sections of the Autism Diagnostic Observation Schedule-2, the 'description of a picture' and 'friends, relationship and marriage' sections. Sections were chosen to get snapshots of communication across different contexts (concrete versus abstract topics). Samples were between 3-10 minutes long. These narrative transcripts were analyzed using the Systematic Analysis of Language Transcripts (SALT) software. Exploratory factor analysis was used to reduce the number of SALT outcome variables. An independent t-test or Wilcoxon test with Bonferroni correction was used to examine differences between groups based on derived factors. Regression analyses were conducted using autism group status and SALT factors to predict the participants' self-reported social interaction impairments on the Social Responsiveness Scale-2.

Results: Results are complete on the description of a picture section, and further analysis are ongoing for the 2nd language sample. We derived a 3-factor model - amount/rate of speech (f1), diversity of vocabulary & pauses (f2), and overlapping/abandoned utterances (f3). RQ1. Adults on the autism spectrum were found to produce fewer utterances and speak less quickly ( $p = 0.007$ ). They also used greater variety of vocabulary on average and had more pauses between utterances compared to non-autistic adults ( $p < 0.001$ ). No significant difference was found between groups for factor 3

( $p = 0.23$ ). RQ2. Participants in the autism group ( $p=0.01$ ) and participants who had faster and longer utterances across both groups ( $p=0.008$ ) tended to report more social interaction impairments.

**Conclusions:** Our study have begun to explore and provide information on differences in communication styles between adults with and without autism, serving as the foundation to future larger studies. Findings potentially serve as a basis for targets in social skills interventions and trainings that include both autistic and non-autistic individuals.

#### **408.007 (Poster)** Early Predictors of Toddlers' Use of Decontextualized Language and Its Associations with Symptoms of Autism

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**Background:** Pragmatics is the functional use of language in ever-changing social contexts. One early pragmatic ability is decontextualized language; to talk about events and things beyond here and now. Pragmatic difficulties are practically universal in ASD, but we don't know about impairments in early pragmatic development. Further, the roles of early socio-communication and linguistic abilities in the development of decontextualized language is of both theoretical and practical value and has not previously been studied in young toddlers.

**Objectives:** Here, we study longitudinal associations between structural language and non-verbal socio-communicative abilities at 14 months age and decontextualized language use at 24 months age. We study both children with high and low likelihood of ASD, to discern potential differences in the predictors and use of decontextualized language between these groups.

**Methods:** Toddlers from two samples were included; Babytwins Study Sweden (BATSS; a longitudinal twin study) and Early Autism and ADHD Sweden (EASE; a prospective sibling study). The BATSS sample and the children with low familial likelihood of ASD from the EASE study constituted the combined typical likelihood group ( $N = 206$ , 49.5% boys). Children in the elevated likelihood group ( $N = 97$ , 53.6% boys) had increased familial likelihood of ASD due to first-degree relatives with the diagnosis. The main measures comes from the Swedish version of the MacArthur-Bates Communicative Development Inventory (SE-CDI): Structural language and socio-communication from the CDI Words & Gestures at 14 months of age, and decontextualized language from the CDI Words & Sentences at 24 months of age.

**Results:** For the combined typical likelihood group, there was an interaction between structural language and socio-communication in predicting later decontextualized language use, controlling for age and sex. Specifically, the positive association between socio-communication and decontextualized language was significant only at low levels of structural language, whereas structural language was an independently significant predictor. Notably, this pattern was specific to decontextualized language, as for grammatical ability at 24 months, only structural language was a significant predictor. For the elevated likelihood group, structural language independently predicted decontextualized language use, but did not interact with socio-communication. However, the interaction between structural language and socio-communication was not moderated by group in the overall sample. For the elevated likelihood group, decontextualized language scores correlated with ADOS-2, and they scored significantly lower on decontextualized language use compared to children with typical likelihood.

**Conclusions:** Structural language seems to be a more important factor in predicting decontextualized language use than social communication in both children with and without elevated likelihood of ASD. Further, while decontextualized language is closely related to structural language, these two abilities are clearly dissociable even this early in development. Lastly, toddlers with elevated likelihood of ASD already show decreased pragmatic ability compared to typically developing infants, but we found no strong evidence for differences in the factors predicting this ability across the two groups. These results may have implication for early intervention targeting pragmatic abilities in infants at elevated likelihood of ASD.

#### **408.008 (Poster)** Gesture As a Potential Early Flag in High-Familial Risk Infants Who Are Later Diagnosed with ASD

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**Background:** Gestures are a form of early nonverbal communication and considered a core deficit of young children with ASD (Manwaring et al., 2018; QiangYe et al., 2021). Previous studies have shown that infants who are later diagnosed with ASD have deficits in early gesture use as early as 12 months of age (Iverson et al., 2017; Mitchell et al., 2006, Watson et al., 2013). Other studies have found that infants with ASD with more gestures also had better verbal skills, suggesting that early gesture use is a harbinger for later development (for a review see Ramos-Cabo et al., 2019). This existing body of literature, while growing, is based on small sample sizes and/or non-standard approaches like retrospective video reports.

**Objectives:** The goal of this study is to examine gesture growth differences in a large sample size of infants at 12, 18 and 24 months of age across three groups: high familial risk with ASD (HR-ASD), high familial risk without ASD (HR-Neg) and low familial risk without ASD (LR-Neg).

**Methods:** Gesture use was measured using the MacArthur Communicative Development Inventory - Words and Gesture (MCDI-WG; Fenson, 1993) at 12, 18, and 24 months. Groups were based on clinical best estimate diagnosis (DSM-IV-TR) at 24 months. Inclusion criteria were completion of at

least one MCDI-WG and diagnostic testing at 24 months ( $N = 473$ , see  $n$  by group in Table 1). Linear mixed models were used to longitudinally characterize early and later gesture use from 12 to 24 months. Dependent variables were raw scores of early and later gestures to account for 24-month ceiling effect. The model included the fixed effects of time (chronological age), diagnosis, and time\*diagnosis. Random effects were time grouped by participants. Covariates were sex, site, and maternal education.

Results: Analysis indicated significant main effects for diagnosis ( $p < .001$ ), time ( $p < .001$ ), and time\*diagnosis ( $p < .01$ ) for early and later gesture use. The HR-ASD group showed slower growth in gestures compared to HR-Neg and LR-Neg (Figure 1). The HR-Neg group also had slower growth when compared to LR-Neg ( $p < .05$ ). Cross-sectional analysis (Table 1) indicated that the HR-ASD group had lower early and later gesture use at 12, 18 and 24 months compared to the HR-Neg and LR-Neg groups. The HR-Neg group had lower early gesture use compared to the LR-Neg group at 12 and 18 months, but not 24 months. The HR-Neg group had lower later gesture use compared to the LR-Neg group at 12, 18, and 24 months.

Conclusions: Our results indicate that the HR-ASD group had deficits in gesture use at 12 months, with deficits increasing at 24 months. This data suggest that gesture deficit is one of many possible early red flags for ASD. These findings are important in identifying treatment targets for infant interventions aimed at supporting communication skills. Future directions include investigating the neurobiology of early gesture.

#### **408.009 (Poster)** Gesture Comprehension in Individuals with and without Autism Spectrum Disorder

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Background: Previous studies have revealed well-established differences in gesture *production* in Autism Spectrum Disorder (ASD) (Özer et al., 2020); however, little work has examined gesture *comprehension*. Our group has developed the Gesture Comprehension (GeCo) task. In this task, participants view a 35-sec video depiction of a conversation between two women discussing the experiences of “Sam” during her move to a new apartment. The conversation is lively and includes multiple co-speech gestures which convey story details, such as how Sam called for help (by texting) and the spiral shape of a staircase. Participants are asked to respond to multiple choice questions about the video; questions probe recall of events as conveyed through either gesture (5 items) or speech (3 items).

Objectives: This experiment compares performance on the GeCo questionnaire between individuals with ASD and neurotypical (NT) individuals. We predicted that individuals with ASD would display deficits in narrative comprehension, compared to individuals in the NT groups, as reflected by reduced accuracy of multiple-choice test responses for story information conveyed in speech. We also predicted a group by modality interaction, with lower accuracy in the ASD group on items probing information conveyed exclusively in gesture, relative to info conveyed in speech.

Methods: We tested for differences in accuracy on the GeCo questionnaire accuracy (full score, gestures only, and speech only) for ASD [ $n=26$  (7 females),  $M(SD)$  age= 28.9(4.4) years] and NT [ $n=42$  (17 females),  $M(SD)$  age= 21.7(4.7)] groups.

Results: Groups differed in accuracy overall,  $t = -4.25$ ,  $p = 6.94e-05$ , and on gesture items,  $t = 0.473$ ,  $p = 1.23e-05$ . There was no difference on verbal items,  $t = -1.28$ ,  $p = 0.21$ ; Figure 1. The ASD group had greater accuracy (by 9%) on speech items relative to gesture items; the NT group showed the opposite pattern (by 5%), although these differences were not significant on within-group t-tests. Repeated measures ANOVA results suggest a main effect of group (ASD vs. NT;  $F(1, 45) = 20.4$ ,  $p = 2.67e-05$ ), question type (gesture vs. verbal;  $F(1, 47) = 12.0$ ,  $p = 0.0009$ ), and interaction of group by question type ( $F(1, 47) = 8.9$ ,  $p = 0.004$ ).

Conclusions: We examined gesture comprehension in ASD using a measure that probed recall of information conveyed in discourse. The ASD group had lower accuracy overall compared to the NT group, with a specific difficulty in recalling information that had been conveyed via gesture. Given that participants had overall cognitive abilities within the average range, this pattern is unlikely to reflect difficulty in comprehending the events related during the GeCo stimulus. Rather, we propose that results show impaired ability to attend to and integrate information conveyed through gesture. Planned analyses will investigate the role of higher order cognitive processes (specifically, theory of mind and working memory) in gesture comprehension in individuals with ASD. In addition, we will examine the relationship between gesture comprehension, and gesture production, within groups.

#### **408.010 (Poster)** Identifying Homogeneous Subgroups of Autistic Youth Based on Talkativeness

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Background: Successful communication requires that speakers do more than merely produce and perceive speech; they must also read a partner's social cues and respond by dynamically adjusting their own linguistic contributions. Sensitive and socially-responsive conversational behaviors play a significant role in successful communication, and research suggests that adaptation is associated with improved rapport, empathy, and perceived connection between social partners (Manson et al., 2013). Disruptions in this phenomenon may yield significant consequences and result in social communication difficulties, which are frequently experienced by autistic individuals. Previous research on the current sample found significant diagnostic group differences (ASC vs NT) in the overall number of words (or talkativeness) produced by participants during experimentally manipulated conversations, with the ASC group producing significantly fewer words overall. However, given the substantial within-diagnosis heterogeneity of language in ASC, it is critical to explore individual differences in the ASC group.



**Objectives:** This study utilizes an exploratory data-driven, latent class approach to (1) identify homogeneous trajectories of talkativeness across two conversational contexts (Bored vs. Interested) for autistic participants, and (2) assess the relationship between latent class membership and clinical phenotype (ADOS-2 scores).

**Methods:** Verbally fluent school-aged individuals with ASC (N=48, 28 male, 20 female; Table 1) completed the Contextual Assessment of Social Skills (CASS; Ratto et al., 2011) with two novel conversation partners naïve to diagnosis. The first person acted interested in the conversation (Interested condition; talked more), while the second acted bored (Bored condition; talked less). Language was transcribed and talkativeness was calculated using word count measured via qdap (Rinker, 2018). Participant word count in both conditions was entered into a general latent class mixed model fitted using maximum likelihood. The optimal number of classes was detected using goodness-of-fit statistics (AIC and BIC). Posterior classification probabilities and class membership are reported; class was used to predict ADOS-2 calibrated severity scores (CSS) in a logistic regression.

**Results:** The optimal number of classes in this dataset is 3 (AIC =1112.1, BIC = 1128.94; Table 2). The most talkative class (10.42%) spoke slightly more in the Bored condition than in the Interested condition (Figure). The moderately talkative class (52.08%) also spoke more in the Bored condition than the Interested condition, but spoke less overall than the most talkative class. The least talkative class (37.5%) spoke less in the Bored condition than in the Interested condition. Class membership significantly predicted ADOS-2 Total CSS ( $F=5.17, p<.001$ ) and ADOS-2 SA CSS ( $F=6.96, p=.002$ ) but not ADOS-2 RRB CSS ( $F=.58, p=.56$ ).

**Conclusions:** Subtle features of a conversation can influence whether social communication is successful, and this study highlighted the within-diagnosis heterogeneity of one potential driver of communication challenges in ASC: variable levels of talkativeness. This study utilized an exploratory data-driven approach to identify three latent classes of talkativeness across two conversational contexts that significantly predicted social phenotype, but not repetitive behaviors. Our findings have implications for understanding individual differences in one aspect of social communication (talkativeness) and may be valuable for clinicians interested in improving conversational competence in verbally fluent autistic individuals.

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**408.011 (Poster)** Internal State Language Production in Storybook Versus Personal Narratives in TD Children and Children with ASD  
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**Background:** Studies have found that the narratives of children with autism spectrum disorder (ASD) are less likely to include terms that refer to emotional states (e.g., “happy”; Tager-Flusberg, 1992) or cognitive states (e.g., “think”; Siller et al., 2014), as compared to their typically developing (TD) peers. These studies have linked this to the social communication challenges routinely experienced by those with ASD (Capps et al., 2000; Rumpf et al., 2012). However, most of these studies have been conducted solely in the context of storybook narratives, which may not be appropriate for adolescents with ASD. Additionally, Losh & Capps (2003) found significant differences in narrative volume and complexity between storybook and personal narratives, suggesting that different prompts may reveal different strengths and challenges.

**Objectives:** 1) To determine if challenges with producing stative language persist in teenagers with ASD, and 2) to assess whether different narrative contexts (i.e., storybook versus personal) affect stative language production.

**Methods:** Participants included 11 teenagers with ASD and 10 TD children. The ASD group had significantly lower age equivalent scores on the CELF-Word Classes subscale than the TD group (Table 1). Storybook narratives were elicited using the *Tuesday* wordless picture book. Personal narratives were elicited with the investigator prompting the participant to narrate specific events (e.g., “Can you tell me about a time you got jabbed by something?” “Can you tell me about a time you felt proud of yourself?”). Participant speech was transcribed, and CLAN algorithms were used to extract number of word tokens. Manual coding was used to determine the total number of stative language tokens, and proportions were calculated out of total number of word tokens.

**Results:** After statistically controlling for participants’ Word Class scores, no significant group differences emerged for any of the stative language measures ( $ps > 0.05$ ). However, a mixed-design ANOVA, with a between-factor of group and within-factor of narrative context, revealed a significant effect of narrative context on stative language tokens for both groups,  $F(3, 36) = 2.764, p = 0.034, \eta^2 = 0.133$ . Post hoc analyses revealed that both groups produced significantly more stative tokens in the personal narrative contexts than the Tuesday storybook narrative context,  $p = 0.021$  (Figure 1).

**Conclusions:** These preliminary findings support the idea that language production varies by context. Overall, children from both groups produced fewer stative language terms in the context of storybook narratives than personal narratives. For example, a child with ASD produced two stative tokens (“guess” & “want”) in the storybook narrative context, but produced four stative tokens (“guess”, “know”, “remember”, & “think”) in one of their personal narratives. Similarly, a TD child matched on language produced only one stative token in their storybook narrative but produced five stative tokens in one of their personal narratives. In sum, tapping into personal experiences, especially those with emotional associations, elicited more stative language from both groups. Thus, when assessing stative language production, researchers should consider the ability of the narrative prompt to elicit these terms.

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**408.012 (Poster)** Investigating Differences in Pronoun Comprehension and Language Abilities in Autistic and Typically-Developing Adults  
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**Background:** Personal pronouns, such as *her*, *she*, and *his*, stitch together discourse by linking referents within and across sentences. Pronouns allow us to refer to prior content in a more efficient manner and thus are critical in understanding and continuing conversations. Previous research has shown that over development, individuals rely on two strategies to comprehend and keep track of pronouns within discourse: 1) the subject bias (i.e., the bias to interpret the pronoun as referring to the subject of the previous sentence) and 2) the repeated mention bias (i.e., the bias to interpret a pronoun as referring to the person mentioned most frequently in the prior discourse) (Hartshorne, Nappa, & Snedeker, 2015). Autistic individuals are a population that is known to have some social communication challenges. Prior work has shown that people with autism use fewer pronouns than controls (Colle et. al., 2008; Arnold, Bennetto, & Diehl, 2009). However, little is known about the possible difficulties these individuals may have in interpreting pronouns.

**Objectives:** This research is motivated by two questions: 1) Do autistic adults, with average language abilities, make use of these two pronoun comprehension strategies to the same degree as typical adults? 2) Is variation in use of these strategies linked to overall language ability?

**Methods:** Participants were adults (18-45) with native English backgrounds. The ASD (Autism Spectrum Disorder) participants were recruited from the SPARK database and self-identified as having average to above average language abilities. The TD (Typically Developing) participants were recruited from Amazon Mechanical Turk. In the subject bias task and the repeated mention task, participants read short passages containing a potentially ambiguous pronoun that could be resolved using the relevant bias (i.e., *Justin went to history class with Ethan. He brought a notepad*) and were asked to identify who the pronoun referred to (i.e., *Who brought a notepad? Justin, Ethan, or Someone else?*). In addition, we collected a vocabulary measure, the Vocabulary Size Test (VST) and the Autism Quotient (AQ).

**Results:** We calculated the percentage of bias responses in each condition. Both the ASD and TD groups showed a strong subject bias (both  $p$ 's < .05, see Figure 1), with no reliable difference between them ( $p = .4237$ ). Similarly, both groups showed a strong repeated mention bias (both  $p$ 's < .05) with no significant difference between them ( $p = .12852$ ). VST confirmed average language abilities in both groups.

**Conclusions:** Autistic individuals with strong language ability demonstrated the same pronoun interpretation biases as neurotypical adults. We plan to engage in further analysis of this data, using a theory of mind task, to ascertain whether performance on pronoun comprehension and theory of mind measures show any correlation since both measures share referential properties.

**408.013 (Poster)** Investigating the Relationship between Early Joint Attention and Later Usage of Verb Subcategories in Children with Autism Spectrum Disorder

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**Background:** Children with autism spectrum disorders (ASD) demonstrate deficits in joint attention (JA; Mundy et al., 1990), specifically engaging in less initiation of JA (IJA) than their neurotypical peers (Mundy & Newell, 2007). Variation in IJA predicts variation in later language skills, such as production of verb tokens/types (Abdelaziz et al., 2018). Moreover, early overall verb diversity predicts later language outcomes (LeGrand et al., 2021), and children with ASD particularly struggle with production of internal state verbs (e.g., *feel*, *learn*; Tager-Flusberg, 1992). This project explores the degree to which variation in early IJA relates to later verb use in three semantic categories: action verbs (e.g., *eat*, *run*), internal state verbs, and general all-purpose verbs (GAP; e.g., *have*, *make*).

**Objectives:** To investigate whether production of action, internal state, and GAP verb tokens/types varies based on the presence or amount of early IJA in children with ASD.

**Methods:** 31 children with ASD participated in a longitudinal project (Naigles & Fein, 2017). Across six visits between ages two and four, language samples were collected during parent-child play. IJA was coded at Visits 1-3 (Time 1 [T1],  $M_{age} = 36.96$  months), and verbs produced during Visits 4-6 (Time 2 [T2],  $M_{age} = 49.33$  months) were coded based on semantic category.

**Results:**

Children who engaged in IJA (IJA+) at T1 produced significantly more verb tokens/types in each semantic category (action, internal state, and GAP) at T2 than children who did not engage in IJA (IJA-) at T1 ( $ps < 0.001$ ). As a proportion of the total number of verbs, the IJA+ group produced a significantly higher proportion of action tokens/types and internal state tokens/types at T1 than the IJA- group ( $ps < 0.03$ ). Conversely, the IJA+ group produced a *lower* proportion of GAP tokens/types than the IJA- group, though this difference was not significant ( $ps 0.339-0.640$ ).

Variability in the *amount* of T1 IJA (i.e., IJA count and duration) was positively correlated with T2 verb tokens/types in each semantic category ( $ps < 0.001$ ). Moreover, T1 IJA count and duration were significantly positively correlated with T2 *proportion* of action tokens/types ( $ps < 0.05$ ) and internal state tokens/types ( $ps < 0.004$ ). T1 IJA count and duration were negatively (but not significantly) correlated with T2 *proportion* of GAP tokens/types ( $ps 0.134-0.812$ ).

**Conclusions:** For young children with ASD, the presence and amount of early IJA both relate to later verb quantity and diversity in all semantic categories (action, internal state, and GAP). However, the presence and amount of early IJA relate differentially to the later *proportional* breakdown of verbs that toddlers use: children whose action and internal state verb uses encompassed high proportions of total verb use engaged in more IJA 1-2 years earlier, whereas those whose use of GAP verbs was proportionately high tended to engage in less IJA earlier. Figures 1 and 2 also highlight the variability of verb use within both IJA groups. Overall, these findings have implications for the focus of early JA and language interventions,

including parent talk during episodes of IJA.

**408.014 (Poster)** Let's Talk about Trains: Personalized Stories about Special Interests Increase Language Network Activation in Children with and without ASD

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**Background:** Multiple neuroimaging studies of language in individuals with autism spectrum disorder (ASD) have shown atypical activation, organization, and connectivity within the language network (e.g., Lindell and Hudry 2013; Eyler et al. 2012; Kleinhaus et al. 2008; Herringshaw et al. 2016). However, these studies have relied on standardized task designs and non-motivating language stimuli. Importantly, individuals vary greatly in what they find intrinsically motivating or rewarding, and individuals with autism often have exaggerated specificity in what they find motivating and rewarding (i.e., special interests - highly specific, interests or passions that are intense, focused, and present in up to 88% of children with ASD; Klin et al. 2007). Therefore, using special interests as stimuli in neuroimaging experiments in ASD may provide a unique opportunity to achieve high levels of motivation and affect brain activation. Past studies using personally-relevant stimuli, such as familiar faces, have revealed greater brain activation in relevant brain regions than canonical neuroimaging designs (e.g., Pierce and Redcay 2008).

**Objectives:** Despite the prevalence of special interests in ASD and their ability to modulate behavior, there is no evidence as to whether or how special interests modulate activity in the brain's language network. Here, we create a personalized neuroimaging experiment, using individualized stimuli based on each child's specific special interest, to assess language network activation in children with and without ASD.

**Methods:** We measured language network activation with functional magnetic resonance imaging (fMRI) in n=16 neurotypical (NT) and n=8 ASD children ages 7-12 years. For each child, we assessed the intensity, duration, and scope of their special interest using questionnaires, semi-structured interviews, and links to video clips of their special interest. We then wrote and recorded unique, short stories related to the precise special interest for every child. Next, we collected fMRI data while children listened to (1) personalized special interest stories, (2) "neutral," non-personalized stories about nature, and (3) backward speech as a low-level auditory control (see Figure 1). Finally, we identified brain regions that showed increased activation for special interests versus neutral stories (special interest > neutral stories) using a whole-brain approach.

**Results:** Across both children with and without ASD, activation in the language network was higher for personalized special interest stories than neutral stories (t-value > 3.1; see Figure 2). Importantly, these activation patterns were robust at the level of a single child (t-value > 3.1 at single subject level), and within each group (ASD and NT separately).

**Conclusions:** Our results suggest that neuroimaging studies of language that rely on stimuli of low personal interest may underestimate the language capacity of children with and without ASD. Approaches that take advantage of heterogeneity and highly motivating material (i.e., special interests) may provide a more accurate understanding of both strengths and challenges in language processing in ASD.

**408.015 (Poster)** Longitudinal Perspectives on Language Impairment in Minority Autistic Young Adults

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**Background:** Little is known about language development in racial/ethnic minorities (hereafter, minority) with language impairment (LI) despite evidence of selection bias in research against autistic individuals with multiply marginalized identities (Durkin et al., 2015; Russell et al., 2019). Further, there is a need for longitudinal knowledge and replication of language development in older autistic individuals (Shattuck et al., 2018). To address these gaps, this study investigated the diagnostic stability of language impairment in minority autistic adolescents and young adults in a longitudinal design over three years.

**Objectives:** Research questions were: 1) Do participants change over time in their performance levels on a measure of overall language and a measure of morphosyntactic abilities? 2) Which language domains relevant to identifying LI (nonword repetition, receptive and expressive overall language, receptive and expressive vocabulary, morphosyntax) show interindividual variation and categorize individuals as having LI? 3) Do abilities in morphosyntactic marking and grammaticality judgments show more within-person variability relative to other language domains?

**Methods:** This study received institutional board approval. Thirteen minority autistic adolescents and young adults completed age-referenced assessments once per year for three years. Two timepoints took place in-person, and the third timepoint took place online. All timepoints included the Clinical Evaluation of Language Fundamentals (CELF) and the Test for Early Grammatical Impairment (TEGI). The third timepoint also included the Expressive Vocabulary Test, Peabody Picture Vocabulary Test, Syllable Repetition Task, Raven's Progressive Matrices, and the Social Responsiveness Scale. Data were analyzed with respect to age-based norms to determine the nature of abilities and how abilities in each domain changed over development. LI was defined as  $-1.25$  SD on 2 or more measures, following an epidemiological study of language impairment (Tomblin et al., 1996).

**Results:** CELF and TEGI scores did not change significantly over time (RQ1); thus, we report Time 3 scores only. CELF scores suggested broad and persistent LI across participants, who all qualified for LI (i.e., qualified on 2 or more measures; RQ2). Other outcomes were more variable; some participants did not qualify for LI on the SRT, PPVT, EVT, or TEGI; see Figure 1. Abilities in morphosyntactic marking and grammaticality judgments differentiated participants (RQ3; see Figure 2). Error analysis revealed that unlike the “TEGI-No LI” group, who showed near-100% accuracy on tense-marking probes (consistent with the adult grammar), the accuracy of the “TEGI-LI” group was <50%. Common error types on the third-person singular and past-tense probes were production of nonfinite forms (18.6% and 17.4%), present progressive *-ing* (14.7% and 10.6%), and “done” on the past-tense probe (13.7%). Common error types on the Be/Do probe were double-marking (10.2%), agreement error (9.8%), and wrong subject (e.g., second-person “you”; 14%). Omission errors were low (5.1%). NVIQ and demographic variables did not associate with language outcomes.

**Conclusions:** Even though the diagnostic stability of LI may be persistent across adolescence and young adulthood, LI may be inconsistent across dimensions of speech and language. Autistic individuals should continue to get comprehensive language assessment into adolescence to inform supports.

References available upon request.

#### **408.016** (Poster) Pronominal Ambiguity in ASD Suggest Struggles with Social (and not linguistic) Pragmatics

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Background: Autistic individuals have been shown to use more ambiguous pronouns than neurotypical (NT) peers when telling narratives (Colle et al. 2008; Novogrodsky, 2013; Novogrodsky & Edelson, 2016). Some authors have related these patterns to differences in mentalizing (e.g., Novogrodsky & Edelson, 2016), while others point to challenges with executive functioning (EF) (e.g., Arnold et al., 2009).

Most studies define pronominal ambiguity as times when a pronoun’s antecedent is missing altogether (e.g., “Once upon a time, **she**...”), but some also include pronouns that are ambiguous due to competing antecedents (e.g., “Two girls lived in a castle. **She**...”). For this study, we refer to these two distinct patterns as “never-introduced-referent” and “competing-referents ambiguity,” respectively.

No previous work has directly compared frequencies of never-introduced-referent and competing-referents ambiguity within and between groups, despite the fact that such a comparison could help disentangle the two proposed explanations for increased ambiguity in ASD: Never-introduced-referent ambiguity signals challenges recognizing that the listener must be introduced to the referent before a pronoun can be used (i.e., perspective-taking or mentalizing); whereas competing-referents ambiguity may entail difficulty tracking the presence, recency, and salience of referents in previous discourse (i.e. executive functioning).

Objectives: This is the first study to compare the frequency of never-introduced-referent vs.competing-referents ambiguity in narratives of older children with and without ASD.

Methods: Thirty-three 10-to-17-year-old participants with ASD (n=17) and Neurotypical peers (n=16), statistically on age, standardized language, and IQ scores ( $p>0.1$  for all), watched two short animated videos alone and then described the videos’ events to two listeners who were openly unfamiliar with the videos. Resulting narratives were video-recorded, and all referential terms were coded as clear or ambiguous. Ambiguous terms were classified as: 1) never-introduced-referent (e.g., “Once upon a time, **she/the girl**”); 2) competing-referents (e.g., “Two girls lived in a castle. **She/the girl**...”). We calculated the proportion of each type of ambiguity out of the total referential terms for each participant, and used a 2x2 (Group x Ambiguity-subtype) repeated-measures ANOVA to compare proportions between groups.

Results: No main effects are significant, but the interaction between group and subtype is ( $F(1,31)=6.165, p=0.019$ ), reflecting (confirmed by a Tukey HSD test) a significantly higher proportion of never-introduced ambiguity in the ASD group than the NT group.

Conclusions: Findings show that narratives of children with ASD are not more referentially ambiguous, overall. Instead, their stories contain a relatively higher frequency of never-introduced-referent ambiguity, suggesting that narrators insufficiently take the listener’s lack of knowledge into account.. This pattern of ambiguity suggests that challenges with perspective taking or mentalizing -- and not executive functioning-- underlie ambiguous referencing in ASD. This is in line with recent findings that children with ASD show greater challenges with social pragmatics (listener/context-specific pragmatic rules) than linguistic pragmatics (e.g., Gricean maxims) as compared to NT children and children with developmental language disorder (Andrés-Roqueta & Katsos, 2020).

#### **408.017** (Poster) The Use of Discourse-Marker ‘like’ By Older Children with ASD

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Background: Discourse markers, such as *well*, or *I mean*, or *like*, are important to conversational reciprocity: they fill pauses, aid in word-finding, convey uncertainty, hold conversational turns, and provide information about pause length. There is substantial evidence that individuals with ASD use discourse markers less frequently than neurotypical (NT) peers (e.g., Lake et al., 2011), especially those that are “listener-oriented” (e.g., Gorman et al., 2016). One listener-oriented discourse marker that has not yet been studied in ASD is *like*, which serves important pragmatic functions that are

not encoded by other discourse markers (Underhill, 1988; Fuller, 2003). Specifically, *like* serves four distinct functions, signalling to the listener that the content of upcoming speech is: 1) Important/new; 2) Loose/approximate; 3) Reformulative; or 4) Quotative. Because of the ubiquity of this discourse marker in typical adolescent speech and the multiple important listener-directed functions it serves, understanding how adolescents with ASD employ this discourse marker can advance our knowledge of communicative reciprocity in this population.

**Objectives:** The current study compares the frequency of discourse-marker-*like* use between older children with and without ASD. We also explore patterns of usage, by comparing relative proportions of the four *like* functions.

**Methods:**

Twenty-one older children with ASD and 20 NT peers participated, aged 10-17 years. Groups were not statistically different in age, sex, nonverbal and verbal IQ scores, and standardized language scores ( $p>0.1$ ). Participants engaged in a semi-structured *Double Interview* (Garcia Winner, 2008) with a researcher, wherein the researcher asked participants questions about hobbies, vacations, and school, and then reversed roles, so that participants were responsible for asking questions of researchers. We video-recorded and transcribed all interviews. In each transcript, we categorized the use of discourse-marker *like* as marking subsequent speech as one of the following:

1. important/new: For a hobby I, like, collect hats
2. loose/approximate: I own, like, 500 hats
3. revised/reformulated: I own 500... like, so many hats
4. quotative: When I see a new hat, I'm like, "OMG!"

We used a t-test to compare overall *like* frequencies between groups and a Fisher exact test to compare relative proportions of *like* subtypes between groups.

**Results:** There were no significant differences in *like* frequencies between groups (ASD  $m=16.86$ ; NT  $m=20.15$ ;  $t=0.438$ ,  $p=0.661$ ), nor were there differences in relative proportions of functions ( $p=0.33$ ). See Figure.

**Conclusions:** Research consistently indicates that individuals with ASD use some listener-directed discourse markers significantly less often than their NT counterparts, but the findings from our study suggest that this pattern does not persist to all such markers. This group of older children with ASD use *like* as often as their peers, and they use it to signify similar information about upcoming speech to their listener. We interpret findings as showing that older children with ASD are adept at using *like* to signal complex and nuanced pragmatic information; we argue this represents a pragmatic strength in ASD that has henceforth gone unnoticed.

#### **408.018 (Poster)** Sex Differences in Social Communication between Males and Females with Autism

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**Background:** There is a male bias in autism prevalence, with a ratio of approximately 4:1 diagnosed males to females. Existing research regarding sex differences suggests that core social communication challenges may differ between males and females. Social processing domains defined by the National Institute of Mental Health (NIMH)'s Research Domain Criteria include attachment and affiliation, or the desire to engage in positive social interactions, and social communication, or the ability to communicate information through facial and non-facial expressions.

**Objectives:** The primary objective of this investigation was to use a newly developed measure of social processing subdomains to examine sex differences in social communication in a large population sample of children with and without autism. These subdomains – facial communication production, non-facial communication production, and attachment and affiliation – can address existing limitations regarding which aspects of social communication are different between males and females with autism.

**Methods:** The Social Communication Questionnaire-Lifetime (SCQ) was collected from 42,315 individuals with autism and 18,751 control siblings without autism who participated in the Simons Powering Autism Research (SPARK) study, a nationwide research project collecting medical and genetic information from families affected by autism. Facial communication production, attachment and affiliation, and non-facial communication production were measured using our novel method that combines items from the SCQ to calculate new subdomains (Uljarevic et al., 2020), for which higher scores reflect more challenges in each domain. Non-parametric Mann-Whitney tests were performed to compare the subscores of males and females in each group. Z-scores are reported from the sum of ranks.

**Results:** We found that males and females with autism only differed in their levels of attachment and affiliation ( $z = -11.05$ ,  $p < .001$ ). The 33,050 males with autism exhibited more difficulty with attachment and affiliation compared to 9,265 females with autism (Figure 1). In the non-autism sibling group, there were differences between males and females in attachment and affiliation ( $z = -12.15$ ,  $p < .001$ ), and facial ( $z = -5.11$ ,  $p < .001$ ), and non-facial communication production ( $z = -7.04$ ,  $p < .001$ ), such that the 9,157 males exhibited more difficulties in each of these domains compared to 9,594 females (Figure 2).

**Conclusions:** Our results indicate that sex differences in social communication were only found for attachment and affiliation in children with autism whereas males and females exhibited similar challenges in facial and non-facial communication. However, female siblings without autism exhibited more general differences in social communication compared to male siblings without autism, with sex differences in all domains of social

communication that were assessed. These findings suggest that there may be fewer sex differences in social communication in children with autism, consistent with previous research. Our novel subdomains also indicated that attachment and affiliation may differ in females with autism compared to males, which suggests that males may show greater social challenges in specific subdomains rather than in all subdomains of social communication. Exploring sex differences in additional areas of interest will provide additional insights regarding important differences between males and females with autism.

**408.019 (Poster)** The Effect of Word-Learning Biases on Early Vocabulary Acquisition in Children with Autism Spectrum Disorder

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**Background:** Vocabulary composition and word-learning biases are closely interrelated in typical development<sup>1</sup>. Learning new words involves attending to certain properties to facilitate word learning<sup>2</sup>. Such word-learning biases are influenced by perceptually and conceptually salient words that are highly imageable, concrete, and iconic. Imageability quantifies the perceptual salience of a word by rating how easily it evokes a mental image<sup>3</sup>. Iconicity refers to the perceptual similarity between a symbol and its referent<sup>4</sup>. Concrete words refer to easily perceptible items<sup>5</sup>. Children with ASD often have delayed language acquisition. Although previous studies have documented that children with ASD use many of the same word-learning strategies as typically developing children, differences in language processing have been reported<sup>6</sup>. Individuals with ASD have difficulties comprehending words with several, vague conceptual units and have an abnormally increased reliance on perceptually-based processing for words<sup>7-9</sup>.

**Objectives:** The current study aims to examine the relationship between early vocabulary composition in children with ASD and lexical features such as imageability, iconicity, and concreteness.

**Methods:** Secondary data analyses were conducted using data obtained from the NIH-supported National Database for Autism Research (NDAR). The productive vocabularies of 264 children with ASD ( $M = 53.06$  months) were measured using the MacArthur-Bates Communicative Development Inventory (MB-CDI; Fenson et al., 2007). Vocabularies ranged from 5 to 680 words, with an average of 446.1 words produced. We gathered concreteness scores for 625 words (Brysbaert et al., 2014), iconicity scores for 578 words (Perry et al., 2015), and imageability scores for 126 words (Masterson & Druks, 1998). Polynomial regression analyses were conducted to examine the association between each child's total vocabulary size and average word feature score (concreteness, iconicity, and imageability). The dependent variable was the average word feature score. Independent variables included linear, quadratic, and cubic growth across vocabulary size. Total vocabulary scores were taken from the number of words that overlapped between the MB-CDI and the respective word-feature databases.

**Results:** Preliminary results indicate that word features are associated with vocabulary size. Although results varied slightly across the word features, the earliest words learned, on average, are highly imageable, iconic, and concrete. The average imageability of words produced displayed a negative linear change as vocabulary size increased. In contrast, nonlinear change was observed for iconicity and concreteness. See Figure 1 and Table 1 for exact results.

**Conclusions:** The results for imageability, iconicity, and concreteness broadly align with the pattern observed in typically developing (TD) toddlers reported in the literature. Children with ASD initially learn words that are highly imageable and iconic. Although this is generally true for concreteness, the very first words are variable. Then, average concreteness increases as children typically experience a burst in vocabulary growth (10-100 words) and as vocabulary size reaches 200 words, concreteness declines. This work contributes novel insights into early word learning patterns in children with ASD and demonstrates an overlap with TD toddlers in word-learning strategies. Furthermore, we report unique information about the nonlinear growth patterns associated with each word feature. Future work will make direct comparisons to TD toddlers.

**408.020 (Poster)** Recognition of Gradable Adjectives in Children with ASD

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**Background:**

Concepts such as height and length, and intensity of emotion, show an ordered, scalable relation to the objects they describe. These are gradable adjectives (GAs) and include two types: Relative, which change based on the context (e.g., which sticks are *short* depends on the lengths of the other sticks in the set) and Absolute, which do not (e.g., which umbrellas are *spotted* does not vary by the 'spotted-ness' of the other umbrellas in the set)<sup>1</sup>. Typically-developing (TD) children as young as four show sensitivity to the relative/absolute distinction with gradable adjectives, including emotions<sup>1,2</sup>. Because children with ASD, despite intact syntactic and vocabulary skills, often show differences in semantic and pragmatic processes in relation to the mental states of others<sup>3</sup>, they may show challenges in processing gradable adjectives, especially those related to emotion.

**Objectives:**

To examine whether children with ASD and TD children differentially process gradable adjectives (GAs) across contexts.

**Methods:**

Participants were thirty-three individuals (ASD:  $n = 15$ , TD:  $n = 18$ ) ranging in age from 6-20 years old, all part of a longitudinal study on language acquisition and originally matched on language ability<sup>4</sup>. Testing occurred at two time points separated by four years.

Processing of GAs was tested via a sorting task. Participants sorted 9 sets of pictures or objects on the basis of an emotion (happy, sad, angry; see Figure 1) or a physical property (gradable-long; absolute-spotted and striped), selecting "all the sad faces", "all the striped umbrellas", or "all the long pencils". Picture sets were presented twice: a baseline was established using 9 pictures in each set; for the 2<sup>nd</sup> presentation, four more pictures of the most extreme dimension of interest were added. Pictures were coded 1-13 in order of intensity. Of the pictures selected, the lowest number was recorded as the cutoff.

#### Results:

For absolute adjectives, no change with different sized sets at either Time1 or Time2 was seen for either group. For relative adjectives, children were sensitive to the relative adjective *long*, in that with the addition of more pencils the cutoff for "long" shifted upward. The upward shift was present in the ASD group ( $T1 = +.7$ ;  $T2 = +.6$ ) but statistically significant at both time points only for the TD group ( $T1 = +.9$ ;  $t2 = +1.1$ ;  $ps < .05$ ). For emotion GAs, both groups at both time points sorted such that cutoffs shifted upwards with the addition of more extreme expressions. The shift was only statistically significant for the ASD group at Time2 ( $= .7$ ;  $p = .017$ ). The groups did not differ in performance from Time1 to Time2 except that the ASD group showed a significant increase from baseline and test from Time 1 to Time 2 for the relative adjective "long" (Time1a-2a  $+1.8$ ;  $t = -2.3$ ;  $p = .038$ ; Time1b-2b  $1.7$ ;  $t = -2.6$ ;  $p = .019$ ).

#### Conclusions:

School-age and adolescent children with ASD performed similarly to their TD peers in the processing of GAs, including both absolute and relative adjectives with both physical and emotional dimensions. Interestingly, at the second time point, the ASD group were more impacted by the extremes with the emotion stimuli, indicating that age—or possibly explicit interventions—may have enhanced their sensitivity to social stimuli.

#### 408.021 (Poster) Vocalization and Word Usage from Minimally Verbal Individuals

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**Background:** Minimally verbal (MV) individuals have been inconsistently defined, making it difficult to obtain reliable measures within and across studies (Koegel et al. 2020; Bal et al. 2016). In addition, particularly little is known about individuals who have zero to few spoken words or word approximations (Tager-Flusberg et al. 2009). These individuals use a variety of means of expression, including gestures, hand leading, sign language, augmentative and assistive communication (AAC) devices, and non-speech vocalizations. Standardized assessments often fail to capture the diversity and nuances of minimally verbal communication (Tager-Flusberg and Kasari 2013). Both quantitative and qualitative methods are required to better understand the language and communication development of this underserved population.

**Objectives:** This research aims to examine in-depth communication profiles from a spectrum of individuals identifying as minimally verbal and to ascertain viable metrics of communication for those with few spoken words.

**Methods:** Family members of individuals identifying as minimally verbal filled out a communication profile questionnaire ( $n = 22$ ). In one section, participants were asked to indicate whether the MV individual used a word/word approximation, a non-speech vocalization, or no sound for various communicative and affective states such as delight, anger, pain, and requests for various items and activities. Detailed communication profiles were also collected, including parent-reported lists of spoken words/word approximations, all communication modalities (gestures, hand leading, vocalizations, sign language, AAC, etc.), and AAC programs used. Demographic information including age, gender, diagnoses, sibling and parent ages, languages spoken in the home, race, therapy service history, parent education, and household income, was also acquired.

**Results:** Figure 1 presents a matrix of vocalization and word usage from survey respondents. Individuals produced 0-500+ words, per parent report, highlighting the breadth of the term "minimally verbal." Individuals with greater than 20 parent-reported spoken words were the first to produce more words than vocalizations, suggesting a possible sub-category of minimally verbal individuals for those producing 0-20 spoken words/approximations. Across all participants, specific communicative expressions like requesting a person, requesting help, or a greeting were likely to emerge as words earlier than affective expressions. Hunger and thirst were also unlikely to be expressed as vocalizations until produced as a word. "Yes" seemed to emerge as a spoken word more commonly than "no," possibly indicating that it may be easier to more clearly reject something with a vocalization than it is to affirm it. This would suggest that the motivation to be understood is a driving factor in the development of words in early MV individuals; however, more precise questioning and a larger sample across contexts and language levels is necessary to further support this observation.

**Conclusions:** Our results suggest a natural delineation for minimally verbal individuals, with a special sub-category for those producing 0-20 spoken words or word approximations. We refer to this 0-20 word population as *mv\** and suggest that looking across this population of individuals, regardless of diagnosis, could provide greater insight into the origin of vocal expression within and across autism and other neurodevelopmental disorders.

#### **408.022 (Poster) Vowel Distinctiveness and Expressive Language in Children with ASD**

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#### **Background:**

A significant portion of children with autism (ASD) experience comorbid motor speech impairment – this is true for up to ¼ of minimally and low-verbal (MLV) children with ASD, for example. Speech production ability has been shown to predict concurrent expressive language (EL) ability in MLV ASD. Because vowels emerge earlier than consonants, identifying vowel development delays may be a particularly useful predictor of EL impairment.

#### **Objectives:**

We investigated the relationship of an acoustic measure of speech production, Vowel Distinctiveness, to a standardized measure of EL. Vowel Distinctiveness is normalized for different vocal tract sizes and can be used with children of any age. EL was indexed by the EL v-score from the Vineland, a parent questionnaire measure that is useful for children with a range of verbal abilities.

#### **Methods:**

41 participants with ASD were prompted to repeat the syllables /bi/, /ba/, /bu/, /bæ/, and /bʌ/ four times each. Fundamental frequency (F0) and the first three vowel formants (F1-F3) were measured in the middle third of each vowel. Mean values for F0 and F1-F3 for each vowel target were calculated. The acoustic distance from each of the first four vowels to /ʌ/ was then averaged to produce a Vowel Distinctiveness score for each child. Pearson's correlations compared Vowel Distinctiveness to five descriptive variables: Chronological age, Vineland Adaptive SS (a proxy for IQ that correlates at  $r = 0.86$  with Leiter NVIQ standard score), Vineland Receptive Language (RL) v-score, Vineland EL v-score, and Total Score from the Social Communication Questionnaire (SCQ; a measure of ASD severity). Vowel Distinctiveness was then regressed on EL v-score. For reference, v-scores have a mean of 15 and SD of 3.

#### **Results:**

We report initial results from 13 children (6 F) aged 5;0-7;11 (mean 6;11, SD 0.10); data analysis for the remaining 28 is ongoing. Mean EL v-score for the initial cohort was 5.9 (SD 5.5); mean RL v-score was 6.7 (SD 3.1). Vowel Distinctiveness (mean 0.29, SD 0.08) was lower than for typically-developing 7-year-olds (0.34) and was significantly correlated with EL v-score ( $r = 0.715$ ,  $p = 0.006$ ) but not with age, Adaptive Score, RL v-score, or SCQ Total Score. Vowel Distinctiveness significantly predicted concurrent EL v-score ( $F(1,11) = 11.529$ ,  $p = 0.006$ ) and accounted for 46.7% of the variance in EL v-score (adjusted  $R^2$ ). Figure 1 shows mean Vowel Distinctiveness vs. EL v-score.

#### **Conclusions:**

Mean RL v-scores, EL v-scores, and Vowel Distinctiveness were lower for our initial cohort of 13 than for typical children; however, there was significant heterogeneity in the group. This is a common finding in ASD that warrants further investigation, especially since Figure 1 and previous work suggest the presence of distinct subgroups with regard to Vowel Distinctiveness. Vowel Distinctiveness was significantly correlated with and accounted for almost half of the variance in concurrent EL v-score, consistent with previous work showing that motor speech ability contributes to expressive language ability in at least some children with ASD.

### **VIRTUAL POSTER SESSION — COMMUNICATION AND LANGUAGE**

#### **508 - Communication and Language --- (V)**

#### **508.001 (Virtual Poster) A Game of Telephone: Longitudinal, Telephone-Based Natural Language Sampling Among Neurodiverse, School-Aged Children**

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Background: School-based support is a primary service modality for autistic youth (Rosen et al., 2019). Since the onset of the COVID-19 pandemic, video conferencing (VC) has been the preferred modality for interventions (e.g. speech therapy and social groups) that would otherwise occur in



schools (Ellison et al., 2021). Researchers have similarly made progress on the development of protocols for VC-based autism assessments (Talbot et al., 2021). However, technical issues and lack of familiarity with novel VC platforms have rendered it challenging to deliver on the promise of telehealth (Auchus et al., 2021). Naturalistic language samples (NLS) are critical for assessing language outcomes, but for autistic children, the presence of an unfamiliar adult (i.e., clinician/staff) during both in-person and VC monitoring sessions could adversely impact their behavior and reduce the accuracy of language ability estimates (Barokova & Tager-Flusberg, 2020). Developing a telephony protocol to capture naturalistic language samples from children and parents, in their homes, could shed light on the real-life efficacy of support services and ultimately inform the development of scalable, cost-effective intervention progress monitoring systems.

**Objectives:** Develop and assess the implementation of a telephony protocol for collecting home-based naturalistic language samples (NLS) from autistic and neurotypical school-aged children – with the support of their parents – once per week for seven weeks.

**Methods:** A telephony platform, created by the Linguistic Data Consortium at the University of Pennsylvania, was adapted for this project in collaboration with the Center for Autism Research at the Children's Hospital of Philadelphia. The research team included experts in clinical language sampling, remote data collection, and lexical/acoustic feature extraction from elicited and spontaneous vocalization samples. The final battery consisted of eight different, engaging, and age-appropriate tasks that a parent or legal guardian could independently facilitate (Table).

**Results:** The final developed platform supports single and dual speaker modes and can record 24 phone sessions concurrently. School-aged children with Autism Spectrum Condition (ASC) and neurotypical development (NT) (N= 15; 5 ASC, 10 NT) and a participating parent complete seven, 30-minute-long sessions utilizing the telephony platform (N= 105; 44 single-speaker, 61 dual-speaker; data collection is ongoing). Prior to the first session, study staff engaged with the participating parent over VC to review the standard elicitation protocol utilized across sessions. Sessions completed without platform-related technical issues were considered successful. Single-speaker sessions yielded a 100% success rate, whereas dual-speaker sessions yielded 71% success across all participants (technological issues included muting and spontaneous system disconnections).

**Conclusions:** Telephony carries great potential as a low-cost and scalable platform for monitoring intervention responses from afar, as well as for measuring longitudinal, ecologically valid developmental changes in individual children. The demonstrated ability of parents to facilitate NLS independently and successfully with their child over the telephone marks telephony as a particularly impactful tool for use among school-aged, autistic children receiving telehealth services or participating in remote research studies. In the long term, telephony has particular potential to address service and monitoring gaps for neurodiverse children from minoritized or low-resource communities.

**508.002 (Virtual Poster)** A Preliminary Study on the Emotional Valences of Passive Sentences in Japanese Perceived By People with ASD  
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**Background:** Lartseva, Dijkstra, and Buitelaar (2015) point out that "...individuals with ASD are able to correctly identify words, sentences or stories as emotionally positive or negative". However, it is not yet clear whether ASD individuals can accurately classify them into positive or negative in a Japanese cultural context. Direct passive sentences in Japanese almost always convey either a positive or negative meaning, with the exception of passive sentences with inanimate subjects which are usually interpreted as having no benefit or damage connotations. In addition, Japanese has the unique indirect passive sentences which require inference as to whether the sentence denote benefits or damages for the speaker. Their interpretation is further complicated since the subject is usually omitted.

**Objectives:** The purpose of this study is to clarify how individuals with ASD experience linguistic difficulties in daily life. This study investigates the difficulties that they experience by comparing them with the control group in their perception of Japanese passive sentences. Also interview data were collected. Due to the paucity of available subjects, this is a preliminary report.

**Methods:** We measured the emotional values of 5 people (17 to 28 years old) diagnosed with ASD without intellectual disabilities on three types of direct passive sentences (16 sentences respectively for damage, benefit, and neutral meanings) with the visual analog scale (VAS). The scale indicates emotional values measured by the distance in millimeters from the center point (neutral) of the straight line to the mark the participants had drawn. We compared their values with the values we had measured on the control group consisting of 106 university students with the same method (Yorozyua et al., 2020).

**Results:**

All the five ASD participants judged an emotional valence for one indirect passive sentence as positive or neutral ("*Taro ni Mado wo akerareta.*", meaning "(I was unhappy because) the window was opened by Taro."). In this sentence, the speaker's unhappy feeling is not explicitly stated. On the other hand, the control group consistently judged the sentence as negative ( $M = -8$ ,  $SD = 13.8$ ).

All the 5 participants with ASD reported that the task was difficult. They said "I could not judge well since the sentences were too short." and "I don't know Taro's feelings because *I am not Taro*". Furthermore, one participant rated all the 16 sentences as neutral, and another one often assigned the completely opposite emotional valences to the control group.

**Conclusions:** This preliminary study suggests that it was difficult for the five ASD participants to judge the emotional valences of Japanese passive sentences. For some sentences, they even showed opposite interpretations to the control group. The study also showed that some ASD subjects were

confused or gave up the task when they tried to interpret short sentences lacking background information. Contrary to the contention by Lartseva, et al. (2015) that ASD individuals are able to correctly judge the emotional values of words, sentences or stories, this study suggests the need to reevaluate the issue from the perspective of the Japanese language.

**508.003 (Virtual Poster)** Contextual Differences in Prosodic Language Profiles in Autism Spectrum Disorder

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**Background:** Prosody (e.g. intonation, rhythm, rate of speech) is importantly used for conveying meaning during conversation. Prosody may be markedly different in autism spectrum disorder (ASD), and this can contribute to broader social communication challenges, making prosody an important focus of study. Prior studies have often relied on perceptual judgements and acoustic measurement of speech to characterize prosody, but have tended to examine prosody within a single context and often in highly structured tasks that may limit the generalization of findings to more naturalistic interactions. Characterization of prosody in both structured and semi-naturalistic tasks is an important step in understanding the exact nature and implications of prosodic differences in ASD.

**Objectives:** This study aimed to examine prosody in ASD across structured and semi-naturalistic contexts and across different linguistic functions to more comprehensively characterize prosodic atypicalities in ASD.

**Methods:** Participants included individuals with ASD (N = 24) and typically developing controls (N = 21). Language samples were recorded using high quality microphones during a structured task designed to test expressive prosody (Profiling Elements of Speech-Prosody in Communication task (PEPS-C; McCann & Peppé, 2003)), and a semi-structured conversation derived from the ADOS-2. (Lord et al., 2012). Questions and statements from the ADOS-2 were manually coded in Praat (Boersma, 2001), and elicited during PEPS-C. Using Praat, intensity and pitch (Fundamental Frequency, F0) were extracted in .01 ms intervals within each force-aligned utterance. Standard deviation (SD) of F0 was calculated as a measure of pitch variability and mean intensity was calculated as a measure of loudness.

**Results:** For questions, a context by group interaction was observed for intensity, such that the ASD group demonstrated significantly greater volume relative to the TD group during the structured task relative to the unstructured ( $F(1,37)=6.71, p<.01$ ). A context effect was observed for SDF0 where all participants demonstrated greater variability in the structured context ( $F(1,38)=32.18, p<.001$ ). For statements, context by group interactions were not observed. For intensity, a group effect emerged such that the ASD group demonstrated greater volume during both contexts relative to the TD group ( $F(1,43)=9.89, p<.01$ ). Context and group effects were observed for SDF0, where all participants demonstrated greater pitch variability in the structured task ( $F(1,43)=10.46, p<.01$ ), and the ASD group demonstrated greater pitch variability relative to controls during both tasks ( $F(1,43)=8.85, p<.01$ ).

**Conclusions:** Across contexts, findings support clinical observations of increased pitch variability and loudness in ASD. Whereas group differences were observed across tasks, they were surprisingly more robust in the structured task. It is possible that individuals with ASD may have over-corrected their speech during PEPS-C in order to produce the correct pitch contour (e.g. question or statement), evoking greater prosodic differences than in more natural interactive speech. Results suggest that the PEPS-C is sensitive in capturing acoustic differences in ASD, however, it may not reflect the true nature of prosody in naturalistic settings. Together, results highlight the importance of evaluating prosody across contexts to inform the prosodic differences in everyday life for individuals with ASD.

**508.004 (Virtual Poster)** Evaluation of Linguistic Abilities and Emerging Literacy Skills of Children with ASD

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**Background:**

Many studies have been conducted regarding the optimal ways in which Typically Developing (TD) children should be exposed to reading. We know that for TD children there is a monumental connection between reading abilities and linguistic abilities and we know that this connection is already found in the earliest stages of reading, hence the stage called 'emerging literacy skills' which includes letter recognition, phonological awareness and awareness to printed materials (Catts et al., 2002; Stothard et al., 1998; Cabell, 2008). Accumulative research is now available showing that many subgroups of children with ASD show different profiles of linguistic deficits (Battaglia, 2013; Sukenik and Friedmann, 2018; Tager-Flusberg and Kjelgaard, 2001). We also know that social skills and social communication have been found as influencing factors affecting reading comprehension (Skibbe et al., 2008). Since both social skills and social communications are part of the core deficits in ASD, children with ASD are at a higher risk for developing reading deficits (Lucas and Norbury, 2015).

**Objectives:**

The aim of the current study is to test the linguistic profiles and the emerging literacy skills of pre-schoolers with ASD and examine the connection between the two abilities.

**Methods:**

Participants included 20 children with ASD aged 4-7 years old and 20 chronological age matched children with typical development. All children with ASD were studying in special education preschools. No known disabilities or delays were reported for the children in the TD group.

Background characteristics included NVIQ (RPM) social skills (SCQ) and adaptive behavior (Vineland). Linguistic skills were assessed using the Katzenberger linguistic assessment battery (Katzenberger, 2016). Emerging literacy skills were assessed using an awareness to print battery build for this study and the 'Shmone msimot' assessment battery (Ministry of education, Israel). Group scores were compared for each task and individual profiles examined the abilities and deficits in each area tested compared to the performance of TD children.

#### Results:

Group scores found a significant correlation between linguistic scores and print awareness scores in both the ASD group and the TD group although as a group, the TD group had higher scores in all variables tested.

Individual profiles showed subgroups of children with ASD: (1) children with very low scores on linguistic tasks hence indicating an overall linguistic deficit and low scores on emerging literacy skills (2) children with age-matched linguistic scores but very low scores on emerging literacy skills (3) children with higher scores than those of age-matched TD children both on linguistic scores and emerging literacy tasks.

#### Conclusions:

For children with typical development, it seems that the connection between linguistic abilities and emerging literacy skills (which will later become reading skills) is very clear. Our results demonstrate the wide variability found in the ASD population and the fact that for some children language does not predict literacy skills. This finding has implications for future intervention strategies and the fact that for some children with ASD emerging literacy skills and especially an interest in print and letters does not come naturally.

#### **508.005** (Virtual Poster) Girls with Autism Speed up More in a Tongue Twister Task

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Background: Autism spectrum disorder (ASD) is diagnosed more frequently in boys than girls, with an estimated male-to-female ratio of 4:1 (Baio et al., 2018). However, some autistic girls may be missed, or misdiagnosed, due to behavioral characteristics that differ qualitatively or quantitatively from autistic boys (Julia Parish-Morris et al., 2017). The current study investigates potential sex differences and diagnostic group differences in autistic speech by comparing speech rates when pronouncing tongue twisters. Previous acoustic-focused studies found that ASD children either articulated more slowly (Fosnot & Jun 1999; Patel et al., 2020) or quickly (e.g., Shriberg et al., 2001) than typically developing (TD) peers. However, due to the predominance of ASD in boys, few studies have evaluated sex differences in the speech rates of autistic children, or compared autistic girls' speech rates to TD girls' speech rates in tongue twister tasks.

Objectives: Investigate speech rate in autistic and TD children, asking (a) whether speech rate is associated with ASD diagnosis and covaries with autism symptom severity, and (b) how speech rate in ASD girls may or may not differ from speech rate in ASD boys, TD boys, and TD girls.

Methods: Sixty-five ASD (n=32; 15 females; mean age=11.7±2.8 years; mean IQ=108±10.2) and TD children (n=33; 20 females; mean age=10.9±2.8 years; mean IQ=109±12.0), matched on age (p=0.68) and IQ (p=0.96), were recorded reading the same two sentences out aloud (*read\_sentence*) and reading the same two tongue twisters as fast as they can (*speeded\_tongue\_twister*). Speech rate was calculated by dividing the total number of syllables in each sentence by its duration in seconds. Then, two aggregate speech rates, one for read sentences and one for tongue twisters, were calculated for each speaker. The mean speech rate difference between tasks (*task\_difference*) was calculated by subtracting the speech rate of *read\_sentence* from *speeded\_tongue\_twister*. T-tests measured diagnostic group differences and sex differences in speech rates (Figure); speech rate was correlated with clinical phenotype using Pearson's correlation (Table).

Results: No significant diagnostic group differences or sex differences in speech rate were found for *read\_sentence* or *speeded\_tongue\_twister*. However, the *task\_difference* of speech rate differed by diagnostic group (p = 0.040), such that autistic children increased their speech rate to a larger extent than TD children in tongue twister pronunciation compared to sentence reading. This difference was driven by autistic females (p=0.015), who exhibited a significantly larger *task\_difference* compared to autistic boys (p=0.044). Negative correlations between the speech rate of *speeded\_tongue\_twister* and three SRS scores were significant for ASD boys (total: p=0.026; communication: p=0.045, RRB: p=0.008), and a negative correlation between *task\_difference* and SRS communication scores emerged in ASD girls (p=0.035). Thus, autistic children with more severe ASD symptoms, including girls, produced slower tongue twisters.

Conclusions: Compared to autistic boys and TD girls, autistic girls sped up their tongue twister pronunciations to a greater extent when instructed. This may be due to elements of behavioral inflexibility, enhanced rule-following, or social motivation which could lead to greater effort in social contexts; future research will examine these possible explanations.

#### **508.006** (Virtual Poster) Measuring Referential Communication Dynamically in Older Children with ASD

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#### Background:

Successful referential communication entails efficacy and efficiency (Yule, 1996). Efficacy reflects how well speaker intentions transmit to listeners; efficiency reflects how quickly intentions are transmitted. These features are dynamic: speakers must adjust the quality/quantity of subsequent messages based on whether previous messages were understood.

Research finds individuals with autism spectrum disorder (ASD) are relatively ineffective and/or inefficient at referential communication (Review in Malkin et al., 2018). However, this research typically uses static metrics of efficacy (how accurately messages were relayed) and efficiency (overall word count), rather than dynamic ones (e.g., Does the speaker alter subsequent descriptions when the listener previously misunderstood them?).

Objectives:

To use dynamic measures of efficacy and efficiency to examine how speakers with and without ASD adjust their message to meet listener needs across time.

Methods:

Fifteen older children with (n=8) and without (n=7) ASD were included in this analysis. Groups were not statistically different in age, sex ratios, standardized language, and nonverbal/verbal IQ ( $p>0.1$ ).

Participants interacted with two research assistants (RA1 and RA2). RA1 sat beside the participant. RA2 sat across from them, behind an opaque barrier. A board was positioned before the participant with a doll in its center and four black, ten-sided shapes surrounding the doll. RA1 explained that shapes were configured around RA2 the same way they were the doll. It was the participant's task to use language to guide RA2 to select targeted shapes (displayed individually on a laptop). There were 64 trials. Sessions were video-recorded. Each trial was coded for strategy:

1. Spatial ("...is behind you")
2. Geometric ("...has a triangle on top")
3. Resemblance ("...looks like Pac-Man")
4. Nondiscriminatory ("...is black")

*Efficacy*

We created an "efficacy quotient" (EQ), which assigned a 1 for trials when participants: 1) changed strategies when the previous trial was unsuccessful; 2) maintained strategies when it was successful. Remaining trials earned a 0. We summed 1s and divided this value by 63 (participants had opportunities to switch/maintain strategies from the second trial on). We used *t*-tests to compare EQs between groups.

*Efficiency*

We measured the number of words within trials, where shorter utterances in later trials suggest referential shortening (de Marchena and Eigsti, 2016). We used linear modeling to compare slopes between groups.

Results:

*Efficacy*

There was no significant difference in EQ between groups (ASD=69.2%; NT=61.5%,  $p=0.432$ ).

*Efficiency*

There was a significant effect of trial ( $p<0.0001$ ), reflecting fewer words used in later trials. There was a marginal interaction between trial and group: Individuals with ASD showed a steeper negative slope in word count across time as compared to NT participants ( $p=0.061$ )

Conclusions:

Both groups were equally *effective* at adjusting communication strategies based on previous success. However, participants with ASD were marginally more *efficient*: they were quicker to abbreviate utterances to reflect increased listener understanding. Findings emphasize the importance of examining interactions dynamically; such measures capture the realities of turn-taking and may identify strengths in autism that have heretofore gone unnoticed.

**508.007 (Virtual Poster)** Associations between Language Use and Classroom Engagement in Inclusive Classrooms for Preschoolers with and without ASD

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**Background:** Classroom engagement plays a crucial role in preschoolers' development. One possible determinant of classroom engagement is children's vocal interactions with peers and teachers, but it remains unclear if classroom vocal input and output are associated with classroom engagement. Additionally, it remains unknown whether children with autism spectrum disorder (ASD), who often have delayed social communication, have lower classroom engagement than their peers with general developmental delay (DD) or typically developing (TD) peers.

**Objectives:** We used objective measures of vocal interaction, and expert observations of classroom engagement in inclusion classrooms to examine how vocal interactions support preschoolers' classroom engagement, and how this varies across children with and without ASD.

**Methods:** Participants included 72 preschoolers (32 girls,  $M_{age}=48.57$  months) enrolled in eight inclusive classrooms. Twenty-one of the children had ASD, 22 DD, and 29 TD. During monthly observations, children wore lightweight vests equipped with Language ENvironment Analysis (LENA) to measure real-time dyadic vocalizations. They also wore two RFID tags to measure location and orientation and synchronize to LENA vocalization measures to determine instances of vocalization during social contact with peers and teachers (both child output and peer and teacher input).

Researchers observed each child using the Individualized Classroom Assessment Scoring System (inCLASS), which consists of four domains relating to children's social engagement with teachers and peers (e.g. eye contact), task engagement (e.g. staying focused on an assigned task), and negative engagement (e.g. yelling). During each inCLASS assessment, a trained researcher observed one child at a time, scoring the child on each of the four domains. Each child was observed for four 10-minute periods over the course of one day. These scores were averaged across all four periods to create a composite score for each child in each domain.

**Results:** Findings reveal that children with ASD had lower engagement with peers than their TD peers ( $p<.001$ ) and peers with DD ( $p=.035$ ). For the teacher, task, and negative domains, children with ASD had lower engagement than their TD peers ( $ps<.05$ ), but did not differ from peers with DD ( $ps>.05$ ; Table 1). Mixed effects regressions revealed that children's own vocalizations to peers and teachers were significantly positively associated with higher scores in the peer ( $p=.005$ ) and teacher ( $p=.030$ ) domains, respectively. However, peer input was negatively associated with peer domain scores ( $p<.001$ ). Teacher input was not significantly associated with the teacher domain ( $p>.05$ ). Neither children's own vocalizations nor peer/teacher input were significantly associated with the task or negative domains ( $ps>.05$ ; Table 2).

**Conclusions:** Overall, we found that children with ASD have lower classroom engagement than their TD peers, but mostly do not differ from peers with DD, suggesting engagement is affected by general language, social, or cognitive delays rather than ASD specific factors. Vocal interactions in the classroom support children's classroom engagement, but children's own vocalizations to social partners supports engagement more than the input they receive. Thus, although children with ASD tend to have lower engagement, their developing language skills can support positive classroom engagement.

#### **508.008 (Virtual Poster)** Automated Recognition of Nouns and Verbs As a Tool for Assessing Language Ability and Response to Intervention in Children with ASD

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**Background:** Automated language recognition based on behavioral signal processing and machine learning may be a useful tool for assessing language and measuring response to intervention in children with ASD. Automated methods have the potential to increase objectivity and scalability, which can complement traditional human coding of language production.

**Objectives:** We aimed to: (1) examine the relation between automatized language measures and other standardized measures of language and to (2) examine the utility of automated language measures to gauge intervention response in children with ASD.

**Methods:** Fifty-two children with ASD (30 treatment, 22 active control) participated in larger randomized control trials of Naturalistic Developmental Behavioral Interventions. Using an automated speech processing pipeline, children's use of nouns and verbs were quantified from 12-minute, natural caregiver-child interactions from the Brief Observation of Social Communication Change (BOSCC) at intervention entry and 3 months after (Grzadzinski et al., 2016). We first examined correlations between automated language measures and age, communication domain age equivalents from the Vineland Adaptive Behavior Scales (VABS), and a standardized metric based on the ADOS overall level of language item (Mazurek et al., 2019). Then, we conducted Generalized Linear Mixed Models (GLMM), including time, treatment condition, and time\*treatment condition as fixed effects, to examine whether automated language measures of nouns and verbs improved over the course of intervention and whether improvement differed by the treatment groups; a zero-inflated model was used to assess verb change as more than half of the sample had 0 verbs at intervention-entry.

**Results:** At baseline, the total number of nouns was significantly correlated with age ( $r=.44$ ;  $p=.001$ ), ADOS language level ( $r=-.38$ ;  $p<.01$ ), and VABS Communication ( $r=.44$ ;  $p<.01$ ). Total number of verbs was significantly related to age ( $r=.34$ ;  $p<.05$ ), ADOS language level ( $r=-.32$ ;  $p<.05$ ), and VABS Communication ( $r=.60$ ;  $p<.001$ ). The GLMM predicting total nouns revealed a nonsignificant main effect of timepoint ( $p=.86$ ) but marginally significant interaction (timepoint\*condition), controlling for age and NVIQ ( $p=.08$ ). The model predicting total number of verbs revealed a significant main effect of timepoint ( $p<.05$ ) and interaction between condition and timepoint ( $p<.05$ ), controlling for age and NVIQ, indicating that the number of verbs increased during the 3-month intervention and that this improvement was larger for the treatment group than the control.

Conclusions: Automated language recognition may increase scalability and objectivity of assessment of simple child language features, like number of nouns and verbs produced, for children with ASD. In the future, automatized language measures may complement traditional measures of language ability as one of the markers of intervention response.

**508.009** (Virtual Poster) Children with ASD Describe Pictures Differently Than Matched Non-Autistic Peers

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Background: Semi-structured speech samples, such as descriptions of a single picture, may prove valuable for investigating word choice and prosodic variability in autistic children compared to typically developing (TD) controls, and could shed light on phenotypic heterogeneity within the autistic population. In this preliminary report from an on-going longitudinal study (data collection anticipated complete by May 2022), we used a telephony-based platform to collect picture descriptions from children with autism spectrum disorder (ASD) and TD peers, and compared various speech-based features by diagnostic group.

Objectives: Quantitatively characterize lexical and acoustic features of picture descriptions produced by autistic children and TD peers.

Methods: Sixteen participants with ASD (n=5; 2 females; mean age=8±0.7 years; mean IQ=113.9±16.9) or TD (n=11; 6 females; mean age=9.5±2 years; mean IQ=119.8±15.7), matched on age ( $p=0.12$ ), sex ratio ( $p=0.59$ ), and IQ ( $p=0.53$ ), described the same picture (ASD: 146.5±37.3 seconds with 287.2±80 words, TD: 172.2±31.4 seconds with 295.6±74 words; duration:  $p=0.2$ ; word count:  $p=0.84$ ) over a telephone platform. Recordings were automatically segmented using a speech activity detector and transcribed by trained annotators. Words were automatically tagged for part-of-speech (POS) categories using spaCy (Honnibal & Johnson, 2015). POS categories, fillers, partial words, repetitions, and “hm” were counted separately and converted to counts per 100 words. Content words were rated for word frequency (Brysbaert & New, 2009), concreteness (Brysbaert et al., 2014), ambiguity (Hoffman et al., 2013), age of acquisition (Brysbaert et al., 2018), and familiarity (Brysbaert et al., 2018). We extracted pitch, jitter, shimmer, and harmonic-to-noise ratio from participants' picture descriptions per 10 ms using openSMILE (Eyben et al., 2013). Pitch values in hertz were converted to semitones (st) using individuals' 10th percentile values to normalize physiological differences among children. We ran Wilcoxon tests to compare groups and given our small sample size, we reported  $p$ -values that were not yet corrected for multiple comparisons.

Results: Compared with TD children, children with ASD produced content words that are typically acquired later in life ( $p=0.029$ ; Fig.1A). ASD children produced more “hm”s ( $p=0.008$ ; Fig.1B), negations ( $p=0.002$ ; Fig.1C), and words longer than six characters ( $p=0.013$ ; Fig.1D), and fewer partial words ( $p=0.042$ ; Fig.1E) than TD children. ASD children's pitch changed more abruptly ( $p=0.038$ ; Fig.2A) than TD children's pitch, and they produced higher mean and interquartile ranges (IQR) of jitter, a measure of irregularities in pitch, than TD children (mean:  $p=0.027$ , Fig.2B; IQR:  $p=0.038$ , Fig.2C).

Conclusions: Autistic children described the same picture using more difficult words than TD peers, and produced prosody that changed more abruptly. These speech-language characteristics may contribute to the anecdotal impression that some children with ASD communicate like “little professors”, and could represent a quantifiable linguistic subgroup of children that could benefit from supports tailored to their specific profiles.

**508.010** (Virtual Poster) Cloze Probability in Visual and Linguistic Narrative Comprehension in Individuals with Autism

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Background: Language comprehension is facilitated by the prediction of upcoming words in a sentence or narrative. To measure the predictability of a word, cloze probabilities are utilized. Words that are “high-cloze” are more predictable given the context of the preceding sentence than words that are “low-cloze”. In studies using event-related potentials (ERPs), the amplitude of the N400 ERP component is reduced for high cloze words compared to low cloze words. Although this effect was first described in the psycholinguistic literature, recent evidence has shown that the N400 is modulated by cloze for both linguistic and visual stimuli: in typically developing (TD) individuals, the N400 amplitude is reduced for high-cloze words/events compared to low-cloze words/events, reflecting a facilitation in semantic processing. Individuals with autism have been shown to have difficulties with predicting incoming information. This may contribute to difficulties with narrative comprehension in these individuals; however, to date there have been no studies exploring this possibility in the context of narrative comprehension in either linguistic or visual domains.

Objectives: The objective of these studies was to compare predictive processes between individuals with autism and TD individuals during narrative comprehension in visual and linguistic modalities.

Methods: In separate studies, participants were shown either linguistic narratives or visual comic strips consisting of three conditions: low cloze words/comic panels, high cloze words/panels, and anomalous words/panels (in which the target word/panel was incongruent with the narrative context). ERP data was analyzed in response to the target word/panel. In the linguistic domain, 21 TD adults (mean age 26, range 18-51; 16 females, 5 males) and 21 adults on the autism spectrum (mean age 33, range 18-64; 8 females, 12 males, 1 trans male) were tested; in the visual domain, 22 TD adults (mean age 26, range 18-50; 17 females, 5 males) and 22 adults on the autism spectrum (mean age 30, range 17-53; 9 females, 11 males, 1 trans male) were tested. Across studies, groups were matched on verbal and non-verbal IQ and on receptive language abilities. Repeated-measure ANOVAs were run on average ERP amplitudes in 100 ms time windows from 200-600 ms.

Results: For TD individuals, low cloze stimuli elicited larger N400 amplitudes than high cloze stimuli from 400-600 ms in the linguistic domain and from 500-600 ms in the visual domain. This replicates prior research demonstrating cloze effects across modalities. However, individuals with autism showed slightly smaller and earlier N400 modulations by cloze: from 200-400 ms in the linguistic domain and 300-400 ms in the visual domain.

Conclusions: We conclude that predictive processing may use different neural mechanisms in individuals with autism compared to TD individuals. In both linguistic and visual modalities, TD individuals showed greater negative amplitudes for low cloze stimuli, meaning that unpredictable stimuli are harder to integrate. However, in both modalities individuals with autism showed reduced and earlier N400 effects, suggesting differences in predictive processing. This may point to a contributing factor underlying narrative comprehension difficulties across modalities in many individuals with autism.

**508.011** (Virtual Poster) Combining Speech and Language Features Improves Automated Autism Detection

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Background: Variability in expressive and receptive language, difficulty with pragmatic language, and prosodic difficulties are all features of Autism Spectrum Disorder (ASD). Quantifying language and voice characteristics is an important step for measuring outcomes for autistic people, yet clinical measurement is cumbersome and costly. Better outcome measures of communication skills are needed. Using Natural Language Processing (NLP) methods and a harmonic model of speech, we analyzed language transcripts and audio to generate automated measures of communication ability.

Objectives: 1. Examine the discriminant validity of automated speech and language measures; 2. combine speech and language features into one model to look for any increase in classification accuracy over the independent models; 3. conduct exploratory analyses of the clinical characteristics and activity metadata for all models.

Methods: 158 participants (88 ASD, 70 non-ASD) ages 7 to 17 were evaluated with the Autism Diagnostic Observation Schedule (ADOS-2), module 3. ADOS tasks were transcribed following modified SALT guidelines. Transcripts and audio of one ADOS task (Friends and Marriage Conversation) were automatically analyzed to generate seven Automated Language Measures (ALMs) and ten prosodic speech measures for each participant. The ALMs (Mean Length of Utterance in Morphemes (MLUM), Number of Different Word Roots (NDWR), um proportion, content maze proportion, unintelligible proportion, c-units per minute (CPM), and repetition proportion) and speech measures (Cepstrum, Delta Cepstrum, Delta Delta Cepstrum, Log Spectral Entropy, F0, Jitter, Shimmer, Harmonic-to-Noise Ratio (HNR), H1H2, and Root Mean Square (RMS)) were analyzed using Support Vector Machines (SVMs), a linear binary classifier. The models incorporated leave-one-participant-out cross validation to reduce overfitting.

Results: Both the ALM and speech models performed well at correctly identifying ASD individuals, achieving sensitivities of 0.7727 and 0.7955 respectively. The ALM model was much better than the speech model at correctly identifying non-ASD individuals (specificities of 0.8286 and 0.5714 respectively). Overall accuracy was 0.7975 and 0.6962, respectively. The combined model showed substantial improvement over both the individual models, with a sensitivity of 0.8864 and a specificity of 0.800, and overall accuracy of 0.8481.

The speech model caught ASD participants with higher CCC-2 scores and ADOS RRB scores, lower ADOS SA scores, who were older and had higher IQ, used more c-units, a larger number of total words, and had a longer activity time. The ALM model caught ASD participants with lower CCC-2 scores, higher ADOS SA and RRB scores, who were younger and had lower IQ, used fewer c-units, fewer total words, and had a shorter activity time.

Conclusions: We showed that a defined set of language- and acoustic-based outcome measures have the independent discriminant validity to correctly classify individuals with and without ASD. The automated language model caught younger individuals with shorter language samples and an overall lower language ability. The automated speech model caught older individuals with overall higher language ability. The combined model shows an increase in both accuracy and sensitivity over the individual models, indicating the value of evaluating communication ability more broadly.

**508.012** (Virtual Poster) Comparing in Developmental Profile of Minimally Verbal Children

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Background: Child development researchers agree that cultural differences influence child development (Halpin et al., 2019). However, relatively little is known about the influences of cultural environments on children with Autism Spectrum Disorders and minimal verbal abilities (MV-ASD; Maltman et al., 2021). Around 30% of individuals with ASD fail to develop verbal communication skills and use 30 or less functional words for interactions throughout their lives (Barokova et al., 2021). Comparing developmental abilities of children with MV-ASD from diverse cultural backgrounds might provide the research community preliminary evidence of potential benefits of certain cultural practices for facilitating communication development in children with MV-ASD. The current study compares children with MV-ASD from India, a Low- and Middle-Income Country (LMIC) and the U.S., a High-Income Country.

Objectives: Comparing and identify differences in developmental profiles of children with MV-ASD from India (n = 35) and the U.S. (n = 35).

Methods: We compared two groups of children with MV-ASD on their developmental profiles as measured by the Vineland Adaptive Behavioral Scale, 3<sup>rd</sup> Edition (Vindland-3; Sparrow, Cicchetti, & Balla, 2005) using the Mann-Whitney U test. Specifically, we compared the groups on

Vineland-3 scores associated with communication: receptive, expressive, written; daily living skills: personal, domestic, community; socialization: interpersonal relationship, play and leisure, and coping mechanism.

**Results:** *Demographic distribution:* The two groups did not significantly differ on children's age and gender, number of siblings, number of family members, age at diagnosis, type of intervention available, weekly duration of the intervention services available, parent education, parents' marital status, and parents' general health conditions. The groups significantly differed on parent employment and child education.

*Developmental profiles:* As anticipated, the two groups of children did not differ on their expressive language abilities but differed on their receptive language  $U(N=70) = 443.00, z = -1.992, p < .046$ , interpersonal relationship  $U(N=70) = 424.50, z = -2.215, p < .027$ , play and leisure  $U(N=70) = 355.00, z = -3.033, p < .002$ , and coping mechanism  $U(N=70) = 395.00, z = -2.566, p < .010$  scores on Vineland-3. Children from India consistently scored higher on receptive ( $M = 35.91, SD 11.518$ ), intrapersonal ( $M = 24.14, SD 6.132$ ), play ( $M = 18, SD 4.814$ ), and coping skills ( $M = 14.74, SD 5.153$ ) than children in the U.S. that scores lower scores on average on their receptive ( $M = 29.97, SD 13.942$ ), intrapersonal ( $M = 21.06, SD 7.00$ ), play ( $M = 15.63, SD 9.714$ ), and coping skills ( $M = 12.94, SD 7.296$ ).

**Conclusions:** Despite limited educational opportunities, children from India scored higher than children in the U.S. on their receptive and social skills. Future studies should examine differences in social-cultural environments that place children in India at an advantage over children within the U.S. for developing adaptive behavioral abilities.

#### **508.013** (Virtual Poster) Differentiating Among Low, Medium, and High "Um" Users with ASD and ADHD

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**Background:** Many studies have highlighted challenges with pragmatic language among school-aged children with autism spectrum disorder (ASD) and Attention Deficit/Hyperactivity Disorder (ADHD). For example, several recent studies report that children with ASD/ADHD differ from their TD peers in production of filled pauses (FPs) such as "um", which has a listener-oriented function, but not "uh", which serves a self-regulatory function (Clark & Fox Tree, 2002; Irvine et al., 2016; Gorman et al., 2016). However, not all investigations have reported this difference (Boo et al., 2021), and few have examined in depth what contributes to children with ASD producing fewer "ums".

**Objectives:** To investigate the production of FPs ("uh"/"um") among school-aged children with ASD and/or ADHD, by considering the roles of language and diagnostic severity as predictors.

**Methods:** Participants included 52 verbally fluent children with ASD ( $Mage = 11.8, SD = 2.3$ ), 24 children with ADHD ( $Mage = 12.0, SD = 2.3$ ), and 22 TD children ( $Mage = 12.5, SD = 2.3$ ). Children were within their age-appropriate range of non-verbal IQ. Language samples were collected during a virtual reality paradigm where children viewed a classroom while answering questions from an experimenter in a conversational format. Children's responses were recorded and transcribed. Transcribers specifically differentiated between "uh" and "um" tokens. Proportions of "uh" and "um" tokens per utterance were computed.

**Results:** Overall, children from all three groups produced comparable rates of "uh" tokens per utterance,  $p = 0.586$ . However, significant group differences emerged in "um" tokens per utterance,  $F(2, 97) = 3.509, p = 0.034, \eta^2 = 0.069$ , with the ASD group ( $M = 0.28, SD = 0.23$ ) producing significantly fewer "um" tokens per utterance than the TD group ( $M = 0.45, SD = 0.38$ ),  $p = 0.026$ . Post hoc analyses were conducted to determine how many children per group produced a low ( $M = 0 - 0.142$ ), medium ( $M = 0.143 - 0.417$ ), and high ( $M > 0.418$ ) proportion of "ums". These categories were created by a 3-way roughly equal split of the proportions of 'um' usage based on the TD group. The chi-square analyses revealed that the distribution of low, high, and medium "um" users significantly differed by group,  $\chi^2(4) = 10.033, p = 0.040$ , with the ASD and ADHD groups having significantly more low "um" users than the TD group (Figure 1). Low, medium, and high "um" users across the three groups did not significantly differ in Conners-3 or ADOS scores; however, they significantly differed in verbal IQ (VIQ) scores,  $F(2, 97) = 7.617, p < 0.001, \eta^2 = 0.138$ , with the low and medium "um" users having significantly lower VIQ scores than high "um" users,  $ps < 0.05$ .

**Conclusions:** Akin to previous studies, school-aged children with ASD and ADHD produced significantly fewer "um" tokens during conversation. However, our findings suggest that the lack of production of "um" is not necessarily associated with autistic characteristics; instead, it is associated with verbal abilities as measured by VIQ. This is also supported by the lower "um" use by the ADHD group.

#### **508.014** (Virtual Poster) Downward Entailment in Mandarin-Speaking High-Functioning Children with Autism Spectrum Disorders

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**Background:** Children with autism spectrum disorders (ASD) have been documented to have profound semantic impairments compared to their relative syntactic strengths (Boucher 2012; Naigles & Taks 2017). Downward entailment, i.e., licensing the inference from sets to subsets, as a core semantic property in human language could be used to uncover children with ASD's semantic knowledge. This study is designed to see whether children with ASD have impairments in the core semantic property of downward entailment.

**Objectives:** This study investigates the semantic properties of downward entailment in Mandarin-speaking high-functioning children with ASD (HF-ASD) through comparison with typically developing (TD) children. Experiment 1 assessed their knowledge of *wh*-word *shenme* 'what' in two



different linguistic contexts: the predicate phrase of *meiyouren* 'nobody' versus *meigeren* 'everyone', as in sample sentence (1) and (2). Sample (1) means that no sheep bought any vegetable. Sample (2) means that what kind of vegetable did every sheep buy? Experiment 2 examined children's interpretation of the disjunction word *huozhe* in the predicate phrases of *meiyouren* versus *meigeren*, as in sample sentences (3) and (4). Sample (3) means that (a) no dwarf bought a mirror **and** (b) no dwarf bought a chair. Sample (4) means that every dwarf bought a vase or a mirror. We tested whether children with HF-ASD possessed core semantic knowledge of downward entailment as their TD peers.

**Methods:** Using a Computer-based Question-Statement Task (Su et al. 2014) and a Computer-based Truth-Value Judgement Task (Su 2015), we tested 27 3-7-year-old children with HF-ASD (mean age = 5;7) and matched 25 3-6-year-old TD children (mean age = 5;1). Specifically, we tested their knowledge of *wh*-word *shenme* in experiment 1 and the disjunction word *huozhe* in experiment 2, respectively, in both downward-entailing and non-downward entailing contexts.

**Results:** When *shenme* was in the predicate phrase of *meiyouren*, children with HF-ASD rejected the test sentences 57.4% of the time whereas TD children rejected the test sentences 86% of the time ( $\chi^2=9.477$ ,  $df=4$ ,  $p=.05$ ). However, when it was in the predicate phrase of *meigeren*, both the TD group and the ASD group accepted the test sentences 92%, 95.4% of the time, respectively ( $\chi^2=1.134$ ,  $df=3$ ,  $p=.769$ ). When *huozhe* appeared in the predicate phrase of *meiyouren*, children with HF-ASD rejected the test sentences 78.7% of the time whereas TD children rejected the test sentences 95% of the time ( $\chi^2=9.455$ ,  $df=4$ ,  $p=.051$ ). However, when it was in the predicate phrase of *meigeren*, both the ASD group and the TD group accepted test sentences 92%, 94.4% of the time, respectively ( $\chi^2=1.615$ ,  $df=3$ ,  $p=.656$ ) (Figure 1).

**Conclusions:** Taken together, 3-7-year-old Mandarin-speaking children with HF-ASD performed similarly to matched TD controls in demonstrating semantic knowledge of non-downward entailing structures but they possibly had delayed knowledge of downward entailing structures. Future studies on older children with HF-ASD's knowledge of downward entailment are needed to see whether or not there is indeed a developmental pattern in their semantics of downward entailment.

#### **508.015 (Virtual Poster)** Examining Language and Communication in Autistic People with Complex Needs – a Systematic Review of Procedural and Measurement Issues and Practice

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#### **Background:**

Approximately 50% of autistic individuals have intellectual disabilities and 30% remain minimally-verbal throughout life. This group is grossly under-represented in research due to methodological challenges and inconsistencies in definitions of intellectual disability and minimal verbal ability. We therefore know least about language and communication functioning in those who demonstrate the most significant difficulties in these areas.

#### **Objectives:**

To review the literature on language and communication function in autistic individuals with complex needs and answer the following questions to derive recommendations for best practice in this area of research:

- 1) What strategies are used for engaging, recruiting and retaining autistic participants with limited speech and/or intellectual disability in research?
- 2) What tools have been used with this population to capture language and communication skills?
- 3) How are minimal language and intellectual disability defined and operationalised?

#### **Methods:**

Systematic searches were conducted in March/April 2021 using a comprehensive list of search terms to describe participants who would come under an umbrella of minimal verbal ability and/or intellectual disability. Full details of the search strategy and review methodology can be found on the registered review protocol (PROSPERO 2021 CRD42021236135).

#### **Results:**

Of 5914 studies initially identified, 195 met all inclusion criteria. Most research has focussed either on interventions to develop expressive language or to characterise language impairment in relation to other features of autism. There remains limited research on the use of AAC. Research Question 1: Reporting on strategies for recruiting, retaining and engaging participants was generally very limited and factors that may contribute to participant exclusions are currently being identified through data extraction. Research Question 2: 49 different language/communication measurement tools were used across studies, most often focussing on expressive language and/or using subsections of broader cognitive tools. The properties and quality of all tools used are now being evaluated using the COSMIN (COnsensus-based Standards for the selection of health Measurement INstruments) framework to develop recommendations concerning their use. Research Question 3: Definitions and constructs of minimal language and intellectual disability have shifted over time, with a clearer distinction between minimal spoken language as opposed to general language delay or impairment emerging only over the past decade. Research in this area has grown significantly over the same period, with definitions and preferred measurement tools becoming more homogenised, largely in response to seminal papers by Bal et al., 2016; Kasari et al., 2013; Tager-Flusberg & Kasari, 2013.

## Conclusions:

Minimally-verbal autistic people remain underrepresented in research, although progress in this area has accelerated over the last decade. Current publications provide little information about the strategies used to effectively engage and retain participants in research. The use of multiple measurement tools and inconsistencies in definitions of minimal verbal ability and intellectual disability makes it difficult to compare findings across studies. Based on the findings, recommendations will be formulated on how to build on recent progress to further accelerate our understanding of language and communication skills in those with the most significant difficulties in these areas.

## **508.016** (Virtual Poster) Examining the Influence of Bilingualism on the Narrative, Social and Pragmatic Abilities of School-Aged Children on the Autism Spectrum

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## Background:

Narratives refer to speech acts conveying information about series of related events that occur in a specific chronological order. They generally include an objective and a set of actions to reach this objective. Narrative skills are important language abilities and serve a vital communicative function. They may also foster psychological and emotional identity, and are linked to academic achievement. In children on the autism spectrum (AS) challenges with narratives, particularly macrostructure (story cohesion and coherence), are frequently reported, and may be linked to social skills.

Children on the AS can become proficient bilinguals and for many, bilingualism is critical to their wellbeing. They may also benefit from stronger social and pragmatic skills than their monolingual autistic peers. However, little is known of narrative skills in bilingual children on the AS, or of the potential beneficial effects of bilingualism on those skills.

## Objectives:

Within this context, our study examined the narrative (i.e., microstructure: structural language, and macrostructure), social and pragmatic skills of bilingual and monolingual children on the AS, and whether narrative skills were influenced by social and pragmatic abilities. Based on the relation between social, pragmatic, and narrative skills on the one hand, and bilingualism and social skills on the other, we predicted that bilinguals would have (a) stronger social and pragmatic skills and (b) stronger macrostructure skills. We also predicted an association between these variables.

## Methods:

The narrative, social, and pragmatic skills of 54 bilinguals and 80 monolinguals on the AS who participated in the *Pathways in Autism* project (mean age: 10.8 months; mean NVIQs: 98 and 93 respectively) were examined using the *Expression, Reception and Recall of Narrative Instrument*, the *Vineland Adaptive Behavior Scales, Second Edition-Interpersonal Domain*, and the *Comprehensive Assessment of Spoken Language* respectively. Parent questionnaires were used to determine language group assignment and estimate children's language exposure(s). For bilinguals, exposure to the language of testing ranged between 42%-94%.

Performances of bilingual and monolingual children on measures of narrative, social, and pragmatic skills were compared using Bayesian t-tests. Regression analyses were completed to examine relations between variables. Exploratory data will be presented from a transcript analysis study examining other aspects of narratives.

## Results:

There were no significant group differences for measures of microstructure or social skills. However, we found a significant negative relation between estimated exposure to the language of testing and pragmatic abilities, and a negative trend between language exposure and macrostructure, suggesting that children who had similar amounts of exposure to both languages had stronger pragmatic and macrostructure skills. We also found a relation between story-recall and pragmatic skills, which was not influenced by language group status.

## Conclusions:

Our findings suggest that some bilinguals on the AS may experience stronger pragmatic and narrative skills, but these may be mediated by the amount of dual-language exposure. Our findings may inform clinicians' expectations when assessing and working with bilingual children. They also underscore the influence that different bilingual experiences have on certain abilities, and the importance of considering such differences in both clinical and research settings.

**508.017 (Virtual Poster)** Identifying Profiles of Grammatical Production in Autistic Children Via Cluster Analysis

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**Background:**

Vast heterogeneity of grammatical abilities exists among autistic children (Kjelgaard & Tager-Flusberg, 2001; Roberts et al., 2004; Wittke et al., 2017). Previous research has demonstrated individual variability on broader measures (e.g., standardized tests, mean length of utterance [MLU]); however, more detailed analyses are needed to investigate why some children habitually produce short/telegraphic utterances. Categorical recurrence quantification analysis (RQA) offers a novel approach to understand the nature of these production difficulties by quantifying the structure within categories. Previous applications to language often quantified grammatical alignment between two speakers (Dale & Spivey, 2005, 2006), but we evaluate changes within individual children at the level of grammatical form classes.

**Objectives:**

We deploy RQA measures plus an iterative clustering algorithm to determine whether we can detect underlying structures that might differentiate amongst children with ASD.

**Methods:**

The present study uses a subset of the Autism Phenome Project dataset ( $n = 31$ ,  $M_{age} = 72.71$  months, 10 females,  $M_{NVIQ} = 95.32$ ,  $SD = 19.39$ ;  $M_{TOTALADOS} = 12.19$ ,  $SD = 4.86$ ). Language sample transcriptions were parsed for MLU and percent ungrammatical utterances (%UU) and annotated for the form classes within noun and verb phrases (see Figure 1). We performed RQA on the form class data. RQA measures instances of pairs of repeated units over time by creating recurrence plots (RP), which are subsequently quantified through recurrence rate (RR) and determinism (DET). RR calculates the percentage of the RP containing filled-in points; high RR indicates frequent reuse of form class units. DET measures the structure of repeated sequences, which are visible on the RP as larger box structures rather than single dots. High DET indicates that children repeat form class combinations. Analyses differentiated between noun phrase (NP), verb phrase (VP), and all other form classes; we evaluated differences between clusters by RQA measures.

**Results:**

See Figure 1 for a visualization of the clusters [ $k = 2$ ] and Figure 2 for exemplar RPs. Analyses reveal %UU does not differentiate between clusters [ $p = .75$ ], at least not with this sample. Cluster 1 repeats NP and VP units more often [ $M_{NPRR} = 6.22$ ;  $t(48) = 3.33$ ,  $p < .001$ ;  $M_{VPRR} = 2.59$ ;  $t(48) = 2.35$ ,  $p < .05$ ] than cluster 2 [ $M_{NPRR} = 4.85$ ;  $M_{VPRR} = 2.06$ ]. Cluster 2 repeats many more NP and VP unit combinations [ $M_{NPDET} = 26.57$ ;  $t(48) = -4.01$ ,  $p < .001$ ;  $M_{VPDET} = 23.90$ ;  $t(48) = -7.42$ ,  $p < .001$ ] and possesses larger MLUs [ $M_{MLU} = 5.5$ ;  $t(48) = -6.87$ ,  $p < .001$ ] than cluster 1 [ $M_{NPDET} = 19.18$ ;  $M_{VPDET} = 14.62$ ;  $M_{MLU} = 3.40$ ]. Cluster analyses suggest that children with higher DET also have larger MLUs, signaling that larger DET indeed reflects greater sophistication in grammatical constructions (i.e., better production).

**Conclusions:**

We use cluster analyses on RR and DET for NP and VP form classes to quantitatively identify different kinds of productivity among children with ASD. Findings underscore the value of using RQA metrics as more fine-grained measures of grammatical production for extricating variability through the use of multifaceted data.

**508.018 (Virtual Poster)** Initiation Strategies of Bilingual and Monolingual Children with Autism Spectrum Disorders in a Verbal Fluency Task

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**Background:** Verbal fluency tasks provide key information regarding individuals' lexico-semantic and executive functioning skills (Shao et al., 2014). Prior research has found that monolingual children and adults tend to outperform their bilingual peers on this task. Different hypotheses have been postulated to explain bilinguals' lower performance (e.g., reduced vocabulary hypothesis, Bialystok et al., 2008). Of interest, a study examining verbal fluency in school-age children with Autism Spectrum Disorders (ASD) found that bilingual children with ASD produced more words than their monolingual peers with ASD, when participants were matched on vocabulary skills (Gonzalez-Barrero & Nadig, 2017). However, there were no significant differences between groups in two cognitive strategies previously examined in individuals with ASD (e.g., Begeer et al., 2013): switching (i.e., the number of switches between categories, such as switching from farm animals to jungle animals) or clustering (i.e., the number of words produced within a specific cluster). Thus, it remains to be examined what specific cognitive strategy yields the increased performance of bilingual children with ASD compared to their monolingual peers. Given the lack of studies including bilingual children with ASD, more research is needed to better understand how these children approach verbal fluency tasks which tap into key semantic and executive functioning skills; two common areas of difficulty for individuals on the autism spectrum (Craig et al., 2016).

**Objectives:** The current study aimed to examine the language skills and initiation abilities of bilingual and monolingual children with ASD on a verbal fluency task going beyond the typical measures analyzed in this task, to better characterize the linguistic and cognitive profile of bilingual children with ASD.

**Methods:** Twenty school-aged children with ASD (10 monolinguals, 10 bilinguals) participated in the study. Children were given 1 minute to name all the elements they knew for a given category (e.g., animals). Items produced in the bilingual children's dominant language were compared to those produced by monolingual children in their single language. Participants were closely matched on key variables that influence verbal fluency performance (i.e., age, gender, vocabulary, socio-economic status, nonverbal-IQ and ASD symptomatology). A time-bin analysis, where the one-minute task was broken up into three time bins of 20 seconds, was conducted to compare the performance of the bilingual children with ASD to that of their monolingual peers with ASD.

**Results:** Preliminary results showed that the bilingual group produced significantly more words (1.4 words) than the monolingual group during the first 20 seconds of the task ( $p = .04$ ). No statistically significant differences between groups were found on the other time bins analyzed.

**Conclusions:** Findings from this study are in line with prior evidence suggesting that bilingualism is not detrimental for the language or cognitive skills of children with ASD (Drysdale et al., 2015), and provide novel evidence concerning the linguistic profile and initiation abilities of children with ASD growing up in bilingual contexts.

**508.019 (Virtual Poster)** Mental State Verbs Expressed By Children on the Autism Spectrum: A Syntactic Perspective  
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**Background:**

Verbs representing mental states are syntactically complex because they may occur with sentential complements, which are phrases that may independently function as grammatical sentences. For example, "Jack thinks his father is at home" contains the sentential complement "his father is at home." Research indicates that typically developing children use sentential complements at age four, frequently with mental state verbs (MSVs). For children on the autism spectrum, evidence indicates delays with mental state language but relative strengths in language form; recent evidence favors sentential complement training to support sentential complement use and false-belief task performance. This study investigates the relationship between MSV and sentential complement production by children on the autism spectrum. This novel approach capitalizes on implicit indicators of mental state knowledge; that is, elevated use of sentential complements for MSVs specifically provides insights into a child's understanding of the uniqueness of mental state verbs.

**Objectives:**

The study aims to explore (1) how sentential complement usage aligns with overall language skills and (2) the rate of sentential complement use with and without MSVs. In addressing aim #1, we quantify the relationship between sentential complement production and widely-used language indicators (i.e., mean length of utterance in morphemes [MLUm] and type-token ratio [TTR]). In addressing aim #2, we compare the rate of sentential complement occurrence with MSVs versus with non-MSVs. We hypothesize that (1) sentential complement use will be positively associated with MLUm and negatively associated with TTR, and (2) sentential complements will occur more frequently with MSVs than with non-MSVs.

**Methods:**

Language samples from 9-year-olds on the autism spectrum ( $N = 10$ , 10 male) were transcribed from videos of either Module 2 ("phrase speech") or Module 3 ("fluent speech") of the Autism Diagnostic Observation Schedule (ADOS) or ADOS-2, from an existing dataset (Lord et al., 2006). Utterances were coded for morphosyntax and variables including sentential complements and MSVs. Within-subjects nonparametric analyses were used, given the sample size.

**Results:**

Wide individual variability in MSV and sentential complement expression was evident. Non-parametric correlations demonstrated that sentential complement frequency was positively correlated with MLUm ( $\rho = .936, p < .01$ ) and negatively correlated with TTR ( $\rho = -.809, p < .01$ ). Sentential complements occurred with MSVs more than with non-MSVs (Related-Samples Wilcoxon Signed Ranks Test,  $N = 9, z = -2.100, p = .036$ , 2-tailed).

**Conclusions:**

As expected, sentential complement usage was associated with overall language skills for each subject. Moreover, *differential* sentential complement usage was evident; as hypothesized, participants produced sentential complements at a higher rate with MSVs than non-MSVs. This finding is similar to typically developing samples and indicates a relative strength in sentential complement production among participants. These results suggesting that children on the autism spectrum have an understanding of the syntactic "uniqueness" of MSVs may lead to evidence-based interventions capitalizing on this strength. While further research is needed to address sample size and coding limitations, this investigation introduces a new possible avenue to measure mental state knowledge in autism.

**508.020 (Virtual Poster)** Metaphors Interpretation Using Comparison and Structure Mapping Processes Among Adolescents with ASD and Theirs Siblings  
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**Background:** Metaphors incorporate language abilities that include symbolic understanding created through processes of structural mapping used to form relations such as categories, analogies, and other knowledge-based structures that encompass properties that are related in complex manners. Structure mapping is a core cognitive process that enables creation of analogies and metaphors, during which different structures of knowledge are aligned, and compared, relevant relations are identified and transferred to form new coherent language structures. Metaphors can be interpreted as attributes based on perceptual characteristics, or using relations based on relational structures that encompass the components of the metaphor. The ability to use and understand metaphors increases, with reciprocal interactions between age language and cognition. Analogies and metaphors contribute to the acquisition of abstract concepts by paralleling between relational structures. Research investigating metaphors among individuals with ASD demonstrate mixed results in development, use, and interpretation of metaphors. For example, in one study comparing children with and without ASD, structural mapping and the development of understanding metaphors were significantly different.

**Objectives:** The purpose of this study was to investigate interpretation of three types of metaphors among adolescents with and without ASD, and siblings of adolescents with ASD: (1) Metaphors as attributes, whereas the base and the target mostly share perceptual qualities and attributes (e.g., “Jelly beans are like balloons”); (2) Relational metaphors that are mostly relational in nature (e.g., “A hat is like a roof”); and (3) double metaphors, in which the base and the target share many attributes and relational qualities (e.g., “a kite is like a bird”).

**Methods:** Fifty adolescences ages 14-18 participated in the study: 20 adolescences with ASD, 10 adolescences that have siblings with ASD, and 20 adolescences with TD. All participants completed a structural mapping assignment aimed to identify perceptual and conceptual targets in uncertainty and certainty conditions; and a task in which they were asked to interpret a set of 24 metaphors (8 of each type) that were presented both in a visual and auditory manner with a request to provide an interpretation of the metaphor and to rank the adequacy of the statement as a metaphor.

**Results:** All participants completed the assignments. Each of the interpretations and the rankings were coded and evaluated. Preliminary results reveal no significant differences between the three groups in interpretations and ranking of metaphors. Preliminary analyses of specific interpretations and ranking provided by the participants demonstrate unique styles in interpretations and in ranking and in the explanations provided among the group of adolescents with ASD. In the structural mapping task, participants in the three groups selected perceptual targets in uncertainty condition but differed in the certainty condition.

**Conclusions:** Similarly to previous studies, groups differed in the certainty but not in the uncertainty condition in the structural mapping task. There were some similarities in the interpretations among adolescents across the three groups which could be related to the levels of knowledge in the understanding of metaphors. Examples of differences and unique interpretations will be discussed, and examples will be provided.

**508.021 (Virtual Poster)** Patterns of Finger-Tracking in Italian Early Readers with Autism Spectrum Disorder

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**Background:** Of late, the synergistic interaction of eye and hand movements in the exploration of a visual scene displayed on a computer touchscreen was shown to provide a congruent signature of the “attention maps” of subjects with autism spectrum disorders (ASD). A familiar context where this visual and tactile interaction is exploited is when children use the finger of their dominant hand to point the letters of written words as they are reading, particularly at early stages of their literacy development. In the present work, a dedicated app running on a common tablet is used to capture and analyse the finger-tracking behaviour of children with ASD while they are reading few episodes of a connected text on the tablet touchscreen. The reader’s voice is also recorded through the tablet built-in microphone. The sliding movements of the finger across the tablet touchscreen are discretized into a series of densely distributed “touch events”, which are then mapped onto the text lines in much the same way eye fixations are projected onto a sequence of words using an eye-tracker. Reading texts are linguistically annotated, to control for levels of reading difficulty, and finger-tracking times are associated with linguistic glosses.

**Objectives:** Investigate patterns of finger-tracking as a potential non biological marker for identification of children with ASD

**Methods:** A preliminary analysis is offered of evidence of the finger-tracking behaviour of 20 Italian children with high functioning ASD, aged 7-11 years, while they are engaged in reading. A grade-matched control group of children with typical development was included. Patterns of finger-tracking are assessed in connection with three complementary aspects of reading behaviour: (1) word recognition, (2) pace of reading of multi-word intonation units, and (3) text comprehension, controlled by asking children a few multiple-choice questions on text content after each reading session.

**Results:** Considerable variation in levels of reading ability was observed in the ASD sample, with a few children showing clear evidence of impaired reading comprehension. However, fluent readers with ASD exhibit the same correlation between accurate decoding (assessed by measuring per-word reading speed) and high levels of reading comprehension found in controls. Likewise, decoding rates were found to significantly increase with increasing grade levels, following the typical developmental pattern observed in controls. On a less local level of linguistic analysis, the reading pace of ASD readers fails to be modulated according to major syntactic structures, punctuation marks and direct speech turns, an effect concomitant with a flat prosodic intonation of oral reading.

**Conclusions:** Preliminary findings confirm the heterogeneous nature of reading skills in children with ASD, showing that the use of a tablet screen as a tactile interface for visual perception analysis can offer a robust experimental protocol for large-scale, multimodal collection of naturalistic data for extensive assessment of readers with ASD.

**508.022 (Virtual Poster)** Scalar and Non-Scalar Implicatures in Preschool Mandarin-Speaking Children with Autism Spectrum Disorder

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**Background:** Conversational implicatures include two kinds of implicatures: (1) scalar implicatures (SIs) based on lexical scales (e.g., the quantifier ‘some’ implies ‘not all’, and the number ‘three’ implies ‘not four’) and (2) non-scalar implicatures (non-SIs) based on the specific contexts (e.g., saying ‘The cat got an apple’ implies ‘not an apple and a pear’) (Horn, 1972). The consistent success in SIs was hardly seen in preschool typically developing (TD) children and those with ASD, whereas non-SIs were only observed in TD children (Mazzaggio et al., 2021; Zhao et al., 2021). However, no study has systematically investigated these two types of implicatures in preschool Mandarin-speaking TD children and children with ASD.

**Objectives:** We tested the interpretation of SIs (including quantifiers and numbers) and non-SIs by Mandarin-speaking preschool TD children and children with ASD, to examine their pragmatic abilities of computing implicatures as well as the link with Theory of Mind (ToM), receptive vocabulary and non-verbal IQ.

**Methods:** We recruited 20 TD children and 13 high-functioning children with ASD, matched on age, but not on scores of ToM, the Chinese Peabody Picture Vocabulary Test (C-PPVT), and the Chinese Raven’s Matrices Progressive Test (CRT) (Table 1). Using the computer-based truth value judgment task (Su & Su, 2015), the experimenter presented the stories to children through Microsoft PowerPoint, and then asked children to judge the truth values of prerecorded test sentences describing the outcome of the stories.

**Results:** A Bayesian linear mixed effects model suggested that ASD group did worse than TD group in computing implicatures. TD group’s total accuracy of both SIs,  $V = 8.5$ ,  $p < 0.001$ , and non-SIs was significantly higher than that of the ASD group,  $V = 0$ ,  $p < 0.001$ . For SI subtests, both groups got significantly higher accuracy in number than quantifier, TD group:  $V = 2$ ,  $p < 0.05$ ; ASD group:  $V = 6.5$ ,  $p < 0.01$ . TD group also performed better than ASD group in both number,  $V = 80$ ,  $p < 0.01$ , and quantifier,  $V = 13.5$ ,  $p < 0.001$ . However, although TD group got significantly higher accuracy in non-SIs than SIs,  $V = 26$ ,  $p < 0.05$ , ASD group showed a reverse pattern,  $V = 5$ ,  $p < 0.01$  (Figure 1). The other two models of ASD revealed a significant effect of TOM in the accuracy of two implicature tasks,  $SE = 0.09$ ,  $p < 0.05$ , and two SI sub-tests,  $SE = 0.15$ ,  $p < 0.001$ , a significant interaction of task and ToM,  $SE = 0.11$ ,  $p < 0.001$ , and a significant interaction of SI sub-test and ToM,  $SE = 0.19$ ,  $p < 0.05$ . By contrast, TD group did not reveal any significant effect or interaction with ToM. No significant effect or interaction with C-PPVT or C-Raven scores was found.

**Conclusions:** Preschool Mandarin-speaking TD children showed pragmatic awareness of both SIs and non-SIs, but the ASD children exhibited difficulty, especially with the non-SIs and the SIs of quantifiers. The pragmatic impairment in ASD may be related to their ToM deficits.

#### **508.023 (Virtual Poster) Sex Differences in Pronoun and Maze Usage in the Language of Children with Autism Spectrum Disorder**

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**Background:** Research on sex differences in the language of children with Autism Spectrum Disorder (ASD) has been limited. Song et al. (2020) found that “we” pronoun (1<sup>st</sup> person plural pronouns; e.g., “we”, “ours”) and “they” pronoun (3<sup>rd</sup> person plural pronouns; e.g., “they”, “their”) usage differs amongst ASD and TD girls and boys. In addition, studies have shown that maze (i.e. intervals of disfluent speech) usage rates distinguish ASD and TD children. However, whether these differences are influenced by sex has not been investigated.

**Objectives:** To compare usage rates of (1) “we” and “they” pronouns, and (2) mazes in ASD and TD girls and boys.

**Methods:** A total of 140 children, 98 ASD (17 girls) and 42 TD (22 girls), aged 7 to 15 years old, were included. All had full-scale IQ  $\geq 70$ . Analyses were performed on transcribed Autism Diagnostic Observation Schedule (ADOS), Module 3 sessions. Transcription was completed according to modified Systematic Analysis of Language Transcripts (SALT) guidelines by trained transcribers who were blind to the participants’ diagnostic status and intellectual abilities. Four ADOS conversation tasks were analyzed: Emotions; Social Difficulties and Annoyance; Friends, Relationships, and Marriage; Loneliness.

We calculated the total number of times each participant said a “we” pronoun, “they” pronoun, and maze. We fit three logistic regression models (Poisson distribution) with total “we”, “they”, or maze as the response variables and the total number of overall tokens as the offset. Each model included age, full-scale IQ, diagnosis, sex, and a diagnosis and sex interaction term. Pairwise Estimated Marginal Means (EMM) were compared post-hoc.

**Results:** Diagnosis and sex significantly predicted “we” frequency (ASD < TD,  $p < .001$ ; male < female,  $p < .001$ ). There was no significant effect of the diagnosis and sex interaction (see Figure 1). Post-hoc comparisons revealed that ASD girls significantly differed in “we” frequency from TD girls and ASD boys but not from TD boys (TD girls > ASD girls = TD boys > ASD boys,  $p < .0001$ ).

Diagnosis and sex also significantly predicted “they” frequency (ASD < TD,  $p < .05$ ; male < female,  $p < .001$ ). The diagnosis and sex interaction did not have a significant effect (see Figure 1). Post-hoc analyses revealed that ASD boys differed in “they” frequency from ASD girls and TD girls (ASD girls > ASD boys,  $p = .001$ ; TD girls > ASD boys,  $p < .0001$ ).

Lastly, diagnosis and sex significantly predicted maze frequency (ASD > TD,  $p < .001$ ; male < female,  $p < .001$ ). There was a significant effect of the diagnosis and sex interaction ( $p < .001$ ; see Figure 2). Post-hoc analyses revealed that maze frequency significantly differed amongst all subgroups except for TD girls and boys (ASD girls > ASD boys > TD boys = TD girls,  $p < .0001$ ).

Conclusions: Preliminary analyses showed that sex significantly effected “we”, “they”, and maze frequency of ASD and TD participants. Because analyses did not omit instances where “they” pronouns were referring to inanimate objects (e.g., “those shoes”), these results should be interpreted with caution.

**508.024** (Virtual Poster) Similarities and Differences in the Generation of a Common Ground in ASD and TD

**E. Karin<sup>1</sup>**, R. Geva<sup>2</sup> and N. B. Bauminger-Zviely<sup>3</sup>, (1)School of Education, Bar Ilan University Israel, Ramat - Gan, Israel, (2)Psychology Department, Bar-Ilan University, Ramat-Gan, Israel, (3)School of Education, Bar-Ilan University, Ramat Gan, Israel

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**Background:**

Common ground (CG) is generated when two interlocutors build shared knowledge and concepts during a reciprocal conversation (Clark, & Wilkes Gibbs, 1986). The understanding of CG's development and the factors that contribute to its generation process in Typically developing (TD) individuals is limited, and even more so in individuals that have core pragmatic deficit in social discourse (Bauminger-Zviely, 2013) like those on the autism spectrum(ASD). Understanding common ground more fully may shed light upon ASD's discourse difficulties and their influence on social interaction.

**Objectives:**

To examine a developmental curve of CG by group (CAASD/TD (via the individual growth curve model (Hoffman, 2015). CG was estimated by individual's intercept and slope variables including CG-time duration and CG-number of words. We also tested the contribution of verbal (IQ, language quality) and cognitive (executive function, theory of mind) mechanisms to the generation of CG.

**Methods:**

Study included 148 children and adolescents (6-16-years, 30 girls and 118 boys), 84 cognitively able (IQ>70) with ASD (CAASD) (IQ=103.88, CA=11.11) and 64 TD controls (IQ=114.53, CA=10.73). Groups matched on IQ and CA. Peer dyads were paired based on gender, IQ, and Chronological Age (CA). Study measures included a dyadic communicational CG task in which children described 10 different Tangram shapes to each other, six times (changing roles as follower and leader). Shapes were placed behind a screen, unseen to followers. We calculated the total number of words for each turn and each turn's total duration. We also counted children's phrases' type according to simple combination (short sentence that includes only one noun and one description) and complete phrases (description of the shape on the card as a complete pattern) for each CG-turn. In addition, we used parents' reports to evaluate children's two cognitive mechanisms, Theory of mind (TOM) (TOMI- Theory of Mind Inventory) and Executive Function (EF) (BRIEF - Behavior Rating Inventory of Executive Function).

**Results:**

Interestingly, even though children with CAASD produced more words and it took them longer to generate common ground at the first turn (the intercept), both groups showed similar developmental curve (slopes) in which they reduced the number of words and time duration from turn 1 to 6. Overall, both the verbal and cognitive mechanisms contributed to the generation of CG. Simpler combinations, complete phrases and better TOM and EF abilities contributed to more efficient CG in CAASD dyads, while all but EF predicted more efficient CG in TD group.

**Conclusions:**

The present study was conducted in a semi-natural conversational environment between dyads of peers and showed CAASD's ability to spontaneously learn through interaction and produce shared common ground. It opens new channels of research on the contribution of peer interaction to spontaneous learning in ASD. More so, the integration of language (phrase type) and cognitive (ToM, EF) mechanisms into social intervention models may suggest new ways to enhance the level of dialogue and social interaction core deficits in ASD.

**508.025** (Virtual Poster) The Use of Syntactic Bootstrapping in Verb Learning of Mandarin-Exposed Preschool Children with Autism Spectrum Disorder

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**Background:**

Grammar is usually reported to be a strength in children with autism spectrum disorder (ASD, Tager-Flusberg, 2001; Naigles & Tek, 2017), but few studies have directly investigated the degree to which the grammar of children with ASD is abstract. Naigles et al. (2011) found that English-exposed preschool children with ASD used *syntactic bootstrapping*, via transitive frame, to conjecture causative meaning of novel verbs. However, questions still remain concerning the cross-linguistic viability of syntactic bootstrapping in ASD, especially in languages allowing pervasive ellipsis of verb arguments (e.g., Mandarin Chinese). This study explored Mandarin-exposed preschool children with ASD's use of syntax (including both transitive and intransitive frames) as a cue for verb learning.

**Objectives:**

Using Intermodal Preferential Looking paradigm (IPL; Naigles & Tovar, 2012), this study investigated whether Mandarin-exposed preschool children with ASD demonstrated syntactic bootstrapping, i.e., mapping novel verbs in transitive frames onto causative meaning and those in intransitive frames onto non-causative meaning.

#### Methods:

Participants included 11 Mandarin-exposed children with ASD aged  $62.91 \pm 13.82$  months and 15 younger Typically Developing (TD) children aged  $30.80 \pm 4.55$  months ( $p < .001$ ). The two groups were matched on expressive vocabulary (ASD:  $590.82 \pm 160.64$  words, TD:  $597.53 \pm 208.69$  words) and mean length of three longest utterances (MLU3); (ASD:  $5.52 \pm 0.98$ , TD:  $4.88 \pm 2.04$ ). Participants listened to sentences with a novel verb in transitive (e.g., 'the duck is *pou4*ing the bunny') or intransitive frame (e.g., 'the duck and the bunny are *ban2*ing') paired with two simultaneously performed causative and non-causative actions, and then they heard neutral sentences with the novel verb (e.g., 'look, *pou4*') paired with side-by-side separate causative and non-causative scenes.

#### Results:

For the percent looking to match measure, ANOVAs yielded a main effect of trial,  $F(1, 20) = 11.52$ ,  $p < .05$ , with no group effect. Follow-up t-tests showed that TD group demonstrated syntactic bootstrapping in both transitive and intransitive conditions, while ASD group only did so in intransitive condition (all tests 1-tailed). Specifically, TD group looked significantly longer at the causative scene during the test versus control trials when novel verbs appeared in transitive condition, total test:  $t(15) = 2.79$ ,  $p < .01$ , 2<sup>nd</sup> half of test:  $t(15) = 4.24$ ,  $p < .001$ , and they looked significantly longer at the non-causative scene in intransitive condition,  $t(15) = 1.93$ ,  $p < .05$ . Moreover, ASD group significantly preferred the non-causative scene during the 2<sup>nd</sup> half of the test versus control trials in intransitive condition,  $t(11) = 2.25$ ,  $p < .05$ . Additionally, for the ASD group, children with longer MLU3 performed better on syntactic bootstrapping in intransitive trials,  $r = .704$ ,  $p = .016$ , and the 2<sup>nd</sup> half of transitive trials,  $r = .613$ ,  $p = .045$ .

#### Conclusions:

While TD children used both transitive and intransitive frames to bootstrap verb meaning, Mandarin-exposed preschool children with ASD only utilized the intransitive frame in syntactic bootstrapping. In contrast to English-exposed children with ASD's strengths in using the transitive frame in syntactic bootstrapping (Naigles et al. 2011), Mandarin-exposed preschoolers with ASD's stronger utilization of the intransitive frame might be due to the disparity in the language environment, i.e., postverbal NPs is a stronger cue for transitive verbs in English than in Mandarin Chinese, 87% vs 39% (Naigles & Hoff-Ginsberg, 1995; Lee & Naigles, 2005).

#### **508.026 (Virtual Poster)** Frequency of Household Reading Predicts Receptive and Expressive Language Development over One Year for Autistic Toddlers

**J. R. Mathee-Scott<sup>1</sup>, T. Reuter<sup>2</sup>, S. Ellis-Weismer<sup>3</sup>, J. Saffran<sup>3</sup> and J. Edwards<sup>4</sup>**, (1)Communication Sciences & Disorders; Waisman Center, University of Wisconsin-Madison, Madison, WI, (2)Waisman Center, Madison, WI, (3)University of Wisconsin-Madison, Madison, WI, (4)University of Maryland, College Park, MD

**Background:** The importance of household reading for supporting language development has been well-established within typical development (Gilkerson et al., 2017) and prior findings suggest shared book reading interventions may facilitate language growth in children with autism spectrum disorder (ASD) (Boyle et al., 2019). There is an important link missing from the current literature: the impact of naturalistic reading in the home, absent of explicit reading intervention, on autistic children's language development remains largely unknown.

**Objectives:** Assess whether household book reading (i.e., caregivers' reported frequency of reading to their child at bedtime) predicts autistic toddlers' receptive and expressive language development.

**Methods:** Participants were 57 toddlers with ASD, who took part in a larger study with two longitudinal timepoints. An experienced clinician confirmed ASD diagnoses using the ADOS, ADI-R, and clinical experience. Toddlers were 24–36 months old at Time 1 ( $M = 30.4$ ,  $SD = 3.38$ ) and 37–50 months old at Time 2 ( $M = 43.8$ ,  $SD = 3.49$ ). To evaluate whether frequency of household reading might support toddlers' language development, we analyzed questionnaire data from Time 1 and standardized assessment data from both timepoints.

**Results:** We took a generalized linear model approach to predicting language development over time, analyzing receptive and expressive language separately, as in previous studies (Haebig et al., 2013). Based on related research (Raikes et al., 2006) our focal predictor in both models was Reading at Home, indexed by parent-reported frequency of bedtime reading with their child. Akin to prior studies (Haebig et al., 2013), we used difference scores to assess language development from Time 1 to Time 2. We measured Receptive Language via PLS-5 Auditory Comprehension raw scores and Expressive Language via PLS-5 Expressive Communication raw scores and calculated difference scores, subtracting Time 1 from Time 2. Covariates included parent-reported number of children's books at home, years of maternal education, and ASD severity (ADOS-2, Lord et al., 2012). Results revealed positive associations between Reading at Home and Receptive Language Difference Score ( $\beta = 3.14$ ,  $t = 9.91$ ,  $p < .01$ , Fig.1) as well as Expressive Language Difference Score ( $\beta = 1.77$ ,  $t = 7.42$ ,  $p < .001$ , Fig.2), and a negative association between ASD Symptom Severity and Expressive Language Difference Score ( $\beta = -1.76$ ,  $t = 6.72$ ,  $p < 0.05$ ).

**Conclusions:** This study provides the first evidence to date that naturalistic parent-child reading may bolster receptive and expressive language development in autistic toddlers, adding to a body of evidence that parent-child reading may support language more broadly (e.g., Karrass & Braungart-Rieker, 2005). By examining caregivers' everyday behaviors, this study adds a crucial piece of evidence to findings from controlled



interventions (e.g., Boyle et al., 2019). Naturalistic parent-child reading appears to support toddlers' emergent language skills, possibly by exposing them to a greater diversity of words (Montag et al., 2015) or by honing joint attention abilities that in turn facilitate learning (Ellis Weismer & Kover, 2015). Although the precise mechanisms remain to be discovered, the current study's message to caregivers is clear: Read to your autistic toddler.

**508.027** (*Virtual Poster*) Efficacy of High-Tech Alternative and Augmentative Communication (Avaz) for Children with Disabilities: A Qualitative Case Study in Northern India during Covid-19 Pandemic  
*D. Nair, Latika Roy Foundation, Dehradun, India*

Background:

In disabilities such as cerebral palsy and autism spectrum disorder, deficit in communication skills is one of the core symptoms. Furthermore, while Covid-19 may have been a boon for some families, for children with special needs it has been challenging. With intervention services moving predominantly to a virtual mode, high technology AAC has been efficacious for some families.

Objectives: The current study aims to check the effectiveness of Avaz application (a picture-based learning and communication tool) for children with disabilities from 7-18 years of age.

Methods:

6 participants were selected for the current study, 2 children between 7-14 years and 4 children between 15-18 years. The children were selected on the basis of their financial status (low to middle socio-economic strata), cognition (average intelligence IQ = 85-95), motor abilities (extremely poor motoric abilities led to exclusion), family support and education background of families. Avaz, a high-technology communication tool was the selected application. Participants were introduced to Avaz in their classrooms by the speech therapist and special educator via a tablet. The order of introduction for AVAZ was generalized for all participants, beginning with yes/no answers, followed by core words and moving on to more complex grammar and syntax depending on the individual's level. Each participant's family was involved for at least 2 sessions initially and a minimum of 10 sessions specific to AVAZ were taken involving the special educator in all.

Results:

Mean (SD) age of all participants in the study was 13.16 (4.26). The current study proved to show Avaz as a reliable mode of communication for individuals with various disabilities ranging from language disorders such as autism spectrum disorder to neuromotor disorders like Cerebral Palsy. It revealed that using the app improved social skills as well as overall expressive communication. A total of 10 questions were asked for each level (yes/no being the first, core words next) to assess consistent and correct responses. 6/6 participants responded correctly and consistently for questions using yes or no keys, 90% correct responses were observed for core words and nouns. 75% correct responses were observed for answers requiring verbs.

Conclusions:

Given the virtual mode may continue, Avaz app can be recommended as a mode of intervention for children over a wide age range with different disabilities and/or impairments. The app's features help improve an individual's social and communication adeptness along with being an educational tool in an inclusive therapy setup. This study concludes that a preliminary framework can be developed for individuals having varying special needs using AAC.

## Diagnostic, Behavioral & Intellectual Assessment

### PANEL — DIAGNOSTIC, BEHAVIORAL & INTELLECTUAL ASSESSMENT

#### 208 - Quantitative Traits in ASD Research: Addressing Measurement, Etiology, and More

**Panel Chair:** Kristen Lyall, A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA

**Discussant:** Kristen Lyall, A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA

**208.001** (*Panel*) Harnessing the Quantitative Trait Indexed By the Social Responsiveness Scale to Elucidate the Developmental Sub Structure of Autism

*J. N. Constantino, Washington University School of Medicine, St. Louis, MO*

Background: Data has accumulated on the familial aggregation and transmission of the quantitative trait indexed by the Social Responsiveness Scale (SRS).

**Objectives:** To systematically examine hypotheses regarding the manner in which inherited liability confers developmental susceptibility to autism spectrum disorders (ASD).

**Methods:** Synthesis of a large body of genetic epidemiologic research implementing the Social Responsiveness Scale, contextualized by knowledge from key frontiers of contemporary science on autism and related disorders.

**Results:**

(1) Autism, even when defined according to less-than-perfect parameterizations of the condition, is highly heritable, on the order of 85% in the general population (Sandin et al., 2014), and most affected children are born to unaffected parents; (2) Sub clinical variations of the characterizing traits and features of autism aggregate in the unaffected family members of affected individuals, and such variations are continuously- distributed population wide (Wagner et al., 2019); (3) Within families in which autism recurs, the individual symptom profiles of co-affected family members paradoxically *diverge* (Spiker et al., 2002; Mazefsky et al., 2008; Castelbaum et al., 2020); (4) The many disparate *single-gene* conditions that lead to the convergent syndrome of autism are a) almost never inherited (rather *de novo*); and b) almost always associated with intellectual disability (Myers et al., 2020); (5) What predicts the recurrence of autism in families are joint elevations of heritable early developmental liabilities—*some non-specific to autism*—which can occur in different combinations or permutations in individual patients (Constantino et al., 2017; Constantino, 2019), and which appear independently-heritable (Pohl et al., 2019) and continuously-distributed in the general population.

**Conclusions:**

Autism heterogeneity may most reliably be parsed (“fractionated” as it were) before it occurs, not after, and in accordance with the inherited liabilities that led to it; traces of which may be partially or completely lost or distorted after the condition itself emerges. The current (and finite) slate of predictors include variation in social reciprocity (transmitted intergenerationally and indexed by the Social Responsiveness Scale), attention, hyperactivity, social visual orientation, motor coordination, tactile sensitivity, and cerebellar-dependent learning (Constantino et al., 2021). To the extent that the common allelic variations that give rise to familial autism are polygenic and incremental, they have been evolutionarily retained population wide, and are much better understood when studied across the wide range of variation they manifest in nature than at the tail of the distribution. In ways that are reminiscent of the Heisenberg Uncertainty Principle, the closer the tail is approached, the more the interpretation of observations is obscured—for most neuropsychiatric disorders this is likely explained by increased vulnerability to stochastic influences in clinical versus typical populations (Mazefsky et al., 2008; White, 2019; Castelbaum et al., 2020), and by the developmental consequences of impairment.

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**208.002 (Panel) A Validation Study of Abbreviated Versions of the SRS and Implications for Epidemiologic Analysis**

**K. Lyall, A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA**

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**Background:** The Social Responsiveness Scale (SRS) is a 65-item measure yielding a continuous score capturing autism-related traits. Score subsets of the SRS have been analytically examined but administration of shortened versions has not been evaluated in validation studies.

**Objectives:** The goal of this study was to compare distributional properties and predictive ability of two shortened versions of the SRS to the full 65-item SRS, in both a clinical and general population setting.

**Methods:** Study participants were drawn from the AJ Drexel Autism Institute clinic (n=154) and Kaiser Permanente Northern California (n=201) and block randomized to receive either the 16-item short SRS, a newly developed computer adaptive testing (CAT)-SRS, or the full SRS. Total scores across the three SRS administration methods were scaled to facilitate comparisons. Scores were plotted to assess distributional properties, while Receiver Operating Characteristic (ROC) analysis was used to estimate Area Under the Curve (AUC) and address predictive ability.

**Results:** Overall, distributional properties of the three administration methods were highly comparable, with shortened measures demonstrating similar ability to capture the range of the distribution and case non-case separation as the full SRS. In addition, AUC values were high (0.91-0.97) and comparable across the administration methods, though there was evidence of difference in predictive ability across measures for females (AUC for full SRS=0.99 vs 0.84 for short). Within individual comparisons of short vs full scores (available only for participants at the general population site), suggested underestimation of actual full SRS scores with the CAT-SRS.

**Conclusions:** Our findings broadly support the construct validity and performance of shortened SRS versions examined here, though the full measure may be needed to more accurately assess traits consistent with ASD diagnosis in females. This work suggests opportunities for collection of ASD-related phenotype in settings where participant burden or feasibility considerations may have otherwise prohibited such measurement.

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**208.003 (Panel) Maternal Autistic Traits and Infant Brain and Behavioral Development**

**J. B. Girault, Carolina Institute for Developmental Disabilities, University of North Carolina, Chapel Hill, NC**

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**Background:** Autistic traits aggregate in first-degree family members of individuals with autism spectrum disorder (ASD). Younger siblings of children with ASD represent a familial high-risk (HR) group, and within HR families, quantitative autistic traits (QATs) may serve as useful, cost-effective early markers of inherited genetic liability for autism. Linking familial QATs to individual variation in early brain imaging and behavioral markers of ASD in HR infants has important implications for both etiology and prediction. If family traits account for significant variation in HR infant development, this would not only identify which phenotypes track with inherited risk for ASD and warrant further genetic dissection and mechanistic study, but it could also yield insight into individualized areas of concern relevant to early intervention.

**Objectives:** In the present study, we investigated associations between QATs in mothers and fathers and global brain volumes and behavioral development in their HR offspring.

**Methods:** Ninety-seven (97) high-risk siblings of children with ASD and 49 low-risk controls (LR-Neg) were included in this study. Clinical best estimate diagnosis was made at 24 months using DSM-IV-TR criteria; 20 HR children were diagnosed with ASD (HR-ASD), the remaining 68 did not met criteria (HR-Neg). Parent QATs were measured using the total score from the Social Responsiveness Scale, Second Edition (SRS-2). Parents were scored using the Informant Report form when completed and available, but if no Informant Report was available, Self-Report forms were used. Toddler verbal and non-verbal developmental quotients (VDQ, NDVQ) were derived from assessment with the Mullen Scales of Early Learning, and autism severity was measured using the ADOS calibrated severity score at 24 months. Total brain volume (TBV), gray matter volume (GMV), and white matter volume (WMV) were derived from MRI scans at 24 months. Linear models were used to examine associations between parental QATs (separately) and toddler brain and behavior variables, adjusting for sex, age, study site, and group (HR-ASD, HR-Neg, LR-Neg), including a group x parent QAT score interaction term.

**Results:** A significant group x maternal QAT interaction was found for TBV ( $b = 0.70$  (0.17, 1.21),  $p = 0.009$ ), GMV ( $b = 0.71$  (0.15, 1.27),  $p = 0.014$ ), and WMV ( $b = 0.71$  (0.21, 1.21),  $p = 0.006$ ) at 24 months, such that higher QATs were associated with larger brain volumes in HR-ASD toddlers, compared to LR-Neg. Pearson correlations revealed that maternal QATs explained 25% of the variance in toddler TBV ( $r = 0.50$ ,  $p = 0.05$ ). Higher maternal QATs were also associated with lower VDQ scores in HR-ASD offspring compared to LR-Neg ( $b = -0.47$  (-0.80, -0.14),  $p = 0.005$ ). No associations were found between maternal QATs and child autism severity or NVDQ. Paternal QATs were not significantly associated with child brain or behavior.

**Conclusions:** Maternal, but not paternal, autistic traits were predictive of toddler brain volume and verbal cognition during toddlerhood. These findings suggest that quantitative variation in subthreshold ASD traits in mothers explain variation in certain aspects of neurodevelopment in offspring.

#### **208.004 (Panel) Measuring Social Responsiveness in the Context of Intellectual Disability**

**C. M. Taylor<sup>1</sup>, M. I. Brown<sup>1</sup>, H. R. Fisher<sup>1</sup>, L. Walsh<sup>1</sup> and J. N. Constantino<sup>2</sup>, (1)Geisinger, Lewisburg, PA, (2)Washington University School of Medicine, St. Louis, MO**

**Background:** The use of parent-report questionnaires in the diagnosis of autism spectrum disorder (ASD) is relatively common. The Social Responsiveness Scale (SRS) is a frequently used clinical and research tool to identify the presence and severity of impairment in social communication, as well as the presence of restricted interests and repetitive behaviors. Despite adequate sensitivity and specificity among clinically selected samples (Constantino & Gruber, 2012), many parent-report ASD-screening tools such as the SRS do not adequately distinguish between presence and absence of ASD in individuals with intellectual disability (ID) (Thurm et al., 2019).

**Objectives:** The purpose of this study was to identify the impact of cognitive functioning on SRS scores.

**Methods:** Children presenting for diagnostic evaluation at a neurodevelopmental clinic were included in this analysis ( $n = 1,544$ ). All children in this sample completed a comprehensive neurodevelopmental evaluation for autism spectrum disorder. Diagnostic evaluations were completed by experienced professionals in developmental disabilities, including psychologists and neurodevelopmental pediatricians.

**Results:** We used multiple linear regression to estimate the unique effects of ASD and mild/moderate ID diagnoses on SRS T-scores. Children who were diagnosed with ASD scored significantly higher on the SRS ( $B = 5.86$ ,  $SE = 0.68$ ,  $t = 8.59$ ,  $p < .001$ ). Children diagnosed with mild or moderate ID also scored higher on the SRS ( $B = 6.56$ ,  $SE = 0.80$ ,  $t = 8.16$ ,  $p < .001$ ), regardless of ASD. These effects were also found while controlling for differences in age and sex. We also found this effect for ID on each of the five SRS treatment domain scores. Children presenting for diagnostic visits who were diagnosed with ID without ASD had clinically elevated SRS scores ( $M = 74.83$ ,  $SD = 11.39$ ,  $n = 203$ ) which were similar to those for children without ID who were diagnosed with ASD ( $M = 73.61$ ,  $SD = 12.35$ ,  $n = 883$ ). Next, we estimated the sensitivity and specificity for SRS scores as a predictor of ASD separately for children with or without ID. Despite strong sensitivity for SRS scores for both children with ID (96%) or without ID (85%), specificity was poor within both groups (11% and 27%, respectively). Among children with ID without ASD, 56% had clinically elevated scores on the SRS (T-score  $\geq 60$ ). This proportion of false positives was nearly three times that for children without ID (20% of children without ASD or ID had clinically elevated SRS scores). Specificity for ASD in the ID cohort only exceeded 50% when using the SRS severe risk cut score (T-score  $\geq 76$ ).

**Conclusions:** Our results suggest that elevated SRS scores may not be specifically attributable to ASD within neurodevelopmental clinic settings. Instead, we find that SRS scores may also be elevated due to other factors including ID. These results suggest that available ASD parent report diagnostic questionnaires are insufficient for differentiating between presence and absence of ASD in individuals with mild to moderate ID. There is a critical need to develop and validate diagnostic questionnaires to assess ASD symptomology in cognitively impaired cohorts.

### **PANEL — DIAGNOSTIC, BEHAVIORAL & INTELLECTUAL ASSESSMENT**

#### **211 - Advancing Understanding of Neurogenetic Syndromes through Novel Analytic and Measurement Approaches**

**Panel Chair: Antonio Hardan, Psychiatry & Behavioral Sciences, Stanford University, Stanford, CA**

**Discussant: Mustafa Sahin, Boston Children's Hospital, Boston, MA**

**211.001 (Panel)** Developing and Validating Touch Screen Tasks As Digital Biomarkers and Objective Outcome Measures for Neurodevelopmental Conditions and Rare Genetic Syndromes

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**Background:** The era of transdiagnostic, precision medicine and “big data” approaches to neuropsychiatry requires reliable, valid, and scalable tests that can be used in individuals with diverse neurodevelopmental conditions across all age and ability levels. For example, large-scale genetic studies require phenotypic characterisation of individuals with genetic syndromes as well as family members. Clinical trials rely on objective outcome measures that overcome “placebo effects”, are sensitive to change, reliably correlate with relevant clinical features and link to underlying mechanisms. To date, we do not have a validated test battery that consistently assesses fundamental social, emotional, cognitive and sensory processes in children and adults. In particular, sensitive tests for people with severe intellectual disability (ID), as often comorbid with genetic syndromes, are missing.

**Objectives:** This project aimed to develop, optimise and validate a suite of touch screen tests for individuals with neurodevelopmental conditions and rare genetic syndromes for use as digital biomarkers and/ or objective outcome measures. Our tests combine animated, interactive cartoons and cutting-edge artificial intelligence approaches to assess five fundamental transdiagnostic processes (social, emotional, cognitive, motivational, and sensory).

**Methods:** We created three companion versions: “Pip and the Brain Explorers” for preschoolers (3-6 years) and children with ID, 2. “Time Trekkers” for school-going children (aged 6-12 years) and “Brain Train”, for adolescents and adults from 13 years. Cartoons, demonstrations, practice trials, and inbuilt rewards are used to increase motivation, comprehension and test for “pre-requisite” processes (e.g., categorisation) needed to complete tasks. We used Bayesian Optimization<sup>1</sup> to adjust task difficulty to one’s prior performance history. This approach imports the structure of some IQ tests to the social and emotional domains. Some tests ‘back-translated’ behavioural assays used in animal models of rare genetic syndromes (social novelty task<sup>2</sup>) or use psychophysical methods (frequency discrimination task). Task development has been carried out in an iterative manner. Validation criteria include 1) data acquisition rates, 2) psychometric properties, 3) assessment procedures (i.e. researcher administered vs. tested at home by parents), and 4) the effect of version/ surface features. If a task does not meet our criteria (e.g., acquisition rates below 80%), it is revised, and the new version tested anew.

**Results:** We created 13 subtests of the preschool version, 8 subtests of the schoolgoing version and 6 subtests of the adolescent/ adult version. The preschool version was tested in 82-123 children aged 30- 60 months (including 34 with autism and/ or ID, ~70 were recruited via AIMS-2-TRIALS PIP, 50 children tested online in the UK). Acquisition rates of 10 subtests ranged from 91-100%. By changing the narrative and surface features of a social reward learning task (from “Milkman” to “Come-play-with-me”) we increased acquisition rates in 3-4 year olds from 68% to 91%. Split-half reliability ranged from 87-.95. Two subtests with acquisition rates <80 are being revised.

**Conclusions:** We provide ‘proof-of-concept’ that we can reliably assess these fundamental processes in preschool children with neurodevelopmental conditions, including ID. We will further report on ongoing efforts of validation, standardisation and comparison with the school-going and adolescent/ adult versions.

**211.002 (Panel)** Development of a Neurobehavioral Evaluation Tool for Neurogenetic Syndromes Associated with Autism

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**Background:** Neurodevelopmental genetic syndromes (NDGS) associated with autism have low prevalence with isolated cases geographically distributed throughout the world. Many NDGS show a wide range of functioning from substantial cognitive and functional impairments with significant autism symptoms to cognitive and functional levels closer to the neurotypical range. As a result, neurobehavioral assessment is challenging and many traditional measures have limited applicability. Thus, there is a great need for neurobehavioral measures that were expressly developed to measure key cognitive, emotional, and functional domains relevant to NDGS patients and families.

**Objectives:** The primary aim was to develop and validate a neurobehavioral evaluation tool (NET) that includes two components: informant (parent)-report survey scales and patient-completed webcam performance measures. The study was designed to assess a range of psychometric properties, including: scale structure, reliability, construct validity, and sensitivity to change.

**Methods:** The development phase of the study included a set of 9 clinician-scientist experts and 10 parent/caregiver informants from 5 NDGS groups (PTEN, SYNGAP1, ADNP, SCN2A, and NFIX/Malan Syndrome) as well as 1 clinician-scientist and 1 parent/caregiver informant for idiopathic ASD. Participants provided input on the most crucial neurobehavioral domains and content areas as well as quantitative and qualitative input on item appropriateness and wording. Simultaneously, concept elicitation interviews were conducted with PTEN patients and parent/caregiver informants to

identify key neurobehavioral domains relevant to this patient group. Data from these processes were combined to generate a concept map and to inform final scale and item development.

**Results:** Thirteen neurobehavioral domains were rated as having medium to high importance for NDGS patients and qualitative data from concept elicitation interviews supported the selection of these domains and informed specific content areas for item coverage. Of the 13 most highly rated domains, 11 were selected for NET survey scale development and the remaining two were determined to be best evaluated with existing clinical methods (e.g., seizures – EEG evaluation; speech/language – patient-completed testing). The final 11 survey scales were generally brief (15 to 35 items) with good but not complete content coverage of key constructs within each domain. Final items selected were rated as easy to understand and highly relevant to each domain and NDGS patient group. NET patient-completed webcam performance measures were created for 4 cognitive paradigms: social attention, processing speed, receptive vocabulary, and single-word reading. Preliminary testing indicated that many patients could complete valid evaluations the first three paradigms with the fourth paradigm being more challenging and appropriate only for individuals with higher cognitive levels.

**Conclusions:** The development phase of NET is complete, yielding 11 informant (parent)-report survey scales and 4 patient-completed webcam cognitive paradigms. The next phase of development will involve collection of both NET components from more than 300 patient/informant pairs from each of these above groups as well as 120 sibling and unrelated healthy controls (ages 3-45) at baseline, 1-month follow-up, and 4-month follow-up. These data will be crucial for validating the NET measures, determining any needed adjustments, and providing key psychometric properties to support future implementation in research and, eventually, in clinical practice.

**211.003 (Panel)** The Sensory Assessment for Neurodevelopmental Disorders (SAND) in Neurogenetic Syndromes: Natural History, Response to Treatment, and Relationships with Core Symptoms

**P. M. Siper<sup>1</sup>, C. F. Layton<sup>2</sup>, T. Levy<sup>1</sup>, J. Zweifach<sup>1</sup>, S. Sethuram<sup>3</sup>, J. H. Foss-Feig<sup>1</sup>, J. D. Buxbaum<sup>4</sup> and A. Kolevzon<sup>1</sup>,** (1)Seaver Autism Center for Research and Treatment, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Department of Pediatrics, Icahn School of Medicine at Mount Sinai, New York, NY, (4)Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY

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**Background:** Sensory reactivity symptoms represent one of the earliest clinically observable predictors of a neurodevelopmental disorder and are widely reported in autism spectrum disorder (ASD) and related conditions. There is a growing body of evidence describing sensory differences in neurogenetic syndromes, including syndrome-specific phenotypes. However, little is known about how these symptoms progress over time, respond to treatment, or relate to other core ASD symptoms. Identifying factors that may predict prognosis could lead to earlier and more specific interventions for populations with a high likelihood of longstanding sensory symptoms.

**Objectives:** To examine the utility of the Sensory Assessment for Neurodevelopmental Disorders (SAND) as a method to objectively measure natural history, treatment response, and relationships with core ASD symptoms in two neurogenetic syndromes: Phelan-McDermid syndrome (PMS) and Activity-Dependent Neuroprotective Protein (ADNP) syndrome.

**Methods:** The SAND is a clinician-administered observation and corresponding caregiver interview that quantifies sensory hyperreactivity, hyporeactivity and seeking within visual, tactile, and auditory modalities. The SAND was administered to 33 children with PMS ( $M_{age} 6.33 \pm 2.58$ ) and 23 with ADNP syndrome ( $M_{age} 7.09 \pm 3.37$ ) in the context of ongoing phenotyping studies. To date, longitudinal data was collected from 6 children followed for three visits at least one year apart. The SAND was also piloted in two recent clinical trials, including 4 children with PMS receiving recombinant human growth hormone (rhGH) for 12 weeks, and 10 children with ADNP syndrome receiving a single-dose of ketamine (0.5 mg/kg) infused intravenously over 40 minutes and followed four weeks post-infusion. Relationships between the SAND and the Aberrant Behavior Checklist (ABC) Lethargy/Social Withdrawal subscale, a primary outcome in both studies, were examined using the full sample.

**Results:** Natural history data suggested, on average, total scores were relatively stable over time. Symptom presentation within individuals was notably stable, particularly hyporeactivity. Low levels of sensory seeking at baseline remained stable. In contrast, high levels of sensory seeking at baseline varied, with one participant showing an increase in symptoms and another displaying improvement followed by worsening symptoms.

PMS clinical trial data indicated improvement in hyporeactivity symptoms in 3 of 4 participants following rhGH treatment. Results from the ADNP trial indicated significant improvement in SAND Total Score from Baseline to Week 1 ( $p=.025$ ) and Baseline to Week 4 ( $p=.05$ ). Hyperreactivity ( $p=.048$ ) and Seeking ( $p=.036$ ) also improved significantly from Baseline to Week 4.

In the PMS group, ABC Lethargy/Social Withdrawal significantly correlated with SAND Total Score ( $r=.521, p=.002$ ), Hyperreactivity ( $r=.354, p=.043$ ) and Hyporeactivity ( $r=.360, p=.04$ ) scores. Similarly, ABC Lethargy/Social Withdrawal scores significantly correlated with SAND Total Score ( $r=.577, p=.004$ ) and Hyporeactivity ( $r=.606, p=.002$ ) scores.

**Conclusions:** Findings demonstrate novel applications of the SAND in neurogenetic syndromes and demonstrate the potential of this measure as a tool to capture change over time and in response to treatment. A shift from our reliance on subjective caregiver questionnaires to objective multimodal approaches as offered by the SAND may improve our understanding of sensory phenotypes and relationships with core symptoms while offering an important new endpoint for use in clinical trials.

**211.004 (Panel)** Developing Computational Infrastructure for Better Characterization of Clinical Variance in Repetitive Behaviors Among Individuals with Neurogenetic Syndromes

**Background:** A number copy number variants (CNVs) have been shown to represent an increased risk for autism spectrum disorder (ASD). It has been argued that taking a genetic-first approach and characterizing the specific phenotypes associated with specific CNVs holds a significant promise for a better understanding of mechanisms behind ASD heterogeneity. However, studies to date have utilized case-control designs comparing these individuals with small, non-representative idiopathic ASD samples. Normative modelling represents a powerful example of precision medicine as it establishes reference standards in a specific group thus allowing precise anchoring of each individual's performance against established standard. However, there have been no attempts to date to utilize this method to quantify whether CNVs differ in their specific symptom profiles from what would be expected from a large heterogeneous cohort of age, sex and IQ matched ASD individuals.

**Objectives:** Current investigation aimed to develop reference standards that would enable clinicians and researchers to quantify individual differences in specific restricted and repetitive behaviors (RRB) subdomains in individuals with neurogenetic syndromes against models of expected age-, cognitive functioning- and sex-related trends seen in idiopathic ASD.

**Methods:** Normative tables and individual percentile scores for Repetitive Behavior Scale-Revised (RBS-R) subscales were derived using the data from 17,581 ASD youth without reported genetic syndromes ( $M_{age} = 8.24$  years,  $SD_{age} = 4.06$ ;  $n = 3,395$  females,  $n = 14,186$  males) from the Simons Foundation Powering Autism Research for Knowledge (SPARK) database. Developed percentile scores were used to characterize RRB profiles among individuals with a range of genetic syndromes (e.g., 22q11.2 deletion and duplication syndrome, Fragile X Syndrome, PTEN mutation, Tuberous Sclerosis Complex [TSC]) and ASD diagnosis from the SPARK database ( $n = 457$ ;  $M_{age} = 8.55$  years,  $SD_{age} = 3.81$ ;  $n = 138$  females).

**Results:** Generalised additive models (GAM) were used to model the linear and non-linear associations between RBS-R subscales with sex, age and cognitive functioning in idiopathic cohort. Male sex was associated with higher repetitive motor behaviors (RMB) and restricted interests and lower compulsions and self-injurious behaviors (SIB). RMB showed a mostly linear (negative) association with age, other RRB domains showed more complex and non-linear associations. All RRB domains showed a significant linear association with cognitive functioning. Based on GAMs, we developed normative models for idiopathic autism for each of the RBS-R subscales and utilized derived models to determine whether certain neurogenetic syndromes significantly deviated from expected distribution of RBS-R scores for idiopathic autism given the individual's sex, age, and cognitive functioning. While a number of neurogenetic syndromes (e.g., 1q21.1 duplication, 22q11.2 duplication, 15q deletion and duplication) had comparable severity of different RRB subdomains as seen in idiopathic ASD, other syndromes had either uniformly more severe RRB (e.g., Angelman syndrome, 22q11.2 deletion) or showed higher severity for only certain RRB subdomains (e.g., TSC for motor stereotypies and self-injurious behaviors). There were significant individual differences within each neurogenetic syndrome.

**Conclusions:** This study provides a computational approach that will serve as a unique open-source resource for future clinical and research work focused on understanding clinical profiles among individuals with neurogenetic syndromes associated with ASD.

## ORAL SESSION - 5A — DIAGNOSTIC, BEHAVIORAL & INTELLECTUAL ASSESSMENT

### 305 - Important Demographic Considerations in ASD Diagnosis: A Deeper Dive

#### 305.001 (Oral) Racial Disparities in the Clinician-Reported Validity of Autism Diagnostic Evaluations

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**Background:** Non-Hispanic Black (NHB) and Hispanic/Latino children are diagnosed with autism spectrum disorder (ASD) later than non-Hispanic White (NHW) children. Inequities in community identification and referral practices can limit access to timely supportive services and produce downstream disparities in health outcomes for individuals from marginalized communities across the lifespan. Most investigations focus on broad associations between sociodemographic characteristics and outcomes to describe disparities, with few opportunities to examine how specific clinical elements within “gold-standard” autism diagnostic processes may influence disparities observed at the group level.

**Objectives:** This study examined associations between family sociodemographic factors (i.e., race/ethnicity, parental education, income) and clinician ratings of the quality and validity of the data from their own administrations of the Autism Diagnostic Interview-Revised (ADI-R) and Autism Diagnostic Observation Schedule (ADOS).

**Methods:** The Study to Explore Early Development (SEED) is a multi-site case-control study of children evaluated between 30-68 months of age. Mothers completed the Social Communication Questionnaire (SCQ) to determine ASD risk. Children with elevated SCQ scores or previous ASD diagnosis participated in an evaluation that included the Mullen Scales of Early Learning (MSEL), ADI-R, and ADOS. The ADOS and ADI-R were administered by SEED clinicians who achieved research reliability status and engaged in quarterly calibrations throughout the study period to minimize coding discrepancies. Clinicians also completed ratings of the “quality and validity” of each ADOS/ADI-R administration, ranging from 0-3 (“Invalid/Very Poor Quality” to “Good Quality”). We built separate ordinal logistic regression models for the ADI-R and ADOS. The outcome was clinician-rated validity of the assessment data. The primary predictor in each model was race/ethnicity of the mother (ADI-R) or child (ADOS). We

considered covariates including maternal education, family income (percentage of the Federal Poverty Level), SEED study site, maternal age, child sex, MSEL composite, and mother-reported autism symptomology via the Social Responsiveness Scale (SRS).

Results: Demographic and validity data were available for 1,078 families who completed the ADI-R and/or ADOS; in both samples, 45% of mothers identified as NHW and 28% as NHB. Clinicians (n=27) rated approximately 80% of ADI-R and ADOS data as “Good Quality.” In the unadjusted ADI-R model, clinicians were significantly less likely to rate interview data as “Good Quality” for NHB mothers relative to NHW mothers (OR 0.33, 95% CI 0.23-0.46); this association remained after adjusting for covariates (aOR 0.35, 95% CI 0.23-0.52). We observed no other maternal race/ethnicity associations in ADI-R data. For the ADOS, validity ratings did not differ significantly by child race/ethnicity for any group, including NHB children (aOR 0.89, 95% CI 0.58-1.37).

Conclusions: Under rigorously controlled administration conditions, clinicians’ ADOS validity ratings did not differ by child race/ethnicity, but clinicians were 65% less likely to rate ADI-R data from NHB mothers as “Good Quality” compared to data from NHW mothers. Clinician implicit bias, measurement inadequacies, and other unmeasured factors may contribute to these contrasting patterns. These findings raise critical questions about how real or perceived differences in the validity of standardized (and unstandardized) autism diagnostic interviews may be an unaddressed mechanism of downstream disparities.

### **305.002 (Oral)** Evaluation of Racial and Sex Bias in the Autism Diagnostic Observation Schedule: An Item-Response Theory Analysis

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Background: There are long-standing disparities in the prevalence of Autism Spectrum Disorders (ASD) across race and sex. Males are three to four times more likely to be diagnosed with ASD than females and under-identification of ASD has been consistently reported in minority racial groups (Jo et al., 2015). There are many mechanisms that drive disparities, including lack of access to care, stigma, and developmental literacy (Zelege et al., 2019). Standardized diagnostic assessments may also contribute to disparities in the timing and accuracy of an ASD diagnosis. However, few studies have examined if these disparities arise partially from systematic biases in the Autism Diagnostic Observation Schedule-Version 2 (ADOS-2), the gold standard measure of ASD. To date, only one study has examined ADOS measurement bias at the item-level, by sex and race, using item response theory (Harrison et al., 2017). While that study found minimal biases, it has several significant methodological limitations (e.g., use of an outdated version of the ADOS, small non-White sample sizes) that are overcome by the present study.

Objectives: To examine differential item functioning of ADOS-2 items across sex (females compared to males) and race (Black/African American compared to Whites) using an item response theory framework.

Methods: In this cross-sectional study, 6269 children, ages 1-17 years (M = 6.8y, SD = 3.3y; 59.3% White, 22.0% Black/AA, 79.6% Male), were evaluated for ASD between 2014 and 2020 at an ASD specialty clinic located in the Mid-Atlantic region of the US. Item-level biases across ADOS-2 harmonized algorithm items, including social affect (SA; 10 items) and restricted/respective behaviors (RRB; four items), were evaluated across Modules 1-3. Measurement bias was identified by examining differential item functioning (DIF), within an item-response theory framework, using an ordinal logistic regression model. Statistical significance was determined by a likelihood ratio chi-square test, while R-squared, regression coefficients, and salient DIF analyses were used to examine the magnitude and direction of DIF.

Results: For race, nine unique items exhibited significant DIF ( $p < .05$ ). Almost all of the items with DIF involved SA, however no single item showed DIF consistently across all modules. Most items with DIF (seven out of nine) had higher difficulty in Black/African Americans compared to Whites. For sex, five unique items showed significant DIF. Most items with DIF involved RRB (three out of five). Stereotyped language evidenced DIF across all five algorithms. Greater difficulty for females (compared to males) was most often observed, especially for Module 3. While greater item difficulty resulted in underestimation of ASD severity, the magnitude of DIF was small for both race and sex.

Conclusions: Findings suggest the ADOS-2 does not have widespread systematic measurement bias across race (Black/African American compared to Whites) or sex (female compared to male). However, the findings raise some concerns about under detection of SA for Black/African American, and RRB for females, particularly in Module 3. Consistent measurement bias involving stereotyped language, for females across all Modules, warrants particular attention and further research.

### **305.003 (Oral)** Are the Diagnostic Rates of Autistic Females Increasing? an Examination of State-Wide Trends

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Background:

Autism spectrum disorder (ASD) has been considered a “male dominant” condition, with a ratio weighted in 4:1 in favor of males (Baio et al., 2018; Fombonne, 2009; Maenner et al., 2020). However, research suggests that autistic females are underdiagnosed and misdiagnosed, with an estimated sex ratio closer to 3:1 based on recent meta-analytic studies (Loomes et al., 2017). Autistic females are diagnosed, on average, two years later than their male peers, particularly when they present with minimal language delays (Begeer et al., 2013; Duvekot et al., 2017; Harrop et al., 2021; McCormick et al., 2020; Salomone et al., 2015).

## Objectives:

The purpose of this study was to examine historical trends in the diagnosis of autism in females across the past two decades. Specifically, (1) whether more females are being diagnosed over time and (2) whether the number of late diagnosed females (females diagnosed in adolescence and adulthood) has increased.

## Methods:

Data for this study was drawn from diagnostic evaluations conducted across statewide outpatient clinics operated by the University of North Carolina TEACCH Autism Program. To evaluate historic trends in diagnosis, we used data from January 2000 to September 2021. Data from 10,028 participants (males = 8135, females = 1893) were included in the initial analyses. Our analysis focused on the rates of females diagnosed over time, the age of diagnosis by assigned sex over time, and the proportion of late diagnosed individuals (13 years and above) by time and assigned sex.

## Results:

The proportion of females receiving first time diagnoses increased over time from 15% between 2000-2005 to 24.55% after 2016 ( $X^2 [3, N = 10,028] = 63.66, p < .001$ ; Table 1). The average age of diagnosis for females across the whole sample was 10 months later than males ( $F = 67.30, p < .001$ ; Table 1). The age of diagnosis overall increased overtime ( $F = 10.78, p < .001$ ), with later diagnoses from 2011 onwards relative to 2000 - 2010. This was driven by an interaction between sex and date ( $F = 5.29, p = .001$ ), with the age of diagnosis for females increasing at a greater rate over time. More females were late diagnosed ( $X^2 [1, N = 10,028] = 64.65, p < .001$ ; Table 1), with the proportion of late diagnosed females increasing more over time.

## Conclusions:

The proportion of autistic females diagnosed at state-wide autism centers has increased steadily over a 20-year period. This increase of females receiving their initial diagnosis from 2016 onwards likely reflects greater societal knowledge of how ASD may manifest differentially in females. The rate of females diagnosed in adolescence and adulthood has also rapidly increased during this time. While these statewide trends are encouraging, efforts must be made to identify autistic females earlier to improve their access to appropriate supports and to provide a sense of identity (Bargiela et al., 2016). Future work includes the analysis of IQ and autism severity data to understand if the profile of females entering TEACCH clinics has changed overtime, accounting for some of the findings reported here.

### **305.004** (Oral) Community-Referral Vs. Siblings with Familial Risk for Autism Spectrum Disorder: Clinician Certainty in the Diagnosis of Toddlers

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**Background:** The differential diagnosis of autism spectrum disorder (ASD) is multifaceted and heterogeneous, often resulting in uncertainty of a toddler's diagnosis (Rogers et al., 2016, Penner et al., 2017, Matson et al., 2012). Increased uncertainty could prolong timing of diagnosis and access to intervention, known to negatively impact children's outcomes (Zwaigenbaum et al., 2015). In community-referred toddlers and preschool-aged children, McDonnell et al. showed that clinicians made 60% of ASD diagnoses with complete certainty (2019). ASD core symptoms (social affect, restricted/repetitive behaviors (RRBs)) are shown to be the strongest predictors of clinician certainty when making a diagnosis (Hedley et al., 2016). Given the complicated, heterogenous and broader autism phenotype often seen in siblings at elevated likelihood for ASD (older sibling with an ASD diagnosis; EL-ASD) (Chawarska et al., 2014), here we investigate whether clinician certainty in the diagnosis of ASD differs by risk status and whether factors, such as specific autism symptomatology, language and cognitive ability increase or decrease certainty.

**Objectives:** This study specifically explores differences between community-referred, EL-ASD and non-ASD toddlers in the predictive value of symptomatology on diagnostic certainty.

**Methods:** Participants included community-referred toddlers with ASD ( $n=110$ ,  $M_{age}(SD)= 24.35(3.47)$  months), EL-ASD siblings ( $n=59$ ,  $M_{age}(SD)=23.95(3.31)$  months), and a chronological age-matched sample of typically developing toddlers (non-ASD) ( $n= 85$ ,  $M_{age}(SD)= 23.51(1.98)$  months). Receptive and expressive language and cognitive ability was assessed with the Mullen Scales of Early Learning. Diagnostic confirmation was made via clinician best estimate using the ADOS-2 toddler module, parent interview and observations. Clinician diagnostic certainty was rated on a 5-point scale (complete certainty described as '81-100%: extremely certain of diagnostic presentation').

**Results:** Certainty was evaluated in relation to group and diagnostic status (community-referred ASD, EL-ASD, non-ASD). Chi square analyses showed that clinicians were more certain in diagnosing ASD in community referrals over EL-ASD and non-ASD diagnosis ( $\chi^2=19.56, p<0.001$ ). Community-referral diagnoses made with complete certainty (90%) were greater than that of EL-ASD (62.7%) and non-ASD diagnoses (74.1%). ADOS-2 social affect, RRBs, and algorithm scores all significantly correlated with clinician certainty across groups. However, RRB scores were the largest predictor of diagnostic certainty in community referred diagnosis ( $r_t=0.372, p<0.001$ ); while total algorithm scores were the greatest predictor for EL-ASD and non-ASD toddlers ( $r_t(EL-ASD)=0.424, p<0.001$ ;  $r_t(non-ASD)=-0.259, p=0.005$ ). In addition to RRBs, receptive language, not expressive or cognitive ability, predicted diagnostic certainty in community-referred toddlers ( $r_t=-0.194, p<0.001$ ).



Conclusions: These results aid in our understanding of the discrepancies in diagnostic certainty of ASD in community-referred, EL-ASD, and non-ASD toddlers and the challenge clinicians face in differential diagnosis. Community-referred increased symptomatology and certainty in diagnosis possibly indicates a “wait-and-see” model where complete symptomatology is already present prior to referral, resulting in delayed intervention. ASD symptomatology, particularly RRBs, may be attenuated in EL-ASD, which could negatively impact diagnostic certainty and highlights the importance of continued observation of children at familial risk for ASD. Preliminary analyses indicate the need to better understand the diagnostic features predicting clinician certainty, in order to increase access to interventions as soon as symptoms begin to emerge.

## POSTER SESSION — DIAGNOSTIC, BEHAVIORAL & INTELLECTUAL ASSESSMENT

### 409 - Diagnostic, Behavioral & Intellectual Assessment I

#### 409.025 (Poster) Factors Affecting Parental Quality of Life in Young Children with Autism Spectrum Disorder in Singapore

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#### Background:

Parents of children with autism spectrum disorder (ASD) tend to experience greater parenting stress and psychological ill-effects. Quality of Life (QoL) of parents is a critical outcome measure when supporting families of children with ASD. Identifying specific child factors which impact parental QoL, a culturally sensitive construct, can facilitate targeted intervention strategies.

#### Objectives:

To identify child and family factors associated with parental QoL of parents of children with ASD.

#### Methods:

This cross-sectional study was conducted at a tertiary developmental pediatric centre in Singapore from September 2019 and August 2021. Inclusion criteria was 1. Parent with a child with ASD aged between 5 and 8 years, and 2. Child diagnosis of ASD following clinical evaluation by a developmental pediatrician and/or formal psychological evaluation with the Autism Diagnostic Observation Schedule. Parents completed the Quality of Life in Autism Questionnaire (QoLA), parent version. The QoLA contains 2 subscales: part A measures parental self-rated QoL (score range 28-140, higher scores denote greater perceived QoL); part B measures perceived problems due to child's ASD-related behaviors (score range 20-100, higher scores denote fewer perceived problems due to behavior). Parents also answered a family demographic questionnaire, Repetitive Behavior Questionnaire-2 and Social Responsiveness Scale (SRS). Standardized child assessments included the Vineland Adaptive Behavior Scales (VABS-2), Mullen Scales of Early Learning (MSEL), Kaufman Brief Intelligence Test (KBIT) and Weschler scales of Intelligence. Descriptive statistics and linear regression were used to identify variables associated with QoLA scores.

#### Results:

Parents of 81 children (85.2% male, mean age 6.2 years, SD 1.9) completed the study. After controlling for gender and family history of autism, QoLA part A scores were higher (greater parental perceived QoL) in parents whose children had greater rigidity and adherence to routine on the RBQ ( $B=1.401$ ,  $p=0.021$ ). Family financial insecurity ( $B=22.8$ ,  $p=0.009$ ) and lower VABS socialisation scores ( $B=-0.535$ ,  $p=0.038$ ) were predictive of higher QoLA part B scores indicating less perceived problematic behaviours by parents. Scores on the KBIT, Weschler scales, MSEL and SRS were not significantly associated with the QoLA scores. Age when child started therapy was also not significantly associated with QoLA scores.

#### Conclusions:

Rigidity in children with ASD with greater adherence to routine may contribute to better parental quality of life due to predictability of child's preferences and behaviors. Children from families with financial insecurity may be receiving more community support or targeted early intervention leading to problematic child behaviors being less of a problem. Interestingly, parents of children with better VABS socialization score had greater difficulties with their behaviors; this could reflect lesser targeted intervention due to better functional skills. In keeping with literature, child cognition and language ability did not significantly affect parental quality of life in our cohort. Regardless of child's cognition and adaptive skills, asking parents specifically about challenging behaviors and addressing them can help improve parental QoL. Further research will focus on 1) qualitative examination for the reasons of these associations, 2) understanding how these factors affecting parental QoL differ between Asian and non-Asian parents.

#### 409.026 (Poster) A Promising New Measure for Quantifying Emotion Dysregulation in Toddlers and Preschoolers: Development and Psychometrics of the Emotion Dysregulation Inventory – Young Child

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**Background:** Emotion dysregulation (ED) is thought to mechanistically underlie the high rates of psychiatric comorbidity in Autism Spectrum Disorder (ASD). By school age, the rate of clinically impairing ED is four times higher in ASD than general population children. The Emotion Dysregulation Inventory (EDI) was designed and validated as a highly efficient, sensitive outcome measure to characterize ED in youth ages 6+. Preliminary evidence documents that ED is also part of the early ASD phenotype. However, there is very limited research quantifying early ED, likely because there are no validated measures of ED in early childhood for ASD.

**Objectives:** This presentation will describe the adaptation process for the Emotion Dysregulation Inventory – Young Child (EDI-YC), following PROMIS guidelines. It will identify the final factor structure of the EDI-YC and the best performing items.

**Methods:** The EDI-YC item bank was generated by inclusion of relevant items from the original EDI and the generation of new items. Expert review and cognitive interviews were conducted to refine the item content, wording, and establish construct validity. The final 48 items were tested in 1,095 children ages 2-5 for psychometric analysis, which included three samples: (1) 914 young children with ASD recruited via the Simons Foundation Powering Autism Research for Knowledge (SPARK) online registry; (2) 58 young children with non-ASD intellectual disabilities (IDD) recruited via a university registry and a state-funded early intervention program; and (3) 123 young children with ASD and non-ASD IDD participating in intervention studies focused on mindfulness-based stress reduction for parents. Preliminary factor analyses were conducted on the SPARK sample (438 cases for EFA, 444 for CFA), as data merging is being finalized for the other two samples.

**Results:** A two-factor solution emerged as most meaningful. 33 items loaded on factor 1 and 12 items loaded on factor 2, with a loading of  $>0.45$ . The factors were consistent with the original EDI: (1) Reactivity, which captures rapidly escalating, intense, and poorly regulated negative affect; and (2) Dysphoria, which reflects sadness, low positive affect, and unease. Some items overlapped with the best-performing items for the original EDI (e.g., does not seem to enjoy anything) and others were newly added items conceptualized to be relevant for young children (e.g., requires preparation before a new activity or transition to avoid a tantrum or meltdown). We will re-run these analyses with the two additional samples, which are enriched for diversity (i.e., specifically non-ASD IDD and race/ethnicity) before finalizing the factor structure. Item Response Theory and Differential Item Functioning analyses will also be completed to identify the final items (all data are collected, analyses ongoing). Norms will be created based on a general population sample of 1000 children.

**Conclusions:** Results from the SPARK sample are promising. They provide preliminary evidence that the ED construct is comparable in early and later childhood. Additionally, early results support the utility of the EDI-YC for use in children ages 2-5 with ASD. The EDI-YC and EDI will be psychometrically linked to enable progress monitoring and longitudinal studies across childhood.

#### **409.027 (Poster) Adaptive Behavior in School-Age Autistic Males and Females**

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**Background:** Due to rising diagnostic rates of autistic females, it is important to assess whether sex differences may be underlying adaptive behavior differences in ASD (See Lawson, 2019 for review). Findings on whether autistic females have more difficulty than males in adaptive behavior have been mixed (Howe et al., 2015; Ratto et al., 2018; White et al., 2017; Mandic-Maravic et al., 2015; Zwaigenbaum et al., 2012). Further, there is limited consensus on the roles of autism traits and co-occurring psychopathology on adaptive behavior (Duncan & Bishop 2015; Tillmann et al., 2019; Yerys et al., 2019). However, few studies have included sufficient numbers of autistic females to assess whether this relationship varies by sex.

**Objectives:** To better understand (1) sex differences in adaptive behavior and internalizing/externalizing behavior in school-aged autistic children and (2) the relationships between adaptive behavior and internalizing/externalizing behavior.

**Methods:** Data for this study was drawn from the University of North Carolina TEACCH Autism Program database of individuals receiving clinical services. Participants were 236 autistic youth (Males=180; 76%; Females=56; 24%) ages 6-18 years who completed the school-age Child Behavior Checklist (CBCL), the Adaptive Behavior Assessment System (ABAS-3), and an IQ test. Sex differences in CBCL, Childhood Autism Rating Scale (CARS), and adaptive behavior scores were compared using Mann-Whitney U tests. Chi-square tests were used to test for sex differences in the presence of an adaptive behavior deficit (i.e., an IQ gap; Duncan & Bishop, 2015). Linear regression tested the effects of internalizing and externalizing problems above and beyond age, sex, IQ, and CARS score on adaptive behavior.

**Results:** There were no significant differences between males and females in adaptive behavior standard score ( $U=4585.00, p=.308$ ), internalizing problems T-score ( $U=4656.00; p=.389$ ), externalizing problems T-score ( $U=4833.00; p=.642$ ), or CARS T-score ( $U=4528.00; p=.599$ ; see Table 1 and Figure 1). Mean scores of adaptive behavior (Males  $M=73.18, SD=11.28$ ; Females  $M=71.82, SD=10.43$ ) were in the low range (i.e., within 70-80) for both groups. The proportion of children with IQ-adaptive behavior deficits (79%) did not differ between males and females ( $\chi^2 [1, N=156]=.709, p=.40$ ). Age ( $b=-.55, t(223)=-2.37, p=.02$ ), IQ ( $b=.23, t(223)=6.53, p<.001$ ), and externalizing problems ( $b=-.22, t(229)=-2.96, p=.003$ ) significantly predicted adaptive behavior standard scores ( $F(6, 223)=9.83, p<.001$ ), with an adjusted  $R^2$  of .19 when holding sex, CARS score, and internalizing problems constant.

**Conclusions:** Males and females showed similar levels of overall adaptive behavior, internalizing and externalizing problems, and autism features. Notably, the mean adaptive behavior score was in the low range, with a gap between adaptive behavior and IQ present in most of the children regardless of sex. Other than age and IQ (Duncan & Bishop, 2015; Tillmann et al., 2019), little research has identified other measures associated with adaptive behavior. The current study suggests that externalizing behavior merits further investigation with future research identifying specific components of externalizing behavior that may predict adaptive behavior.

**409.028 (Poster)** Adaptive Functioning and Autism Symptomology As Correlates of DSM-5 Severity Levels in a Clinical Sample  
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**Background:** The diagnostic criteria for Autism Spectrum Disorder (ASD), as presented in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5; American Psychiatric Association, 2013), features level of support ratings for social communication (SC) and restrictive and repetitive behaviors (RRB). The specifiers require clinicians to delineate between three classifications: Level 1 ("Requiring support"), Level 2 ("Requiring substantial support"), and Level 3 ("Requiring very substantial support") in both SC and RRB. The DSM-5 descriptions of SC and RRB levels of support are conceptual in nature, but research supports clinical characteristics related to levels of support including intellectual and adaptive functioning, and scores on autism-specific measures (e.g., ADOS-2). Higher levels of support for SC and RRB domains have been associated with intellectual impairment, delayed adaptive skills, and elevated scores on autism-specific measures.

**Objectives:** The purpose of the current study is to determine how individuals with mixed levels of impairments across adaptive and ASD symptomology were classified by DSM-5 levels of support in both SC and RRB as a result of a comprehensive diagnostic evaluation.

**Methods:** Adaptive and autism symptomology scores were contrasted across SC and RRB groups for 158 children (mean age = 41.28 months; 80.8% male) with ASD diagnosed at an academic medical center. Adaptive functioning was measured by the parent report Adaptive Behavior Assessment System, Third Edition (ABAS-3; Harrison & Oakland, 2015). Autism-specific symptomology was assessed using the Childhood Autism Rating Scale, Second Edition (CARS-2; Schopler et al., 2010). Autism diagnoses and levels of support for SC and RRB were determined by an interdisciplinary assessment team.

**Results:** Approximately 81.4% of autistic children were identified as needing Level 3 support in SC and RRB. A chi-square test of independence revealed a significant relationship between SC and RRB coding,  $\chi^2(4, N = 158) = 84.03, p < .001$ , and no individuals were identified as needing RRB Level 1 support, and SC Level 3 support. Two children were identified as needing RRB Level 3 support and SC Level 1 support. After excluding multivariate and univariate outliers, 158 participants were available for multivariate analysis of variance (MANOVA) and direct discriminant analysis (DDA). MANOVA and DDA revealed both SC and RRB groups showed a graded pattern of higher adaptation/lower autism severity to lower adaptation/higher autism severity from Level 1 to Level 3.

**Conclusions:** DSM-5 criteria for determining levels of support in SC and RRB currently lack explicit guidance or practice recommendations for distinguishing between levels based on quantifiable data. The present study contrasted adaptive scores and autism-specific symptomology across SC and RRB groups in a clinical sample. The majority of children were identified as needing Level 3 support for both SC and RRB, and two were rated as needing a combination of Level 1/Level 3 supports across domains. A graded pattern of higher adaptation/lower autism severity to lower adaptation/higher autism severity from Level 1 to Level 3 was found across SC and RRB domains. Findings identify quantifiable clinical factors that may be helpful in determining appropriate levels of support when diagnosing ASD.

**409.029 (Poster)** Age and Gender Implications on the Symptom Presentation for Autism  
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**Background:** Prevalence rates (CDC, 2018) suggest 1 in 38 males and 1 in 152 females have an autism diagnosis, a significant discrepancy based on gender. The most consistently reported differences in diagnostic symptoms are apparent in the Restricted, Repetitive Behaviors and Interests (RRBs) category. For example, Hiller and colleagues (2014) found that a child was 10 more times likely to be a girl than a boy if they did not meet threshold for RRBs on diagnostic criteria. It has been theorized that this lack of representation in diagnosis may be due to a phenomenon called "camouflaging" where females mask their autistic difficulties, thereby making a diagnosis harder to ascertain.

**Objectives:** This study examines symptom presentation and diagnostic differences between males and females evaluated for autism. Furthermore, research questions examined the potential influence of gender and/or age on meeting specific diagnostic criteria for diagnosis of autism as well as co-existing mental health conditions.

**Methods:** We conducted a retrospective chart review for 2,044 children and adolescents referred for interdisciplinary autism evaluation at an academic medical center (mean age=6.13) that included autism assessments to determine the presence of DSM-5 criterion and diagnosis. A portion of the sample also included assessment of co-existing internalizing and externalizing symptoms and/or mental health disorders. The sample consists of primarily White (~65%; ~35% racial/ethnic minority) and male (75.1%, 24.9% female) individuals. We utilized descriptive statistics and Chi Square Tests to examine potential differences in referral rates, diagnoses, and presentation of autism related symptoms across age groups and gender.

**Results:** Overall referral rates were consistent with autism prevalence documented in the literature, ~75% of those referred were male as compared to ~25% female (Chi-squared=515.008,  $p < .001$ ). Although significant differences in the overall referral rates of males and females, rate of autism diagnosis within genders were relatively similar across the sample. Chi Square Tests revealed an age by gender interaction such that elementary aged females were significantly less likely to be referred as well as diagnosed compared to elementary aged males and that regardless of referral rates, females were more likely to be diagnosed than males within the high school age range. Females had higher rates of meeting DSM-5 Criteria A than males within their high school years. Contrary to hypotheses, females did not demonstrate higher rates of overall DSM-5 Criteria B across age ranges, however they were less likely to meet the individual criterion B3.

**Conclusions:** Initial findings suggest minimal gender differences across our sample in the proportion of autism diagnosis in males compared to females. There are however meaningful gender differences in rates of diagnosis considering age groups with school age females less likely to receive

a diagnosis and high school females more likely to receive the diagnosis. More research is needed to examine symptom presentation across age ranges and gender and diagnostic criteria. We anticipate that this could be due to the presentation of symptoms and that girls may start to present more “typical” autism symptoms as they age contributing to exacerbated social impairments and mental health concerns.

**409.030 (Poster)** Agreement of Parent-Reported Cognitive Level with Measured IQ Among Children with Autism Spectrum Disorder

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**Background:**

Cognitive ability is critical when examining behavior and causative factors in research on autism spectrum disorder (ASD), but many large-scale studies have inherent logistical and practical barriers to completing standardized cognitive testing. Alternatively, many studies have used parent-reported cognitive ability in place of direct testing; however, few studies have compared agreement of parent report with direct cognitive testing. Understanding the agreement of parent-reported cognitive ability with direct testing is important not only to the validity of large-scale studies but also to the implications for education and treatment choices families may make.

**Objectives:**

The purpose of this study is to evaluate the agreement between parent report and direct assessment of child cognitive abilities in a large cohort of individuals with ASD.

**Methods:**

1,555 children with ASD from the online SPARK study were included. Full-Scale IQ (FSIQ) scores from clinic medical records were compared to data from three parent-reported estimates of cognitive impairment: 1) diagnosis of intellectual disability (ID/Cognitive Impairment), 2) presence of cognitive delay (Cognitive Level), and 3) their estimate of the IQ test result if available (Cognitive Score). Parent report of an ID diagnosis, a “significantly below age level” on Cognitive Level, or a reported test result of IQ < 70 on Cognitive Score were coded as “matching” if consistent with their clinic records of IQ < 70. Binary logistic regression was used to explore how demographic factors, ASD symptoms on the Social Communication Questionnaire (SCQ), and adaptive skills on the Vineland Adaptive Behavior Scale (VABS) were associated with parental accuracy.

**Results:**

Participants were 81.74% male with a mean age of 6.9 years (SD 3.91). Parent report of Cognitive Score revealed the best agreement (74.13% with 317 responses), followed by Cognitive Level (64.10% with 780 responses) and ID/Cognitive Impairment (57.68% with 1,555 responses). Significant age differences were noted (age at survey and cognitive testing,  $ps < .0001$ ) with an increased agreement for children older than 5 years (68.81 – 76.21%). The SCQ total score and FSIQ significantly impact the agreement of ID/Cognitive Impairment ( $R^2 = 0.251$ ) with lower SCQ and higher FSIQ associated with the better agreement. Better adaptive skills, higher FSIQ, and lower verbal IQ are associated with better agreement on Cognitive Level ( $R^2 = 0.259$ ). Higher FSIQ and lower verbal IQ are associated with better agreement on Cognitive Score ( $R^2 = 0.413$ ).

**Conclusions:**

Parental accuracy in estimating their children’s cognitive level was shown to be generally good in a large online cohort, but dependent upon how cognitive ability was queried using survey methods. Child age, verbal IQ, and adaptive skills influenced the agreement between parent-reported and measured IQ. These findings suggest that parent-reported cognitive level can be an effective way to obtain an accurate estimate of whether cognitive impairment may be present, and different query methods will be more or less accurate depending on the characteristics of target samples. The implications of these findings, concerning the influence of a parent’s estimate of their child’s abilities upon treatment, education, and other life choices, warrant further study.

**409.031 (Poster)** An Exploration of a General Social Outcome Measure

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**Background:** Social skills impairments are central to several disabilities including autism spectrum disorder (ASD). Social skills deficits are linked to academic failures, antisocial behavior, drug abuse (Snyder et al, 2003), and may lead to increased risk for dropout and a higher rate of bullying at school (Zablotsky et al., 2014). To identify and/or develop social skills interventions to support students, reliable assessment tools that can be implemented with rigor and fidelity are necessary. There is a lack of assessment tools that are sensitive to social changes in an individual's behavior (Anagnostou et al., 2015; Salvia & Ysseldyke, 2007). In our presentation, we aim to present the psychometric properties of a performance-based assessment, the General Social Outcome Measure (GSOM) which evaluates the change in social skills performance for students receiving social competence intervention.

**Objectives:** The General Social Outcome Measure (GSOM) is a performance-based measurement tool that was designed to assess the change in social skills performance during and after the intervention for students with social skills challenges. In the current study, the psychometric properties of the GSOM, including a total score, and social communication domains (SCDs), were examined.

**Methods:** The data for the current study was obtained during a federally funded four-year cluster-randomized trial completed to evaluate the Social Competence Intervention. The participants for the study were recruited from 34 middle schools in one Midwestern state. A total of 283 middle school students participated in the study. The following measures were used in the study: General Social Outcome Measure (GSOM), Children's Communication Checklist-2 (CCC-2; Bishop, 2006), School Social Behavior Scales (SSBS; Merrell, 2002), Autism Diagnostics Observation Schedule-2 (ADOS-2; Lord, et al., 2012). Data analysis steps included psychometric analyses to determine reliability and validity as well as an exploratory analysis of groups differences on key variables.

**Results:** The data analysis established good internal consistency for the total GSOM score and for the conversational reciprocity construct. Correlational analyses were conducted with the GSOM and the CCC-2, SSBS, and the ADOS-2. A limited correlation was found between the GSOM and the SSBS and GSOM and CCC-2. A small but significant correlation was documented between the GSOM and the ADOS-2 with higher GSOM total scores (higher social competence) associated with lower ADOS-2 scores. Additional analyses found that individuals with different levels of symptomatology according to the ADOS-2 (moderate or high) differed significantly on the GSOM total score.

**Conclusions:** The results provide support for the reliability of the total GSOM, as well as the separate domain of Conversational Reciprocity. The GSOM could be utilized to monitor students' progress over time and allow making instructional decisions based on the results of the assessment (e.g., plan for the intervention, adjust/change the intervention, etc.). With the implementation of the GSOM, educators and clinicians have the opportunity to assess students' skills before the intervention and then right after it which allows them to adjust their instructional programming or clinical intervention and plan accordingly.

**409.032 (Poster)** Applying a Service Design Framework to Teleassessments: Incorporating Both Family and Assessor Points-of-View  
**L. V. Ibanez<sup>1</sup>, S. Scott<sup>2</sup>, N. Berger<sup>3</sup>, M. Petrucci<sup>4</sup>, D. M. Tagavi<sup>5</sup>, Y. G. Dai<sup>6</sup>, J. Birudavol<sup>7</sup>, A. Morelos<sup>7</sup>, C. Schubert<sup>8</sup>, A. Wainer<sup>8</sup>, B. R. Ingersoll<sup>9</sup>, A. S. Carter<sup>10</sup> and W. L. Stone<sup>11</sup>**, (1)UW READi Lab, Seattle, WA, (2)University of Washington, Seattle, WA, (3)Rush University Medical Center-AARTS Center, East Lansing, MI, (4)University of Massachusetts, Boston, MA, (5)University of California, Santa Barbara, Santa Barbara, CA, (6)University of Massachusetts- Boston, Boston, MA, (7)University of Massachusetts Boston, Boston, MA, (8)Department of Psychiatry, Rush University Medical Center, Chicago, IL, (9)Psychology, Michigan State University, East Lansing, MI, (10)Department of Psychology, University of Massachusetts Boston, Boston, MA, (11)Psychology, University of Washington, Seattle, WA

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#### Background:

The COVID-19 pandemic accelerated telehealth innovation and practices for ASD and social communication assessments, including the development of new/adapted protocols (Berger et al., 2020) to meet safety and social distancing demands. To optimize the adaptation of a new teleassessment protocol for both families and assessors, the current study applied a service design framework to maintain technical/construct validity, while maximizing feasibility (e.g., research logistics, technology set-up) and family acceptability (e.g., managing parent coaching/instructions and burden).

#### Objectives:

- Adapt teleassessment protocol from highly expert setting (lab with assessment team) to naturalistic environment (in-home with parent)
- Contribute a new teleassessment protocol, technology package, and approach for developing and evaluating such tools

#### Methods:

The service design approach focuses on developing a positive experience from the family point-of-view while addressing the technical rigor and feasibility needs from the assessor point-of-view, including the technological supports needed to facilitate the interactions between the two user types. The specific process comprises 3 primary and iterative stages: Discover/Ideate (scope the context and generate possible solutions), Develop/Adapt (converge on and refine solution), Deploy/Evaluate (pilot and receive feedback on solutions from end users). These stages were navigated in parallel for both the teleassessment and technology package and were transactional/interactive such that decisions made for each component influenced the other.

#### Results:

**Teleassessment protocol.** As part of Discover/Ideate stage, the assessor team re-examined key social-communication target outcomes (i.e., joint attention, imitation, intentional communication) and conducted an extensive comparative review of existing validated measures (e.g., Communication Play Protocol; Adamson & Bakeman, 2016) that parents would be able to implement in-home. In Develop/Adapt stage, the team converged on further modification of the CPP as the primary solution/approach. As a key step, the team engaged in role playing/internal rehearsal and script review to identify flow, parent instructions, toy sets, and related initial gaps in validity and feasibility. Finally, in Deploy/Evaluate stage, the teleassessment was piloted with families to generate observations about the elicited behaviors (including their frequency) for construct validity and obtain parent feedback on administration pain points such as instruction comprehension and manageability of toy sets.

**Technology video package.** In Discover/Ideate stage, the team identified existing high quality video recording systems originally developed for home security and educational research (i.e., Ubiquiti Technology; video conferencing w/ Kubi on iPads). Hardware was uniquely configured to support viability for teleassessments. In Develop/Adapt stage, both tech systems were piloted through role playing/internal rehearsal among different staff member homes to determine which package would maximize portability, set-up feasibility, camera angles, video quality, broadband accessibility and

to identify potential challenges once deployed in families' homes. Finally, in Deploy/Evaluate stage, a customized Ubiquiti configuration was piloted with families, along with the teleassessment, to closely examine system reliability and receive feedback on set-up feasibility

#### Conclusions:

As the field goes back to the "drawing board" to develop assessments that can be implemented using telehealth, a service design approach can optimize such tools to meet the needs of both families and assessors, which may lead to improved scalability in both research and "real-world" clinical settings.

#### **409.033 (Poster)** Autism Assessment from Home: Inter-Rater Reliability of the Remote, Caregiver-Facilitated CARS-2 Observation during COVID-19

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**Background:** The COVID-19 pandemic has resulted in an unparalleled dependence on telehealth. In particular, assessing autism spectrum disorder (ASD) remotely during COVID-19 has left providers in the field to use their best clinical judgment without reliable or validated remote observations that span childhood and adolescence. This is a critical gap given that evidence-based ASD assessment typically includes a direct observation measure in addition to a developmental interview with a caregiver. However, the gold-standard observation tool for in-person assessment (i.e., the Autism Diagnostic Observation Schedule – 2nd Edition [ADOS-2]) cannot be conducted validly via telehealth or with facial coverings in-person. As such, our team adapted the Childhood Autism Rating Scale, 2<sup>nd</sup> Edition (CARS-2) Observation for use as a remote, caregiver-facilitated observation during COVID-19.

**Objectives:** To demonstrate initial inter-rater reliability in clinician coding of the remote, caregiver-facilitated CARS-2 Observation.

**Methods:** Participants included 15 children (ages 2-13 years,  $M=7.92$ ; 33.3% female) who completed a caregiver-facilitated CARS-2 Observation from home as part of a broader tele-assessment pilot study. The CARS-2 Observation codes a brief play and interaction-based observation according to the first eight items of the CARS-2, each of which is coded on a 4-point scale (i.e., 1-4) with half-point increments. The clinician overseeing the administration for a given child coded the observation immediately after the administration. During a follow-up team meeting, a group of graduate trainees ( $n=3$ ) and a licensed clinical psychologist then watched the administration video together, each independently coded the administration, and then discussed discrepancies in their codes. This resulted in a set of eight consensus codes for each child's CARS-2 Observation. Inter-rater reliability was then calculated by comparing each of the codes selected by that child's clinician to each of the corresponding consensus codes determined by the full team and dividing by eight items. A clinician's code for an item was considered to be in agreement if it was within one-half point of the corresponding consensus code.

**Results:** Agreement between a clinicians' eight individual codes and each of the eight corresponding team consensus codes was 91.67% on average, ranging from 75 to 100%; their agreement with the group on their individual codes met or exceeded 87.5% (i.e., 7 of 8 items) for 13 of 15 participants. Intraclass correlation ( $ICC=.97$ ) was excellent between a clinician's total score and the team's consensus total score.

**Conclusions:** Reliable methods of remotely observing characteristics of autism have become more necessary during the COVID-19 pandemic, but remain invaluable tools for assessing hard-to-reach populations generally, such as families in rural locations or where providers are scarce. With the use of consensus coding, the current study demonstrated high reliability between raters on the caregiver-facilitated CARS-2 Observation. However, training materials and videos do not exist at present to train clinicians on these scoring procedures. As such, future work will focus on creating training materials for free and wide dissemination, which will allow clinicians to demonstrate their reliability in rating and operate as independent raters thereafter, thereby alleviating the need for lengthy consensus coding after each administration.

#### **409.034 (Poster)** Almost ASD : When Autistic Construction Is Incomplete and Quickly Reversed

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#### Background:

Accumulated evidence suggests that autism results from a diachronic process originating from genetic vulnerability and precipitated by diverse environmental constraints towards autistic mechanisms. Many clinical findings from the last 5 years from many practitioners describe incomplete autistic processes that are reversed quickly before the criteria of an ASD can be fully met.

**Objectives:** to describe a clinical population of children with incomplete clinical history of autism

#### Methods:

systematic review of clinical records of all children with developmental delays and learning challenges and survey of clinicians managing children with developmental problems in the region of Sousse and Monastir, Tunisia, over years 2018 to 2020

## Results:

Even though most of current diagnoses are ADHD, specific learning disorders or language developmental disorders, at least 10% of patients are found with a history of autistic symptoms between 1 and 2 years (mainly extensive repetitive play such as spinning or alignment, withdrawal, different degrees of echolalia or pronoun reversal, sensory overreaction, delayed pointing and other non verbal communication milestones). These symptoms often remain for some weeks or months and partially disappear. Often, clinician label these situations as autistic traits or broad autism phenotypes or use metaphors such as “your child touched autism and bounced back”

Conclusions: This population with border-line clinical picture can shed more light on vulnerability to ASD and its study may lead to important secondary prevention strategies

### **409.035** (Poster) Catatonia Associated with ASD: Correlates and Treatment Orientations

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## Background:

Although catatonia is found in 4 to 12% of patients with ASD, no clear recommendations are established regarding its assessment and treatment in the context of ASD. Its onset is often sudden and unexpected and adds an important burden to the management of the condition

## Objectives:

to describe clinical features, correlates, treatment and outcome of patients with ASD and catatonia

## Methods:

clinical case descriptions of the 4 patients with ASD that developed catatonia from the clinical population of University Hospital Fattouma Bourguiba, Monastir, Tunisia.

## Results:

Catatonia onset was at age 7 to 10 years, with a quick installation of motor symptoms such as “freezing” and keeping postures, important regression of language and interaction, and extreme slowness in daily routines. An episodic evolution was noted although without a specific time or season for catatonia. Treatment consisted in benzodiazepines (Lorazepam) and antipsychotics, with moderate improvements. Regardless of the previous developmental level, important losses in communication and cognitive skills persisted after catatonia

## Conclusions:

Catatonia is a serious condition complicating some cases with ASD that needs specific attention and care. Persistence of developmental losses and regressions after its improvement may mean that profound intricacies with autistic etiological mechanisms

### **409.036** (Poster) Characterization of ASD Symptomatology in Individuals with CHAMP1 Disorder

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## Background:

*CHAMP1* is a gene associated with chromosomal segregation and neurodevelopment. Mutations in *CHAMP1* are rare and result in intellectual disability, delayed speech, hypotonia, dysmorphic features, microcephaly, and over-friendly behavior. While a few studies have documented the phenotype of this rare disorder, no studies to date have characterized autism spectrum disorder (ASD) traits.

## Objectives:

To characterize ASD symptomatology in individuals with CHAMP1 disorder. We describe our remote diagnostic procedure and highlight measures of repetitive behavior and social inhibition.

## Methods:

Data was prospectively collected from eleven participants with CHAMP1 disorder between the ages of 1.6 to 28.3 years (10.7 ± 7.8).

A psychiatric evaluation, the Childhood Autism Rating Scale (CARS<sup>obs</sup>), the Autism Diagnostic Interview-Revised (ADI-R), the Social Responsiveness Scale, 2<sup>nd</sup> edition (SRS-2), and the Repetitive Behavior Scale- Revised (RBS-R) were used to identify features of autism. A best estimate ASD diagnosis was determined by a team of psychiatrists and psychologists to reach a DSM-5 consensus diagnosis.

#### Results:

Overall, 3/9 (33%) participants met DSM-5 criteria for ASD. Clinicians deferred one participant for later testing due to young age and another participant for later testing when in-person assessments are feasible.

On the CARS<sup>obs</sup>, 3 individuals met for severe ASD and 2 for mild-moderate ASD. Five participants did not surpass the threshold for ASD. The CARS<sup>obs</sup> correctly classified 80% of participants.

On the ADI-R, 7/10 participants surpassed the cutoff in all ADI-R domains. All 10 met cutoff in the Development domain, 9 in Restricted and Repetitive Behavior, 8 in Social, and 9/10 in Communication. The ADI-R correctly classified 70% of participants.

On the SRS-2, 5/10 participants' total T scores fell in the severe range, 3 in the moderate range, and 2 in the normal range. The mean total T score was  $73.5 \pm 11.4$ . The mean overall SRS-2 score for the three individuals with ASD was  $74.3 \pm 8.7$  and for the six without ASD was  $71.8 \pm 13.7$ . There was no significant difference in overall SRS-2 scores between those with and without ASD ( $p=1.00$ ).

Finally, on the RBS-R, the Total Raw Score ranged from 2 to 71 ( $29.4 \pm 19.8$ ) out of a maximum score of 129. The cohort had the highest scores in the Ritualistic domain, followed by the Restricted Behavior and Sameness Behavior domain. The mean Overall Repetitive Behavior score did not differ for the three participants with ASD ( $39.3 \pm 27.7$ ) and for the six without ASD ( $28.2 \pm 16.2$ ). There was no significant difference in overall RBS-R scores between the groups with and without ASD ( $p=0.714$ ).

#### Conclusions:

When in-person assessments are not feasible, remote administration of ASD diagnostic assessments provides useful metrics to determine diagnostic status for most participants. Autism features such as impaired social responsiveness and repetitive behaviors appeared at similar rates in individuals with CHAMP1 disorder regardless of autism status. Autism symptoms in individuals with CHAMP1 disorder require more in-depth evaluation to provide higher quality care. Further research with a larger sample and in-person phenotyping is needed to enhance our understanding of ASD in CHAMP1.

#### **409.037 (Poster)** Children with ASD Have Differences in Index-Level IQ Structure Despite Unaffected Full Scale IQ

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**Background:** It has long been known that individuals with ASD perform differently on IQ tests, showing both diagnosis-typical differences in some cognitive abilities compared to others, as well as overall greater variability across subscores. In particular, individuals with ASD have consistently demonstrated alterations in working memory and processing speed. The concept of IQ rests on empirical covariance among individual performance on various tasks (Spearman's  $g$ ), and increased subscore variability in ASD brings into question whether this construct is as relevant in ASD as in the broader population.

**Objectives:** Our goal was to examine how the factor structure of subtests functions in ASD and compares with the published scoring rubric, with the theoretical aim of understanding the relevance of Spearman's  $g$  in ASD and the practical aim of identifying needs for ASD-specific revisions to the scoring rubrics of IQ tests.

**Methods:** We conducted confirmatory factor analyses on three cohorts of 8-12-year-old children: children with ASD administered the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) (N=131), typically developing (TD) children administered the WISC-IV (N=209), and children with ASD administered the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V; N=83). Four factors were specified in all analyses. (WISC-V has five published index scores, and a five-factor analysis did not alter the conclusions below.) These data-driven factors were then compared to the manualized indices using Pearson correlation.

**Results:** All three cohorts showed strong correlations between data-derived  $g$  and FSIQ: WISC-V ASD group ( $r=0.98, p<0.01$ ), the WISC-IV ASD group ( $r=0.97, p<0.01$ ), and the WISC-IV typically developing group ( $r=0.96, p<0.01$ ). In the TD WISC-IV group, the data-driven factors were tightly correlated with the manual-derived indices. However, in the WISC-V ASD group (see Table 1) and the WISC-IV ASD group (see Table 2), the correlations between the data-driven factors and the manual-derived indices were weaker and did not have a 1:1 (factor-to-index) correspondence like the typically developing group. Instead, the Working Memory Index correlated with several data-driven factors.

**Conclusions:** The hierarchical structure of intelligence as implemented in the Wechsler tests does not fit neatly with empiric factorization of the ASD group. Working memory in particular plays a role in convoluting the published indices in the ASD group, which puts at risk clinical interpretations made from any single index score alone. The strong relationship between overall FSIQ scores and the data-driven  $g$  in all three groups, however, suggests soundness of the FSIQ score. These results could prompt ASD-specific redesign (e.g., refactoring) of Wechsler tests within ASD samples



and the subsequent study of the clinical relevance of any resulting index scores.

**409.038 (Poster)** Comparing Executive Functioning across Clinical Groups: ASD, ADHD, and ASD + ADHD

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**Background:** Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) are common childhood psychiatric diagnoses. Deficits in executive function (EF) abilities, which impact the way in which people respond to and interact with the world, have been frequently identified in children with both disorders. However, EF performance in comorbid ASD and ADHD (ASD + ADHD) has received less attention in research and literature.

**Objectives:** The current study explored EF performance on specific measures in a group of children ages 6:0 to 17:11 with ASD + ADHD compared to ASD or ADHD alone using data from comprehensive evaluations conducted at an outpatient clinic from October 2014 to March 2020. The impact of psychiatric medication status, cognitive ability, age, and sex on EF performance in clinical groups was also investigated.

**Methods:** The current study used deidentified archival data that were collected from comprehensive psychiatric diagnostic assessments conducted at an outpatient clinic during which children received diagnoses of ASD and/or ADHD. Assessments included data from an initial parent intake and additional assessment appointments. A variety of psychological assessments, including a cognitive measure, the WCST, BRIEF or BRIEF-2, and Conners-3, were administered by trained clinicians to appropriately answer diagnostic questions. There were 121 total participants, including 39 in the comorbid group, 31 in the ASD group, and 51 in the ADHD group.

**Results:** The results suggested that, overall, children with ASD tended to show the least EF impairment compared to ADHD and ASD + ADHD. The comorbid group generally exhibited the greatest EF impairment, though children with ADHD and ASD + ADHD exhibited more similar performance than compared with the ASD group. All groups exhibited clinically and/or statistically significant EF impairments compared to population norms.

**Conclusions:** These findings highlight the importance of adequately assessing for both ASD and ADHD in children, especially because of their high co-occurrence and potentially more complex symptom picture. While there are symptoms common in both ASD and ADHD that can be addressed through treatment, targeting EF deficits in ASD + ADHD may uniquely address a nexus of difficulties that are seen in both diagnoses alone and were generally demonstrated to feature greater impairment in the comorbid group. EF is related to a host of critical outcomes, such as those in the social, academic/educational, and vocational realms (Diamond, 2013; Miller & Hinshaw, 2010), highlighting the value of interventions in this area. The findings of this study suggest that clinicians should be aware that the EF profile of children with comorbid ASD + ADHD may be more impaired than these diagnoses alone, particularly on parent-report measures and when compared to ASD only. While EF difficulties are not diagnostic on their own, EF measures are often used during evaluations, and the results of this study help to further elucidate an EF profile for children with comorbid ASD + ADHD.

**409.039 (Poster)** Comparison of Age of Diagnosis and Sex Differences in Parent Report of Autism Characteristics

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**Background:**

Early diagnosis has been associated with better outcomes for children with autism spectrum disorder (ASD), but there is a group of children who receive an initial ASD diagnosis after preschool (Ozonoff et al., 2018). The children who receive an ASD diagnosis after the age of five includes girls, who typically receive an ASD diagnosis later than boys, as well as some boys whose difficulties perhaps only present as ASD as social demands exceed their abilities. Both these groups miss opportunities for early supports which could positively affect their developmental trajectories. It is critical that researchers and clinicians understand the characteristics of this later diagnosis group in order to identify the subtleties of their ASD.

**Objectives:**

The main objective of this study is to compare ASD symptomatology in girls and boys who receive an early diagnosis (between the ages of 3-6) to the ASD characteristics of boys and girls who receive their initial ASD diagnosis later (between the ages of 8-11). Information regarding the participants was collected through parental report using the Autism Diagnostic Interview-Revised (ADI-R: Rutter et al., 2003) at initial diagnosis in a similar number of boys and girls matched for chronological age and intellectual ability. The aim of this unique research is to identify which profiles relate to female ASD symptomatology and which are associated with a later diagnosis. It is possible that current diagnostic instruments are not sensitive enough to detect the subtleties of ASD symptoms in children who receive a later diagnosis, and given the fact that girls often receive an ASD diagnosis later than boys, the focus on sex differences is particularly informative.

**Methods:**

Eighty children were divided into four groups. Forty boys and 40 girls were matched on cognitive functioning and age; twenty boys and 20 girls received their initial ASD diagnosis between the ages of 3-5 (early diagnosis group), and 20 boys and 20 girls received their initial ASD diagnosis of autism between the ages of 8-11 (later diagnosis group). Analyses of group comparisons were performed between males and females and between early and later diagnosis, as well as for all four groups. All information was gathered from parents' report on the ADI-R.

**Results:**

Significant differences emerged on specific ADI-R items. Preschool-aged girls had fewer circumscribed interests than participants in all other groups. Girls of all ages offered more comfort and spontaneously imitated others' actions more than boys did. The only significant difference between the early and later diagnosis groups emerged in the communication domain, with significantly more pathology emerging in the early diagnosis group.

#### Conclusions:

The results of this study suggest that age and sex have a differential impact on ASD expression, with some items reflecting differences among boys and girls at all ages and others reflecting differences between early and later diagnosis. The reexamination of diagnostic profiles taking age of diagnosis and sex into account should be a research priority, in order to correctly diagnose boys and girls as early as possible.

#### **409.040 (Poster)** Compliance of ASD Management to International Guidelines in a Low-Income Country

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#### Background:

Recommendations in the areas of ASD (Autism Spectrum Disorder) are constantly evolving and changing based on advances in scientific research. In our Tunisian context, we are faced with cultural and financial barriers which often hamper the application of these Guidelines.

#### Objectives:

To Describe the management of patients diagnosed with ASD in the child psychiatry out-patient unite of Monastir, Tunisia, and to compare the results to international recommendations

#### Methods:

this is a retrospective descriptive study, covering all patients diagnosed with ASD during the years from 2010 to 2016, at the child psychiatry unit of Monastir, Tunisia. patients were identified using the consultation's digital archives. Data were collected via files' search. Five hundred eighty-seven patients were enrolled. Average age was  $4.02 \pm 2.3$  years; with two extremes 1 year and 19 years, with a sex ratio 4/1 predominantly male.

#### Results:

The diagnosis was made in all patients according to the DSM criteria (IV-R or 5 depending on the year of diagnosis). Only 22% of patients had an ADI-R and ADOS assessment. Screening by m-CHAT was carried out in 5% of patients. Neuropsychological evaluation was done in 25% of the cases. Karyotype was carried out in 67% of cases. 36% of the cases benefited from an EEG. Auditory evoked potential was prescribed in 35% of cases, brain imaging in 15% of cases and metabolic screening in 17% of cases. Parental guidance and modeling was carried out on all patients. Sixty percent of patients received speech therapy. Eighteen percent of cases had specialized education. Occupational therapy was done in 6% of cases. In 45% of cases a drug was prescribed to the patient.

#### Conclusions:

The current management in the child psychiatry consultation unit in Monastir, Tunisia, is far from being in line with international recommendations. These results emphasizes the importance of developing recommendations more suited to the financial and cultural reality of low-income countries.

#### **409.041 (Poster)** Confirmatory Factor Analysis of the CARS2-ST in Virtual Autism Evaluations with Measurement Invariance for White and Non-White Children

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**Background:** The CARS2-ST, which typically incorporates direct observation and caregiver interview, is frequently used to aid diagnostic decision-making in autism spectrum disorder (ASD) evaluations. With the COVID-19 pandemic, and the need to conduct such evaluations virtually, it is important to understand the utility of such an application of the CARS2-ST, compared to in-person observation. Specifically, understanding whether the factor structure of the CARS2-ST is similar, whether observations are completed virtually or in-person, can help elucidate its utility in identifying the range of symptoms contributing towards an ASD diagnosis. In addition, consideration of cultural factors (e.g., race, social norms) is important in understanding the validity of the CARS2-ST and its factor structure. We hypothesized that the factor structure of the virtual observation CARS2-ST would demonstrate similar model fit to the in-person CARS2-ST rating found by Moulton et al. (2019).

**Objectives:** We examined the Moulton et al. (2019) three-factor model for the CARS2-ST: Social Communication, Stereotyped Behaviors and Sensory Sensitivities, and Emotional Reactivity. Measurement invariance (MI) was utilized to determine the appropriateness of this model for groups of White and Non-White children.

**Methods:** Participants were 320 children ( $M_{Age} = 48.23$  months,  $SD_{Age} = 23.13$  months) who participated in online autism evaluations during the COVID-19 pandemic. Information used to complete the CARS2-ST was obtained via observation of a caregiver-administered, play-based assessment and a clinical interview with their caregiver. Confirmatory factor analysis (with the *lavaan* package in R) was used to test both a single-factor model and the Moulton et al. (2019) three-factor model. Full information maximum likelihood estimation was used. The sample was then split into White ( $n = 204$ ) and Non-White (e.g., Black, African American, Hispanic, Native American;  $n = 105$ ) groups; MI between these two groups was assessed at configural, metric, and scalar levels.

**Results:** The Moulton et al. (2019) three-factor model had a better fit than the single-factor model, using standard fit indices. Using the three-factor model to assess MI, both the White ( $CFI = 0.91$ ,  $TLI = 0.89$ ,  $RMSEA = 0.80$ ) and Non-White groups ( $CFI = 0.95$ ,  $TLI = 0.93$ ,  $RMSEA = 0.69$ ) demonstrated acceptable model fit. At the configural level, the data had acceptable model fit ( $CFI = 0.92$ ,  $TLI = 0.90$ ,  $RMSEA = 0.77$ ). Moving to the metric model showed acceptable change in model fit ( $\Delta CFI = -0.011$ ,  $\Delta RMSEA = 0.002$ ,  $\Delta SRMR = 0.017$ ) as did the scalar model ( $\Delta CFI = -0.003$ ,  $\Delta RMSEA = -0.002$ ,  $\Delta SRMR = 0.002$ ).

**Conclusions:** When completed based on virtual observations, scores on the CARS2-ST appear to adhere to the same factor structure as those based on in-person observations. This supports the validity of the CARS2-ST for use in ASD evaluations conducted virtually. For groups of White and Non-White children, this data suggests that the three-factor model of the CARS2-ST is appropriate and supports its use for these groups in virtual clinical autism evaluations. Further research should explore the suitability of the CARS2-ST in other groups and ways to further improve its construct validity across groups.

**409.042 (Poster)** Cross-Cultural Differences in Reporting Autistic Symptoms in Toddlers: A Study with the M-CHAT(-R) Data from Ten Countries D. Stevanovic<sup>1</sup>, M. Jiménez<sup>2</sup>, F. Costanzo<sup>3</sup>, E. Fucà<sup>4</sup>, G. Valeri<sup>5</sup>, S. Vicari<sup>6</sup>, H. Özek Erkan<sup>7</sup>, F. Yaylaci<sup>8</sup>, L. Albores-Gallo<sup>9</sup>, G. G. Gatica-Bahamonde<sup>10</sup>, M. Gabunia<sup>11</sup>, M. Zirkashvili<sup>12</sup>, T. Charman<sup>13</sup>, S. Ali Samadi<sup>14</sup>, T. H. Toh<sup>15</sup>, G. C. Windham<sup>16</sup>, L. Brennan<sup>17</sup>, T. Zorcec<sup>18</sup>, A. Auza<sup>19</sup>, M. V. de Jonge<sup>18</sup>, R. Knez<sup>19</sup> and D. L. Robins<sup>2</sup>, (1)Clinic for Neurology and Psychiatry for Children and Youth, Belgrade, Serbia, (2)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (3)Child and Adolescent Neuropsychiatry Unit, Bambino Gesù Children's Hospital, Rome, Italy, (4)Child and Adolescence Neuropsychiatry Unit, Department of Neuroscience, Children Hospital Bambino Gesù, Roma, Italy, (5)Dr Behcet Uz Children's Research and Training Hospital Child and Adolescent Psychiatry Unit, Izmir, Turkey, (6)Bursa Dörtcelik Children Hospital, Bursa, Turkey, (7)Hospital Psiquiátrico Infantil Dr. Juan N. Navarro. Secretaría de Salud, México, Mexico, (8)Mental Health Department, Universidad de la Frontera, Temuco, Chile, (9)Mental Health Center, Tbilisi, Georgia, (10)Ilia State University, Tbilisi, Georgia, (11)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (12)Institute of Nursing and Health Research, University of Ulster, Newtownabbey, Coleraine, Northern Ireland, United Kingdom, (13)Clinical Research Centre & Department of Pediatrics, Sibu Hospital, Ministry of Health, Sarawak, Malaysia, (14)Environmental Health Investigations Branch, California Department of Public Health, Richmond, CA, (15)University of Connecticut, Auburn, CT, (16)Department for Psychophysiology, University Children's Hospital, Skopje, Macedonia, The former Yugoslav Republic of, (17)Language and Cognition Laboratory, Hospital General Dr. Manuel Gea González, Mexico City, Mexico, (18)Faculty of Social Science, Education and Child Studies, Clinical neuroscience and developmental disorders, Leiden University, Leiden, Netherlands, (19)Department of Women's and Children's Health, Skaraborgs Hospital, Skövde, Sweden

**Background:** Evidence has emerged over the past decade that reporting autism spectrum disorder (ASD) symptoms with available instruments may vary across regional and linguistically diverse samples. The extent to which differences in reporting ASD symptoms are inherent characteristics of the disorder, reflected in the variability in responding across cultures, or the effects of differential measurements with these instruments across cultures is still unclear. The Modified Checklist for Autism in Toddlers (M-CHAT), and its revised form (M-CHAT-R), are the most frequently used ASD screeners in toddlers, even from low-resource regions, and one of the most promising instruments to identify ASD risk.

**Objectives:** The aim of this study was to evaluate the endorsement rates of the M-CHAT(-R) items by parents/caregivers of toddlers with ASD from ten countries: Albania, Chile, Georgia, Macedonia, Malaysia, Mexico, Serbia, Turkey, United Kingdom (UK), and the United States of America (USA).

**Methods:** Data were aggregated for toddlers aged 14 – 36 months who participated in previous studies or completed screening and evaluation for clinical purposes: Albania ( $n = 17$ ), Chile ( $n = 15$ ), Georgia ( $n = 189$ ), Macedonia ( $n = 95$ ), Malaysia ( $n = 52$ ), Mexico ( $n = 46$ ), Serbia ( $n = 30$ ), Turkey ( $n = 150$ ), UK ( $n = 28$ ), and USA ( $n = 312$ ). Item endorsement was classified as low ( $< 30\%$ ), moderate ( $30-60\%$ ), or high ( $> 60\%$ ).

**Results:** All items had a low endorsement rate in at least one country and moderate to high in others. There were 14 items with a moderate to high endorsement rate in seven to nine countries. Of these, seven items had moderate to high across nine countries: *point to show* and *understand what is said* had a high endorsement rate for six (and moderate for three); *follow your gaze* and *get parent to watch* had high for five (and moderate for four); and *point to get help*, *brings things to show*, and *follow a point* had a high for four (and moderate for five). The other items with frequent moderate or high endorsements were *interest in other children* (for 8 countries), *play pretend* (for 8), *imitate action* (for 8) *respond to name* (for 7), *unusual finger movements* (for 7), *hearing concerns* (for 7), and *social referencing* (for 8). Looking at performance within countries, Mexico had moderate or high endorsement on all 20 items; Albania, Georgia, Macedonia, Serbia, and Turkey had moderate or high endorsement on 14-17 items; Chile, UK, and USA had moderate or high endorsement on 11-12 items; and Malaysia only had moderate endorsement on one item (and low on all others).

**Conclusions:** There were differences in responding to M-CHAT(-R) items related to typical behaviors affected in toddlers with ASD as well as atypical behaviors common in ASD by parents/primary caregivers across ten countries, which may indicate cross-country variations in the recognition and evaluation of early autistic symptoms in toddlers. Items related to joint attention, imitation, social engagement, and language comprehension may be less variable and potentially interpreted as universal atypical behaviors in toddlers with ASD.

**409.043 (Poster)** Developing the Signposting Questionnaire for Autistic Adults (SQ-A Adult)

**Background:** Brief, self-report questionnaires are increasingly used to help clinicians identify adults who may require in-depth assessment for autism spectrum disorder (ASD), as well as facilitate research, where detailed clinical information about autistic participants may be lacking. However, many current questionnaires (e.g., the 10-item Autism-Spectrum Quotient; AQ-10) are limited as they 1) do not map onto the latest DSM-5 criteria, and 2) have been designed by non-autistic clinicians and/or researchers alone, and thus often contain items that do not reflect autistic people's lived experiences.

**Objectives:** We aimed to adapt the Signposting Questionnaire for Autism (SQ-A; Jones et al., 2020), a questionnaire based on the DSM-5 criteria for ASD and previously used with parents of children, into a self-report questionnaire for use in adults. Specifically, we designed the new questionnaire, termed the SQ-A Adult, with direct input from autistic adults.

**Methods:** The study had two key phases. In phase 1, 18 DSM-5 items from a valid clinical interview (the Diagnostic Interview for Social Communication Disorders; Wing et al., 2002) – known to highly discriminate between autistic and non-autistic people (Carrington et al., 2015) – were converted into an 18-item self-report questionnaire for adults (SQ-A Adult). Four autistic adults provided input to adapt the wording of the items to better reflect autistic people's lived experiences. Subsequently, in phase 2, a large online sample of autistic and non-autistic adults ( $N = 302$ ), matched on age, sex, and IQ, completed both the original and adapted versions of the questionnaire, as well as the AQ-10. Autistic adults additionally rated their preference for the original or adapted wording of each item on a 5-point Likert scale and gave qualitative responses for their reasoning, thereby providing further input into the development of the measure.

**Results:** Autistic adults scored significantly higher on both the original and adapted versions of the SQ-A Adult compared to non-autistic adults, and the adapted version showed greater discrimination between autistic and non-autistic groups. Both original and adapted SQ-A Adult scores were also positively associated with AQ-10 scores, thus demonstrating the questionnaire's construct validity. Finally, quantitative and qualitative content analyses showed that autistic adults generally preferred the wording of the adapted items as they better reflect their lived experiences (for example, they better reflect individuals' desire for social relationships, despite social difficulties).

**Conclusions:** The SQ-A Adult, using the adapted wording, has the potential to be a valid, clinically useful questionnaire to assist in the diagnostic process, and in research. Our findings also highlight the utility of incorporating autistic people's lived experiences into the development of such questionnaires. Further research is required in larger samples to ascertain the psychometric properties of the SQ-A Adult and thus recommend its use in clinical and research settings.

**409.044 (Poster)** Development of a Novel Questionnaire for Assessment of Visual Processing in Children with Neurodevelopmental Disorders  
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## Background:

Differences in visual processing are well-documented in autism. Visual symptoms such as light sensitivity or superior attention to visual detail may be experienced as detrimental or advantageous to quality of life. To our knowledge, no standardised parent-report measures exist that capture the range of visual behaviours seen in autistic children. Such a measure could aid mechanistic understanding of the association between visual processing and phenotypic behaviours, assist early diagnosis and guide intervention.

## Objectives:

To develop a valid and reliable parent-report measure (ViPro) that captures the breadth and specificity of visual behaviours seen in autistic children and adolescents.

## Methods:

The novel, 27-item ViPro questionnaire was developed following literature review and consultation with clinical and research neurodevelopment specialists. Using a cross-sectional design, ViPro was distributed via online survey to parents/carers ( $n=453$ ) of children, ages 4-15 years, with or without a neurodevelopmental condition (NDC). Established questionnaires measuring autism traits (SRS and AQ10) and response to visual input (5-item visual component from the SP2) were included in the survey. Reliability and exploratory factor analyses (EFA) of ViPro determined problematic items which were subsequently removed. A second sample of parents ( $n=160$ ) answered a revised 18-item ViPro, including 15 original items and 3 additional items following feedback from autistic individuals providing details of their visual experiences and parent consultation. Additional questionnaires measuring anxiety (SCAS), rigid and repetitive behaviour (RBQ2) and sleep patterns (CSDI) were also administered. Discriminant validity was assessed by comparing ViPro scores between diagnostic groups: ASD +/-ADHD; ADHD; and other (typically developing or neurodiverse but not ASD or ADHD). Construct validity of ViPro was ascertained via correlations with sensory and autism trait measures. EFA was conducted to determine factor structure and reliability.

## Results:

Factor analysis concluded to three-factors: visual hypersensitivity, detail-focus, and peripheral-vision stimulation. All factors had good internal consistency ( $\alpha = .78 - .82$ ) reflecting to the complete scale (.89). Importantly, significant group differences in mean ViPro total score were found, with the ASD group scoring higher than the ADHD group ( $U=1207$ ,  $p=.006$ ) and 'other' group ( $U=912$ ,  $p=.008$ ). Convergent validity was supported by a moderate significant correlation between RBQ2 and ViPro ( $r=.539$ ,  $p<.001$ ). Highly significant, albeit modest, correlations between total scores for the ViPro and the visual component of the SP2 ( $r=.340$ ,  $p<.001$ ), as well as the SRS ( $r=.368$ ,  $p<.001$ ) further indicates support for convergent validity with sensory and autism trait measures.

## Conclusions:

Analysis of the novel ViPro shows promising reliability and discriminant validity, suggesting visual behaviours characteristic of autism may be captured by this parent-report measure and quantitatively assessed. Involvement of the autistic community and broader support network in development of items has aided ViPro's acceptability and relevance. Future research should include confirmatory factor analysis to verify the three-factor structure observed and further validation in a large, neurodiverse paediatric population compared to typically-developing children.

### **409.045 (Poster)** Diagnosing Autism Spectrum Disorder in Phelan-Mcdermid Syndrome: Assessing the Utility of Gold-Standard Diagnostic Instruments

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**Background:** Phelan-McDermid syndrome (PMS) is a neurodevelopmental disorder resulting from the loss of function of the *SHANK3* gene. PMS is a relatively common cause of autism spectrum disorder (ASD) and intellectual disability, accounting for between 0.5% and 2.0% of cases (Costales & Kolevzon, 2015). The Autism Diagnostic Observation Schedule-2 (ADOS-2) is considered the gold-standard diagnostic tool for ASD, though final diagnosis is made through clinical judgement. The specificity of the ADOS-2 has been questioned in other disorders with intellectual delay as a prominent phenotype component. Particularly in patients with a mental age below 18 months, clinicians have advocated for metrics that better differentiate between intellectual delay and ASD-derived neurodivergence (Trelles & Thurm, 2018).

**Objectives:** This study aimed to assess (1) how diagnostic instruments function in correctly diagnosing ASD alongside clinical judgement, and (2) phenotypic differences between individuals with idiopathic ASD, non-ASD PMS, and ASD-related PMS.

**Methods:** Eighty-seven children participated, including 61 with iASD (51 males;  $M_{age}=X\ 6.42\pm2.96$  years), 8 with PMS without ASD (2 males;  $M_{age}=6.46\pm2.84$ ), and 17 with PMS and ASD (12 males;  $M_{age}=6.45\pm3.00$ ). All participants completed a full-length ADOS-2 assessment conducted by licensed clinicians. Between-group differences in ADOS-2 total and subscale scores were examined across iASD, PMS-only, and ASD+PMS groups. Sensitivity and Specificity of the ADOS-2 Assessment as a diagnostic tool was also calculated.

**Results:** Results yielded an overall sensitivity of 0.987 and specificity of 0.375 on the ADOS-2 assessment. Specifically, there were 5 false positives and 1 false negative (in the PMS+ASD group) among the 86 participants. Despite low specificity, there were significant differences among groups across all ADOS-2 subscales, total score, and comparison score ( $p<.01$ ), with the most marked contrasts in the Social Affect (SA) domain and on the Total Score. Within the SA domain, the PMS-only group ( $M=5.25\pm2.252$ ) scored significantly lower ( $p<.001$ ) than the iASD group ( $M=12.66\pm3.705$ ), while the PMS+ASD group ( $M=15.76$ ,  $SD=4.116$ ) scored significantly higher ( $p=.003$ ) than the iASD group. On the Total Score, the PMS+ASD group ( $M=20.12\pm5.278$ ) scored significantly higher ( $p=.043$ ) than the iASD group ( $M=17.52\pm4.603$ ), while the PMS-only ( $M=7.75\pm2.493$ ) scored significantly lower ( $p<.001$ ) than the iASD group.

**Conclusions:** These results suggest that while the ADOS-2 is a highly sensitive assessment, it poorly differentiates between non-ASD and ASD participants in a subset of individuals with PMS (specificity<0.8). The frequency of false positives reported in this sample suggest overdiagnosis of ASD in patients with other neurodevelopmental syndromes if ADOS-2 is used alone. The ADOS-2's low specificity rate may also explain such significant scoring differences between iASD and PMS+ASD groups. In trying to distinguish between ASD and other neurodevelopmental disorders, clinicians may perceive ASD symptom severity to be even higher in PMS patients who ultimately receive ASD diagnoses than in iASD individuals. This is most markedly the case with social behavior ratings. Overall, these results point towards the need for more precise diagnostic measures of ASD for use in complex behavioral syndromes such as PMS.

### **409.046 (Poster)** Diagnostic Discrepancies: Factors Associated with Unconfirmed/Inaccurate Community-Based ASD Diagnosis in a Research Referred Sample

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**Background:** Despite increased awareness of autism spectrum disorder (ASD) heterogeneity and improvements in diagnostic reliability, there is concern for under-diagnosis (Zuckerman et al., 2013), over-diagnosis (Hill, Zuckerman, & Fombonne, 2015; Skellern, Schluter, & McDowell, 2005),

and misdiagnosis (Lucinao et al., 2014). Diagnostic accuracy is crucial for targeting intervention, and inaccurate ASD diagnoses hamper efforts to characterize the disorder at the population-level.

**Objectives:** We describe children with community-based diagnoses of ASD in a research referred sample with confirmed/included ASD diagnoses (ASD+) and unconfirmed/excluded/inaccurate diagnoses (ASD-) and explore the clinical characteristics that differentiated the groups.

**Methods:** Participants were 232 children (M<sub>Age</sub> = 10.71 years; 19% female) recruited for a study examining brain functioning in ASD. Families completed a phone screening confirming they met eligibility criteria (i.e., prior formal diagnosis of ASD, fluent in English, and no intellectual disability). Diagnostic confirmation was ascertained via team consensus of expert ADOS-2 reliable clinicians using DSM-IV and DSM-5 after review of intake paperwork and standardized assessments protocols and video recordings. Children's demographic characteristics, psychiatric history, developmental history, and medication use were ascertained via caregiver report. Measures included questionnaires (SRS-2, CCC-2) and assessments (WISC-V, ADOS-2, ADI-R). Group differences between unconfirmed/excluded (ASD-) and included (ASD+) children were examined via chi-square or Fisher's exact tests for categorical variables, and t-tests or Kruskal-Wallis tests for continuous variables.

**Results:** Nearly half ( $n = 109$ ) of children with a community-based ASD diagnosis did not meet ASD criteria by expert consensus. ASD+ and ASD- groups did not differ in age, gender, ethnicity, or racial make-up ( $p$ 's  $> .20$ ). The ASD+ group was more likely to have a history of early language delays (33%) compared to the ASD- group (14.9%,  $p < 0.01$ ); however, no group differences in current functional language use were observed on parent report ( $p$ 's  $> 0.05$ ). The ASD+ group scored significantly higher on the ADOS-2 Social Affect, Restricted and Repetitive Behaviors and Total scores ( $p$ 's  $< 0.01$ ) and on calibrated severity scores (CSS;  $M = 7.64$ ,  $SD = 1.45$ ) relative to the ASD- group ( $M = 2.50$ ,  $SD = 1.93$ ,  $p < 0.01$ ). Additionally, ASD+ had greater elevations on the ADI-R total scores (88.6%) compared to the ASD- group (56%). No group differences emerged for SRS-2 scores ( $p$ 's  $> 0.23$ ). The ASD- group attained higher full-scale IQ scores ( $M(SD) = 106.57(19.08)$ ) compared to the ASD+ group ( $M(SD) = 97.64(21.59)$ ,  $p < 0.01$ ). The ASD- group had more psychiatric disorders ( $p < .01$ ), with higher rates of anxiety disorder, conduct disorder, and mood disorder diagnoses ( $p$ 's  $< 0.04$ ). No differences were demonstrated in current medication use ( $p = 0.69$ ).

**Conclusions:** Parent questionnaires (SRS-2, CCC-2) did not differentiate the groups suggesting more limited clinical utility when ASD is the referring/central question. Clinician mediated tools (ADI-R and ADOS-2) demonstrated higher scores among the ASD+ group and were sensitive, even in this group with high concerns and previous (suspect) diagnoses, suggesting utility in ASD clinical referral settings. Increased reported psychiatric disorders in the ASD- group suggests psychiatric complexity may contribute to misdiagnosis.

#### **409.047 (Poster) Differences in Children at Risk for Autism Detected By Screening Vs. Surveillance**

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#### **Background:**

Pediatric providers are often the first to identify whether a child is at risk for autism spectrum disorder (ASD) through the complementary processes of surveillance and screening. This project evaluates what factors in this process may relate to provider referrals and evaluation attendance.

#### **Objectives:**

This study 1) examined the likelihood of evaluation attendance after positive screen, provider concern (surveillance), or both, and 2) determined whether likelihood of endorsed provider concern for ASD is greater with more severe ASD symptomology or cognitive delays in children.

#### **Methods:**

7,040 toddlers (age 14.24–22.43 months) were screened at well-child visits across two multi-site studies examining early detection of ASD. During well-child visits, parents completed the Modified Checklist for Autism in Toddlers, Revised, with Follow-Up (M-CHAT-R/F) and providers had the opportunity to endorse ASD concerns. Children at risk for ASD ( $n=616$ ) from screen result, surveillance, or both were invited for an evaluation; 284 children attended the evaluation and were classified as ASD ( $n=141$ ) or non-ASD ( $n=143$ ). The Mullen Scales of Early Learning (MSEL) and the Autism Diagnostic Observation Schedule, 2<sup>nd</sup> Edition (ADOS-2) quantified cognitive abilities and ASD symptoms, respectively. ADOS-2 calibrated severity score (CSS) and MSEL early learning composite (ELC) scores were used.

#### **Results:**

There was a significant difference in evaluation attendance depending on referral source ( $X^2(2, n=616) = 39.79$ ,  $p < .001$ , *Cramer's V*=0.25). Pairwise comparisons indicated that attendance was significantly higher when both screen and concern indicated risk for ASD (65.97%) compared to when screen-only indicated risk (36.30%;  $X^2(1, n=549) = 39.95$ ,  $p < .001$ ,  $\phi=0.27$ ) or when provider-only indicated risk (35.82%;  $X^2(1, n=211) = 16.90$ ,  $p < .001$ ,  $\phi=0.28$ ). The difference in attendance based on screen-only and surveillance-only was not significant ( $p=.94$ ). The proportion of children with cognitive delay (i.e. MSEL ELC  $< 70$ ; see Figure 1) identified by provider concern (with or without at-risk screen) did not differ from screen-only ( $p=.18$ ). Providers were more likely to indicate concern for children with more severe ASD symptom severity whereas children in the screen-only group were more evenly divided among milder vs. more severe severity ( $X^2(1, n=272) = 6.70$ ,  $p=.01$ ,  $\phi=.16$ ); this was also true when examining ASD severity among the subgroup of children who received an ASD diagnosis ( $X^2(1, n=136) = 5.53$ ,  $p=.02$ ,  $\phi=.20$ ).

## Conclusions:

Our findings suggest that evaluation attendance increases when both screening and provider concern indicate risk compared to either modality alone. Providers may be more likely to encourage attendance and/or parents may be more aware of the need for evaluation when children are identified by both strategies. When examining symptom profiles in children identified by provider concern versus those detected by screen-only, cognitive impairment did not differ; however, providers were more likely to refer children with more severe ASD presentations, whereas screening identified cases across the spectrum of severity. These findings suggest providers may be missing milder presentations of ASD and, as a whole, highlights the importance of both providers and screening in the diagnostic process.

### **409.048 (Poster)** Differences in Reported and Observed Skills in Children with ASD from Multiplex and Simplex Families

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**Background:** Recent research suggests that children with Autism Spectrum Disorder (ASD) from multiplex families have greater cognitive functioning compared to children from simplex families (Berends et al., 2019). Other research indicates that similar differences may be detectable at evaluation with the Mullen Scales of Early Learning (MSEL; Dissanayake et al., 2019). Further research is needed to assess differences between multiplex and simplex children.

**Objectives:** (1) To replicate findings of previous research demonstrating cognitive advantages for multiplex children; and (2) to compare differences on screening and assessment tools in children from multiplex and simplex families.

**Methods:** Participants included 105 age and gender matched children who were screened and diagnosed with ASD as part of a parent study that investigated the effects of the Get SET Early Model (Pierce et al, 2021). Participants were split into three groups of 35: 1) multiplex; 2) simplex1 (i.e. ASD children without siblings); and 3) simplex2 (i.e. ASD children with siblings without ASD). The simplex families were split into two groups to examine the potential effects of siblings on development. Screenings were conducted between the ages of 9 and 36 months using the Communication and Symbolic Behavior Scales Developmental Profile Infant-Toddler Checklist (CSBS-ITC). While the upper age limit of the CSBS-ITC is 24 months, the parent study permitted the referral of children up to age 36 months; thus, CSBS-ITC data from children 24 to 36 months were included. Diagnoses were made by a licensed clinical psychologist and included the Autism Diagnostic Observation Schedule (ADOS), MSEL, and Vineland Adaptive Behavior Scales (VABS).

A Kruskal-Wallis test was used to compare ADOS calibrated severity scores among the three groups. Separate MANOVA models were used to examine the differences on the subscales (i.e. not global composite scores) of the CSBS-ITC, MSEL nonverbal and verbal developmental quotients (Stephens et al., 2018), and VABS.

**Results:** Statistically significant effects were not detected between the multiplex and simplex groups for the ADOS ( $\chi^2=0.57$ ,  $p=0.75$ ), MSEL developmental quotients (Pillai's Trace=0.04,  $p=0.410$ ), or VABS subscales ( $\lambda=0.93$ ,  $p=0.463$ ). A statistically significant global effect between mean CSBS-ITC subscale scores was identified among the three groups ( $\lambda=0.85$ ,  $p=0.014$ ). A post-hoc ANOVA revealed the effect to be associated with speech subscale ( $F(2, 99) = 3.11$ ,  $p=0.049$ ), with the multiplex group having significantly higher mean speech subscale scores than the simplex1 group ( $p=0.04$ , Cohen's  $d=0.545$ ; mean(SD) = 6.47(3.58) vs 4.56 (3.43), respectively).

**Conclusions:** In this sample there were no differences in MSEL developmental quotients, which differs from previous research. Findings suggest possible differences based on parent-reported speech skills among multiplex children compared to simplex1 children. These differences, however, were not found in a direct measurement of skills (i.e. MSEL developmental quotients). One possible explanation could be that parents from multiplex families have lower expectations for speech skills than simplex1 parents. Future research should examine discrepancies in parent reports of child language skills compared to direct assessments.

### **409.049 (Poster)** Differential Patterns of Response across Seven Dimensions of Risk on the First Years Inventory (FYIv3.1) Screening As Related to Autistic Traits at Age 3 in a Community Sample

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**Background:** The First Year(s) Inventory (FYI; v2.0, Turner-Brown et al., 2013) has demonstrated promise as an ASD risk screener in a community sample of 12-month-olds, due in part to the inclusion of prodromal sensory-regulatory markers in addition to traditional social-communication markers. The FYI, version 3.1 (Baranek et al., 2013) was expanded to a broader age range (6-18 months) and seven dimensions to better capture heterogeneity. Dimensions include: Communication, Imitation & Play (CIP); Social Attention & Affective Engagement (SAE); Sensory Hyperresponsiveness (HYPER); Sensory Hyporesponsiveness (HYPO); Self-regulation in Daily Routines (SREG); Sensory Interests, Repetitions, Seeking Behaviors (SIRS); and Motor Coordination and Milestones (MCM). However, these factors haven't been tested in relation to diagnostic outcomes.

**Objectives:** We examined scores on the seven FYIv3.1 risk dimensions to assess group differences in diagnostic and/or autistic traits at age 3.

**Methods:** FYIv3.1 surveys were collected via mail and online from parents (N=6,427) of infants (6-16 months), recruited through birth records in North Carolina. At age 3, parents (n=2211) completed the Developmental Concerns Questionnaire (regarding medical/developmental history/diagnoses) and Social Responsiveness Scale (to quantify autistic traits). Coding of outcome groups was: Group 1=Diagnosis of ASD and/or high ASD traits, Group 2=Other Diagnosis/Developmental Concerns, and Group 3=No reported diagnosis/concerns. ANOVAs were used to test group differences across dimensions, and describe differential patterns. Follow-up analysis explored heterogeneity in Group 1 by comparing those with a confirmed ASD diagnosis to those without, but with SRS-T score $\geq$ 60.

**Results:** Results indicated significant differences between groups across all seven dimensions (see Table 1) (all  $p < .05$ ). For six risk dimensions: Group 1>Group2>Group3; CIP dimension showed Group 1=Group2>Group 3. Next, (Table 2) we parsed Group 1 into two subgroups – (Group 1A) with ASD diagnoses (n=15), and (Group 1B) with high SRS traits but without ASD diagnoses (n=55), per parent report at age 3. Group 1A tended to have higher risk scores on CIP, SAE and MCM dimensions, but lower risk scores on HYPER, HYPO, SIRS and SREG. In Group 1B, although they were not currently diagnosed with ASD, ~75% were reported to have various developmental problems, most notably developmental delay and language delay.

**Conclusions:** Our findings indicate important differences in both amount and pattern of FYIv3.1 risk scores across outcome groups in this community sample. Six of seven dimensions discriminated Group 1 (ASD Diagnosis/Traits) from both other groups, whereas, Group 1 and 2 were statistically similar on CIP. Further, the subgroup of children (Group 1A) with confirmed ASD diagnoses by age 3 differed from the subgroup with high autistic traits but no diagnosis (Group 1B) with respect to higher social communication and motor problems, whereas, the opposite was true for sensory-regulatory risk scores. These findings suggest that current ASD screening methods with the general population may be missing early expressions of sensory-regulatory risk of children who have high ASD traits by age 3. Longitudinal follow-up is needed to assess how many children in Group 1B “age-in” to an ASD diagnosis and determine whether the FYIv3.1 screener may help decrease barriers to early diagnosis.

**409.050 (Poster)** Discordance Among Parents and Teachers with Self-Reports on Internalizing Problems in Children and Youth with Autism Spectrum Disorders

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**Background:** Co-occurring internalizing disorders (i.e., anxiety and depression) are common in youth with Autism Spectrum Disorder (ASD) thus it is essential for clinicians to quickly identify and treat associated symptoms. However, measurement of internalizing symptoms is complicated by continued debate about differences in phenomenology of anxiety and depression in youth with and without ASD, and poor agreement on standardized measures across respondents. Understanding possible differences in ratings across respondents and how that compares to self-report is important as clinicians are often faced with reconciling discrepant data from multiple sources.

**Objectives:** This was an exploratory study that aimed to examine the agreement between parent and teacher ratings of internalizing problems in younger and older children with ASD, and how those ratings predict self-report measures of anxiety and depression in older children with ASD.

**Methods:** The sample included 1,386 participants (78.2% male) with ASD ranging in age from 1 to 21 years old ( $M=8.41$ ,  $S=4.33$ ), with an average IQ of 90.25 ( $S=17.41$ ; 13.2% with  $FSIQ \leq 70$  and 1.3% with  $FSIQ \geq 130$ ). Data were normal (skewness and kurtosis  $< \pm 1$ ), and extreme outliers (i.e.,  $> 2$  standard deviations) were removed. All analyses were conducted using standard scores, and separately for two age groups (1.5-5 and 6-18). We conducted paired sample  $t$ -tests to determine whether parent ratings (from the Child Behavior Checklist; CBCL) were significantly different from teacher ratings (from the Teacher Report Form; TRF) for internalizing problems. A subsample of participants ( $n=687$ ) completed self-report measures of anxiety (Multidimensional Anxiety Scale for Children; MASC) and/or depression (Children's Depression Inventory; CDI). We conducted logistic regressions to assess if parent report or teacher report predicted self-reports of anxiety or depression.

**Results:** In 1.5-5 year old children, parents reported significantly more somatic complaints ( $t=2.447$ ,  $p<.05$ ) than teachers; whereas, in 6-18 year old children, parents reported significantly higher levels of every subscale of internalizing problems ( $p's<.05$ ) than teachers (Table 1). In older children, levels of self-reported anxiety and depression did not differ by gender or IQ ( $p's>.05$ ). Of the sample who completed self-report measures, 45.9% were at-risk for anxiety on the MASC (22.9% reached clinical threshold), and 40.3% were at-risk for depression on the CDI (15.3% reached clinical threshold). Teacher-reported internalizing problems and stress problems significantly predicted the likelihood that the individual would report themselves at-risk for anxiety on the MASC; whereas, no CBCL or TRF scores significantly predicted at-risk levels of depression on the CDI (Table 2).

**Conclusions:** In this large, well-characterized sample of children with ASD, we found more discordance between parent and teacher ratings of older children than younger children, with parents endorsing greater levels of internalizing problems than teachers. Parent report and teacher report of internalizing problems were largely not predictive of self-reported at-risk levels of anxiety and depression in older children. Clinicians should continue to utilize multiple informants when assessing internalizing problems in children and youth with ASD until rater agreement can be improved and interpretation of discrepant data is clarified.

**409.051 (Poster)** Discrepancies between Parent and Clinician Report of Autism Spectrum Disorder Features: Associations with Demographics, Diagnosis, and Intervention

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**Background:** The autism spectrum disorder (ASD) diagnostic process incorporates parent report and clinician observation (Neuhaus et al., 2017). However, discrepancies may arise between parent and clinician perceptions of ASD (Neuhaus et al., 2017; Ventola et al., 2006). Understanding factors associated with clinician-parent disagreement is important because discrepancies may impede access to care.

**Objectives:** This study explored how discrepancies between clinician and parent reports of ASD symptoms related to children's demographic background (i.e., sex, family income, race), age at first diagnosis, and amount of intervention received.

**Methods:** As part of the Autism Biomarkers Consortium for Clinical Trials (ABC-CT), 280 children with ASD (76.8% male, 67.9% white), ages 6 to 11 ( $M=8.5\pm1.64$  years), were assessed via the Autism Diagnostic Observation Schedule (ADOS-2; Lord et al., 2012) and the Social Responsiveness Scale (SRS-2; Constantino, 2012). Parents also reported family income, child's age at initial diagnosis, and number of hours of intervention their child received in the past six weeks. Clinician-parent discrepancy scores were calculated by subtracting SRS z-scores (parent report) from ADOS z-scores (clinician report). Mann Whitney U and Kruskal Wallis Tests were used to explore how discrepancies between parent and clinician ratings of ASD symptoms differed by race, sex, and family income. Relationships between clinician-parent symptom rating discrepancies and the child's age at first diagnosis, as well as the number of hours of intervention received, were examined using Spearman's correlations.

**Results:** Discrepancies between parent and clinician ratings of ASD symptoms did not differ by race or family income; however, they did differ by child sex ( $U=553.00$ ,  $p=.028$ ) such that, relative to clinicians, parents reported higher symptom levels for males ( $M=.10$ ) and lower symptom levels for females ( $M=-.38$ ). Discrepancies between the SRS Social Communication and Interaction domain and the ADOS Social Affect domain revealed a similar pattern ( $U=5408.50$ ,  $p=.014$ ;  $M=.12$  for males and  $M=-.40$  for females). Additionally, higher clinician ratings of overall ( $r(264)=-.20$ ,  $p=.001$ ) and social symptoms ( $r(264)=-.19$ ,  $p=.002$ ), relative to parent ratings, were associated with an earlier diagnosis. This pattern was also observed for intervention hours (overall [ $r(254)=-.19$ ,  $p=.003$ ], social [ $r(254)=-.20$ ,  $p=.001$ ]).

**Conclusions:** Findings suggest that agreement between clinician and parent ratings of ASD symptoms differs by child sex, with parent ratings lower than clinician ratings for boys and higher than clinician ratings for girls. This study cannot differentiate whether these findings reflect parental under-report in boys and over-report in girls or clinicians overlooking female symptoms, potentially due to 'social camouflaging' (Dean et al., 2017). Both clinicians and parents may benefit from a deeper understanding of how ASD presents differently in boys and girls. Another major finding was that higher clinician ratings of ASD symptoms, relative to parent ratings, was correlated with an earlier diagnosis age and a greater number of intervention hours. These results emphasize the importance of clinician evaluation in facilitating support for children with ASD. The lack of other demographic differences may reflect the homogeneity of the present sample and should be revisited in more diverse samples.

#### 409.052 (Poster) Do Behavioral and Parent-Reported Measures of Sensory Filtering in Autism Match?

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**Background:** Sensory responsivity and filtering differences are commonly associated with autism. Sensory issues have been hypothesized to influence many other aspects of autism, such as social communication skills, restricted and repeated behaviors and interests, and motor stereotypies (Sinclair et al., 2017). Clinically, sensory issues are usually evaluated through parent questionnaires, though behavioural measures of sensory processing are available in laboratory settings. Specifically, the acoustic startle response is used to measure acoustic reactivity, pre-pulse inhibition, and habituation, all of which are measures of sensory filtering. The startle response is a reflexive muscular reactivity to an acoustic stimulus measured by the strength of an eyeblink (Takahashi et al., 2014). To date, however, it is unknown how sensory responsivity and sensory filtering measured through parental reports and through the startle response relate.

**Objectives:** The objective of this study is to use both parent report and the acoustic startle paradigm to examine sensory gating differences in autism, and to directly compare behavioral and parent-reported measures.

**Methods:** Autistic ( $n=14$ ) and neurotypical ( $n=13$ ) school-aged children completed an auditory startle task to assess the acoustic startle response, habituation, and pre-pulse inhibition (Figure 1). Participants listened passively to a series of pulses ranging from 65db to 105db while watching a silent video. The startle response is measured through the eyeblink by electromyogram (EMG) of the muscles under the eye. An increase in EMG magnitude reflects an increase in startle response. Parents completed the Short Sensory Profile questionnaire. The startle magnitude was correlated with the auditory filtering and auditory/visual sensitivity sections of the short sensory profile.

**Results:** The sample included autistic ( $n=14$ ) and neurotypical children ( $n=13$ ). The autistic children displayed significantly increased startle ( $M_{ASD}=290\pm21.57$ ,  $M_{NT}=172.69\pm30.23$ ,  $p=0.005$ ) compared to neurotypicals (Figure 2), but there were no significant differences in habituation and pre-pulse inhibition. Moreover, the autistic children scored lower in the total short sensory profile ( $M_{ASD}=124\pm5.89$ ,  $M_{NT}=145.25\pm6.66$ ,  $p<0.001$ ) and the auditory filtering section specifically ( $M_{ASD}=18.38\pm1.43$ ,  $M_{NT}=25.38\pm1.03$ ,  $p<0.001$ ). Moreover, individuals showing stronger startle responses were also rated as having significantly more sensory issues by their parents overall ( $n=15$ ,  $r=-0.634$ ,  $p=0.011$ ), and a trend towards showing difficulties in auditory filtering based on parent reports ( $n=26$ ,  $r=-0.363$ ,  $p=0.069$ ).

**Conclusions:** It is important to ensure that behavioral, lab-based measures of sensory filtering map onto existing clinical measures. Here, both parent reports and the startle task confirmed the presence of sensory processing alterations in autism. Importantly, the negative correlation between SSP score and startle indicate that children whose parent reports indicated more sensory issues also had increased startle response. The lab-based startle measures thus confirm the subjective parent-reports and provide guidance for future research into the startle pathway. Previous research indicates

auditory filtering issues may relate to alterations in the brainstem (Seif et al., 2021), which overlaps the sensorimotor interface of the startle pathway. Future research should investigate the startle pathway for mechanism of disruptions which could inform us about the neurobiological underpinnings of autism, which could inform the development of targeted supports.

**409.053 (Poster)** Early Autism Adaptive Behavior Subtypes Differ in Verbal, Non-Verbal, and Motor Developmental Trajectories over the First 6 Years of Life

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**Background:** One of the major goals of precision medicine in psychiatry is to develop clinically meaningful stratification tools for more individualized intervention strategies. Adaptive behavior, measured by the Vineland Adaptive Behaviors Scales (VABS), is considered a key treatment target in interventions for autism. Stratification tools applied on the VABS may help facilitate intervention work to understand variability in treatment response in clinical trials.

**Objectives:** We developed a highly generalizable developmentally meaningful stratification model of autism using one snapshot of the VABS at early ages (<72 months) to make accurate out-of-sample predictions. Next, we tested whether the subtypes identified by our model differ from each other in terms of developmental trajectories through the first 5 years of life.

**Methods:** We developed a stratification model of adaptive behavior using a large dataset of VABS identified in 1098 autistic individuals aged 0-72 months within the National Database for Autism Research (NDAR). Standardized scores from the four subscales of VABS (Communication, Daily Living Skills, Socialization, Motor) were used as input features for our model. We applied an unsupervised clustering algorithm (k-means) within a context of relative clustering validation to ensure reproducibility of the clustering solution (Landi et al., 2021). Subsequently, we tested the newly discovered clusters for differences in developmental trajectories. With a k-nearest neighbor classifier trained on NDAR data we applied subtype labels to a new dataset of 1216 autistic children aged 0-72 months who participated in a longitudinal study at University of California San Diego (UCSD). These children were administered with VABS at T1, together with Mullen Scales of Early Learning (MSEL) collected at multiple time points after T1 within the first 5 years of life. Longitudinal trajectories of MSEL domains (Visual Receptive -VR, Fine motor -FM, Receptive Language -RL, Expressive Language -EL) were modeled with linear mixed effect models with random intercepts and slopes for the effect of age grouped by participant and fixed effects of age and subtype, along with their interaction.

**Results:** Our stratification model, trained on the NDAR dataset identified 3 clusters of autism adaptive functioning with high out-of-sample prediction accuracy (97%). Applying this model to UCSD dataset, we find age\*subtype interactions for every MSEL domain (VR:  $F=23$ ,  $p<0.001$ ; FM:  $F=14$ ,  $p<0.001$ ; RL:  $F=13$ ,  $p<0.001$ ; EL:  $F=31$ ,  $p<0.001$ ), indicating that VABS subtypes differ significantly in their longitudinal trajectories. Combining our subtype model with VABS norm cutoffs, we were able to significantly improve prediction models of developmental trajectories over and above a range of other comparison models (e.g.,  $\Delta AIC>80$ ).

**Conclusions:** Unsupervised clustering of adaptive behavior in autism yields consistent and reproducible subtypes that highly differ in their developmental trajectories across verbal, non-verbal and motor domains. This subtyping model can be utilized for out-of-sample predictions in new data and will be applicable via a web application for facilitating future research on adaptive behavior subtyping in autism.

**409.054 (Poster)** Early Reading and Linguistic Indicators for Daughters with Delayed or Missed Diagnosis of Autism Spectrum Disorder  
*D. F. Stovall<sup>1</sup>, M. Gillies<sup>2</sup>, E. A. Cutrer-Parraga<sup>3</sup>, C. Yaccarino<sup>3</sup> and R. A. Lundwall<sup>4</sup>, (1)Psychology, Brigham Young University Psychology Department, Provo, UT, (2)Brigham Young University, Provo, UT, (3)Counseling Psychology and Special Education, Brigham Young University, Provo, UT, (4)Psychology & Neuroscience, Brigham Young University, Provo, UT*

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**Background:** The ratio of male to female diagnosis in autism spectrum disorder (ASD) is 3 to 1, indicating a possible gender bias in assessment protocol. This disparity has led researchers to propose that females are misdiagnosed or underdiagnosed due to their natural propensity to “camouflage” autistic traits. These females need early, accurate detection to improve quality of life.

**Objectives:** This study attempts to find common early reading and linguistic traits among females with autism (and possible delayed or missed ASD diagnosis) to help pave the way for female-specific identifiers of ASD.

**Methods:** Our sample consisted of 21 parents whose daughters participated in a larger study investigating life experiences of females (aged 14+) with autism or autistic traits. The Broad Autism Phenotype Score (BAP-Q) was administered to potential participants, and parents were contacted to schedule 30–60-minute recorded interviews. Semi-structured interviews followed a guided protocol allowing for reflection and probing to ascertain pertinent developmental background information. The interviewer maintained deliberate naivete to diminish presumptions and preserve openness for unforeseen findings. Recordings of interviews were transcribed verbatim. Interpretative Phenomenological Analysis (IPA) was employed as a qualitative measure to analyze responses for interpretation of data. In phase one, transcriptions were reviewed by the research team to identify patterns. Data were compiled into two a priori codes: (a) early language development progression, and (b) early language development skills. Further organization of data was aided through process-coding to catalogue recurrent actions. Following within-case analyses, cross-case analyses were conducted in phase 2. Multiple rounds of revision led to the emergence of themes embodied in the data.

**Results:** Two overarching themes captured the data: (a) parents reported early reading development, and (b) parents reported advanced fluency in word level reading while acknowledging lagging comprehension skills (especially regarding the emotions and motivations of story characters). All participants, except one, reported literacy developing early (the remaining participant reported typical reading development). Most parents perceived their daughters to be voracious readers, demonstrating advanced and/or above grade-level ability. This finding was coupled with sleep issues and missed social opportunities. Despite a perceived hyper focus on reading, many parents indicated a concern for lack of comprehension, a need for speech therapy, and a distaste for conversation in general. Reading comprehension dominated as the most challenging domain of early literacy development. This was apparent in a struggle to identify emotions and connect with characters, a tendency to take language and characters literally, lack of general comprehension, and an obsessive propensity for one singular genre.

**Conclusions:** This exploratory study was successful in identifying common literacy and linguistic traits among daughters with delayed or missed ASD diagnosis. Our findings are consistent with previous findings of less coherent narrative production in story recall (Diehl, 2006) and overall lower reading comprehension amongst children with autism (McIntyre et.al., 2107). Early identification of autism in females may benefit from prompt detection of early, voracious readers who lack associated advanced level comprehension.

**409.055 (Poster)** Autism Observation Scale for Infants: Systematic Review and Meta-Analysis in Samples at Increased Likelihood of Autism Spectrum Disorders

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**Background:** The Autism Observation Scale for Infants (AOSI) has been used in many studies to investigate early features of children with an increased likelihood (IL) of a later diagnosis of autism spectrum disorder (ASD). Studies from independent research groups have evaluated its use in IL infant siblings (younger siblings of the children with ASD), with more recent studies examining its use in other IL populations.

**Objectives:** To assess the discriminative and predictive utility of the AOSI across different IL populations.

**Methods:** A systematic review and meta-analysis was conducted to provide an in-depth examination of current research investigating the use of the AOSI in IL infants. A search for relevant articles was conducted across four databases: CINAHL, PubMed, JSTOR, and Web of Science, with articles independently reviewed for inclusion and exclusion criteria by two reviewers.

**Results:** Searches resulted in a total of 276 articles, with 11 articles meeting inclusion criteria. Four IL infant populations were assessed across these studies: younger siblings of children diagnosed with ASD, as well as infants with Fragile X Syndrome (FXS), Tuberous Sclerosis Complex (TSC), and Down Syndrome. There were three main findings. First, five studies reported individual classification properties, yet they were not analyzed using a consistent approach. Second, across studies, stable group differences emerged between IL non-ASD, IL-ASD, and typically developing (control) samples beginning at 12 months of age. Third, meta-analyses resulted in a large effect size for comparisons between typically developing control and IL-ASD samples and a moderate effect size for comparisons of IL non-ASD and IL-ASD samples.

**Conclusions:** Utility of the AOSI to identify early signs of ASD was demonstrated in IL populations, including infant siblings of children diagnosed with ASD, FXS, TSC, and Down Syndrome.

**409.056 (Poster)** Gaze-Based Features Extracted Via Computer Vision Are Differentially Correlated with Parent-Report Measures of Autism-Related Behaviors and Internalizing and Externalizing Behaviors

**M. Coffman<sup>1</sup>**, A. Rieder<sup>2</sup>, J. M. Di Martino<sup>3</sup>, R. E. Aiello<sup>4</sup>, K. L. Carpenter<sup>1</sup>, Z. Chang<sup>3</sup>, S. Compton<sup>1</sup>, N. O. Davis<sup>4</sup>, S. Espinosa<sup>2</sup>, J. Flowers<sup>1</sup>, L. Franz<sup>5</sup>, J. Howard<sup>1</sup>, S. Perochon<sup>1</sup>, P. R. Krishnappa Babu<sup>1</sup>, M. Spanos<sup>1</sup>, S. Vermeer<sup>5</sup>, C. A. Wall<sup>6</sup>, G. Sapiro<sup>3</sup>, G. Dawson<sup>1</sup> and S. Yang<sup>7</sup>, (1)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (2)Duke Global Health Institute, Duke University, Durham, NC, (3)Department of Electrical and Computer Engineering, Duke University, Durham, NC, (4)Department of Psychiatry and Behavioral Sciences, Duke ADHD Program, Duke University Medical Center, Durham, NC, (5)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (6)Department of Psychology, Duke University Medical Center, Columbia, SC, (7)Duke Center for Autism and Brain Development, Durham, NC

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**Background:**

Digital phenotyping via computer vision analysis (CVA) has potential to provide objective, scalable, and reproducible measures of autism-related behaviors. The *SenseToKnow* (S2K) application was developed to capture and quantify digital phenotypes associated with child behavior and engagement with movies and games displayed on a tablet. S2K was designed to strategically assess social, cognitive, and motor behaviors associated with autism, including patterns of eye gaze. Elucidating gaze patterns is a promising approach to autism screening, outcome monitoring, and differentiation from common comorbidities. However, measuring eye gaze has previously been limited to laboratory settings, requiring costly equipment and trained personnel. Understanding whether measures of eye gaze quantified via CVA are correlated with well-established caregiver report and clinician measures of autism-related behaviors is an essential next step in establishing the validity of a digital phenotyping approach.

**Objectives:**

The present project extended prior work by examining the relation between parent-report measures of autism-related behaviors and internalizing and externalizing behaviors and gaze features quantified via CVA.

## Methods:

Toddlers 17-36 months old (N=426) were invited to participate in the study during their well-child visit. 43 toddlers were diagnosed with autism based on the ADOS-2 and ADI-R and 20 toddlers were diagnosed with developmental and/or language delay (DDLD). In standard clinical settings, children watched S2K while their upper body and face were recorded using the tablet embedded camera (Chang, Z. *et al.* 2021). Three gaze-based features were extracted while the toddlers watched three stimuli (see Figure 1). We estimated the proportion of time children looked at the right side of the screen (which, depending on the stimuli, corresponds to attention to the social or non-social part of the stimuli, referred to as social/non-social gaze). The third stimulus consisted of two women conversing, from which we derived a feature representing the correlation between participant gaze and pattern of speech over time (gaze-speech correlation). We analyzed these digital phenotypes based on CVA features and compared their distribution with clinical measures of autism and internalizing and externalizing behaviors based on parent-report measures, namely, the Modified Checklist for Autism-Revised with Follow Up (M-CHAT-R/F), Social Responsiveness Scale – 2 (SRS-2) and the Child Behavior Checklist (CBCL).

## Results:

Significant correlations were observed between the SRS total score and S2K digital phenotypes of non-social gaze, social gaze and gaze-speech correlation. On the CBCL, significant correlations were observed between internalizing behaviors and nonsocial gaze, social gaze, and gaze-speech correlation and between externalizing behaviors on the CBCL and non-social gaze and gaze-speech correlations (Table 1). Figure 1 illustrates the distribution of participants for three CVA features: social gaze, non-social gaze, and gaze-speech correlation (horizontal axis), and the SRS/CBCL total score.

## Conclusions:

Parent-report measures of autism-related behaviors and internalizing behaviors were positively associated with gaze towards the non-social side of the stimuli whereas externalizing behaviors negatively associated with the gaze correlation with speech. Notably, correlations between gaze patterns and behavior were stronger for autism-related behaviors, as compared to behaviors related to internalizing and externalizing symptoms, providing suggestive evidence of convergent validity.

### 409.057 (Poster) Test-Retest Reliability of Social Attention Measures from a Digital Phenotyping Application

**K. L. Carpenter<sup>1</sup>**, C. Sullivan<sup>2</sup>, J. M. Di Martino<sup>3</sup>, Z. Chang<sup>3</sup>, S. Perochon<sup>3</sup>, P. R. Krishnappa Babu<sup>3</sup>, D. Y. Isaev<sup>4</sup>, J. A. Summers<sup>2</sup>, K. Washington<sup>1</sup>, M. Sabatos-DeVito<sup>5</sup>, G. Sapiro<sup>3</sup> and G. Dawson<sup>1</sup>, (1)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (2)Duke University, Durham, NC, (3)Department of Electrical and Computer Engineering, Duke University, Durham, NC, (4)Duke Center for Autism and Brain Development, Durham, NC, (5)Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC

**Background:** Behavioral assessments of young autistic children currently rely on subjective clinical ratings and caregiver reports. These measures are influenced by expectancy, often lack granularity and sensitivity to change, and require labor-intensive coding. There is a need for objective, scalable, and quantitative behavioral assessments that can be used to complement clinician ratings and caregiver report. We developed the *SenseToKnow-Toddler-Preschool* (S2K-TP) application that can be administered on a smartphone or tablet. S2K-TP consists of brief, developmentally appropriate, engaging movies that contain naturalistic, dynamic social and nonsocial stimuli and take less than 10 minutes to deliver. The child's responses are recorded via the frontal camera embedded in the device and computer vision analysis (CVA) is used to quantify the child's behavioral responses automatically. In previous studies, we have demonstrated that S2K-TP can quantify several digital phenotypes, including those based on gaze, facial expressions, responding to name, and postural patterns.

**Objectives:** To assess the test-retest reliability of gaze features derived from the S2K-TP app.

**Methods:** We assessed test-retest reliability of two types of gaze features measure by the S2K-TP app, one feature related to the amount of gaze directed toward the social elements in the movie and a second feature related to the coordination between gaze and the speech patterns of actors in the movie (see Chang *et al.*, 2021).<sup>1</sup> The sample was 102 children ages 40.8-98.7 months, 62 of which were diagnosed with autism spectrum disorder via ADOS and ADI-R. Children received a second S2K-TP administration between 1 and 55 days after their first administration. Test-retest reliability was computed with the *psych* package in RStudio with the "testRetest" and "ICC" functions. Impact of time and multiple visits were inspected with the *lme4* package "lmer" function.

**Results:** Within-subject test-retest reliability of response patterns over items (rrq) was high (mean = .99 [SD = .03]; range = .80-.99). The ICC between visits for individual CVA features was .60-.80. Days between visits in the tested range did not affect outcomes. Preliminary analyses suggest there's not a difference between autistic and non-autistic children. Figure 1 illustrates the distribution of three gaze-based features during the first and second visit in the subset of autistic children.

**Conclusions:** These results describe the stability of the digital phenotypes captured by our novel S2K-TP application and suggest that gaze-based features can be extracted reliably across multiple administrations. Taken together, the objective nature of the digital features, the scalability of eliciting such behaviors using just an iPad or an iPhone, and the stability of the CVA signal as demonstrated by these results, suggest that the S2K-TP

may be a useful tool for evaluating the efficacy of interventions for young autistic children.

**409.058** (Poster) Validity Evidence of Cultural Adaptation of the English Original Version of Emotional Outburst Questionnaire to Brazilian Portuguese.

**C. S. Paula<sup>1</sup>, M. C. Teixeira<sup>1</sup>, C. Mevorach<sup>2</sup>, R. Lowenthal<sup>3</sup>, B. Balbueno<sup>1</sup>, J. Chung<sup>4</sup> and K. Woodcock<sup>4</sup>,** (1)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil, (2)School of Psychology, University of Birmingham, Birmingham, United Kingdom, (3)Santa Casa Hospital, Sao Paulo, Brazil, (4)University of Birmingham, Birmingham, United Kingdom

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#### Background:

The emotional outbursts (EO) are brief episodes of challenging behaviors or meltdowns disproportionate to the situation or context in which they occur and frequent in people with severe neurodevelopmental disorders.

#### Objectives:

To verify psychometric properties of cultural adaptation of the English original version of the Emotional Outburst Questionnaire instrument to Brazilian Portuguese.

#### Methods:

The measure was the Portuguese version of Emotional Outburst Questionnaire - informant-report measure for outburst characteristics, including 55 items that assesses the frequency and duration of behavioral topographies indicative of EO, emotional patterns during EO, recovery time from EO, environmental and physiological factors EO triggers and effectiveness of control strategies to calm EO. The study was conducted in four stages: a) Translation, translation synthesis and cultural adaptation of the instrument to Brazilian Portuguese, b) evaluation of translation by a sample of the target group, c) Back-translation, d) Pilot Study on sample composed of 359 individuals with autism spectrum disorder (ASD), Down syndrome (DS) and intellectual disability (ID) between 6 and 25 years old, both genders with average age=10.41, standard deviation=0.42.

#### Results:

The main results of the first three stages were: changes made for cultural adaptation purposes based on idiomatic and conceptual equivalence criteria and, of 11 terms that required adjustments, only two were fully modified and the others partially modified. In the item's evaluation, instructions, and response scale by the seven participants of the target group there were no suggestion of changes. In the back-translation stage, the semantic and idiomatic type adjustments predominated in 38 words and phrases with adjustments of the final version in Portuguese. The results of the pilot study showed that the most severe EO topographies presented more frequently in the sample are "non-verbal vocalizations", "avoidance", "ignoring or not talking to certain people", "increased motor activity" and "increased physiological response", the occurrence being 4 to 6 times every 10 outbursts. The duration of more severe EO (58%) and less severe (20.89%) was short being less than 5 minutes, followed by 34.81% of the sample with more severe EO and 59.94% with less severe EO that lasted from 5 to 15 minutes. Statistical association was verified between the overall frequency of EO and the diagnostic (ASD, DS and ID). The chi-square test of independence showed an association between some types of frequency of EO and diagnostic ( $\chi^2$  (24) = 46.840;  $p=0.004$ ). Participants with ASD are more likely to have EO once a week and people with ID are more likely to have EO 2 to 3 times a month. Cramer's V Index showed an association of approximately 28% between age classification and EO (V of Cramer =0.280;  $p=0.00$ ). Children between 6 and 11 years old have a greater tendency to have EO one to three times a week and people over 17 years have them once a month ( $\chi^2$  (16) = 56.267;  $p=0.00$ ).

#### Conclusions:

Study results showed psychometric properties suitable for use in a research context and clinical context in Brazil.

**409.059** (Poster) Potential Relationships between Sleep and Daily Activity in Children with Autism

**G. Eylon<sup>1</sup>, G. Meiri<sup>2</sup>, I. Menashe<sup>3</sup>, L. Tikotzky<sup>4</sup> and I. Dinstein<sup>5</sup>,** (1)Cognitive and Brain Sciences, Ben Gurion University of the Negev, Beer Shev, Israel, (2)National Autism Research Center of Israel, Ben-Gurion University of the Negev, Beer Sheva, Israel, (3)Public Health Department, Ben-Gurion University of the Negev, Beer Sheva, Israel, (4)Psychology, Ben Gurion University of the Negev, Be'er Sheva, Israel, (5)Cognitive and Brain Sciences Department, Ben-Gurion University of the Negev, Beer Sheva, Israel

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#### Background:

More than half of children with autism exhibit considerable sleep disturbances evident in late sleep onset, multiple wake periods during the night, and shorter sleep duration. Large scale studies have so far used parent questionnaires, sleep diaries, and/or actigraphy to measure these sleep disturbances in large populations. Recent development of wearable sensors may offer more accurate identification of sleep parameters as well as additional measures, such as heart rate and activity levels throughout the day, that may yield further mechanistic insights regarding the causes of different sleep disturbances and ways of treating them (Figure 1).

#### Objectives:

To compare common sleep parameters as reported by the Fitbit Charge 3 sensor, parent questionnaire and sleep diary while relating them to daily activity measures.

#### Methods:

A total of 56 children with ASD (11 females), mean age 4.1 (range 1.9–7.6) were recruited to this ongoing study. Sleep variables, heart rate, and activity levels were measured in each child using a Fitbit Charge 3 sensor that was taped to the upper arm over 1-5 consecutive days and nights (i.e., at least 24 hours). Sleep onset, awakenings during the night, and awakening in the morning were identified by the Fitbit sleep staging algorithm. All parents completed the Child Sleep Habit Questionnaire (CSHQ) within six months of the recorded period. Parents of 36 children also completed a sleep diary in parallel with the Fitbit recordings (i.e., same nights). We computed total sleep time (TST), wake after sleep onset (WASO), sleep onset and final awakening across the three data sources. We then compared these measures using t-tests, and assessed their relationship with activity levels using Pearson's correlation coefficients.

#### Results:

The Fitbit Charge 3 sensor reported significantly lower estimates of TST in comparison to both parent report with the CSHQ ( $t(39) = -2.4, p < .05$ ) and the sleep diaries ( $t(35) = -13.5, p < .001$ ). Conversely, the sensor reported significantly higher estimates of WASO in comparison to parent report with the CSHQ ( $t(39) = 4.5, p < .001$ ) and the sleep diaries ( $t(35) = 17.1, p < .001$ ). Nevertheless, TST and WASO measures from the sensory and sleep diary were significantly correlated when compared across nights ( $r(34) = .57, p < .05$  and  $r(34) = .58, p < .05$  respectively, figure 2). Initial analyses did not reveal a significant correlation between the amount of activity during the day and the amount of sleep during the following night ( $r(210) = -.01, p = 0.16$ ).

#### Conclusions:

Initial results suggest that parents over-estimate their children's sleep likely because they are not aware of the child's precise sleep onset time and some of the child's awakenings during the night. Nevertheless, Fitbit and sleep diaries were significantly correlated, demonstrating the utility of Fitbit in quantifying sleep disturbances along with additional measures such as activity for further studying sleep disturbance in large cohorts of children with ASD.

## POSTER SESSION — DIAGNOSTIC, BEHAVIORAL & INTELLECTUAL ASSESSMENT

### 418 - Diagnostic, Behavioral & Intellectual Assessment II

**418.083** (Poster) Echo Autism: Developing Clinical Expertise for Autism Spectrum Disorder Assessment and Diagnosis in Primary Care Clinicians K. Schieltz<sup>1</sup>, R. Brown<sup>2</sup>, V. Nanclares-Nogues<sup>3</sup>, M. Odum<sup>4</sup> and K. Sohl<sup>5</sup>, (1)University of Iowa, Iowa City, IA, (2)KUMC, Wichita, KS, (3)ECHO Autism Communities, University of Missouri, Columbia, MO, (4)ECHO Autism Communities, University of Missouri, School of Medicine, Columbia, MO, (5)ECHO Autism Communities, Child Health, Columbia, MO

#### Background:

Diagnosis of autism spectrum disorder (ASD) currently relies on highly specialized standardized instruments administered by subspecialist providers, making wait times for diagnostic assessments often very long. Project ECHO models provide an established platform to disseminate expert knowledge from specialist to community generalist. Implementing the ECHO Autism model has the potential to dramatically increase access to autism diagnosis, especially in rural and underserved communities.

#### Objectives:

The project aims to describe the process for determining a primary care clinician's (PCC) readiness to independently evaluate, discriminate differentials, and diagnose a child with unambiguous symptoms of ASD between ages 14-48 months, as well as assess the accuracy and level of entrustable professional activity (EPA) concordance in the development of clinical expertise in PCCs.

#### Methods:

ECHO Autism is an innovative approach that leverages videoconferencing technology to amplify scarce specialist knowledge to mentor generalist clinicians through de-identified, case-based learning. ECHO Autism sessions occur twice a month for 90 minutes. Between 2017-2020, 20 PCCs successfully achieved reliability with experienced diagnosticians. Each completed ECHO Autism: STAT training, including a 1.5-day training on the STAT (Screening Tool for Autism in Toddlers and Young Children) and elements of diagnostic best practices. Additionally, the PCCs completed a 12-module curriculum and presented cases to the ECHO Autism team for diagnostic process feedback and recommendations.

The PCCs completed case presentation forms that included comprehensive developmental/behavioral and medical history, screening results, and direct behavioral observation scores. Each PCC then synthesized this information to indicate their impression of the symptoms as absent, subthreshold, or present in each of the seven DSM-5 ASD criteria and provided a summative diagnostic impression rating of yes, maybe, or no.

Accuracy was defined as the level of agreement between ECHO Autism panel experts (who also rated the symptom presentation and diagnostic impression) and the PCC presenting the case. Accuracy was rated using a 4-point Likert scale ranging from *definitely disagree* (1) to *definitely agree* (4).

#### Results:

256 diagnostic cases were presented during teleECHO sessions across the 20 participants. Of the cases determined to meet unambiguous ASD diagnostic criteria, 90% met the average 3.5 accuracy criterion for DSM-5 symptom impressions and 94% met the impression score of 4 for the unambiguous diagnostic criterion. Similarly, of the cases determined to be not-autism or ambiguous, 73% met the average 3.5 accuracy criterion for DSM-5 symptom accuracy and 84% met the impression score of 4 for diagnostic impression. Thirteen of the 20 participants met criteria to independently evaluate children for ASD ( $M = 11.5$  case presentations; range, 9-20). The remaining participants continue to present cases for diagnostic discussion and verification.

#### Conclusions:

PCCs can develop clinical expertise in the evaluation and diagnosis of young children with ASD that is accurate and reliable. Their ability to discriminate symptoms within the DSM5 criteria as well as the overall diagnostic impression is promising as a means to reduce diagnostic bottlenecks in tertiary specialty centers. Expanding access for community-based diagnosis is critical to detect ASD symptoms and guide individualized intervention to support a child's development.

#### **418.084** (Poster) Examining the Cultural Sensitivity of a Social Communication Screening Tool for Toddlers ("My Toddler's Social Communication"): A Mixed-Methods Study

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#### Background:

Inequities in healthcare have led to disparities for many populations, particularly people belonging to linguistic, cultural, and racial minorities. One area where this is prevalent is in the diagnosis and treatment of Autism Spectrum Disorder (ASD). Among other causes for these existing disparities, the tools used for assessing children for ASD have been shown not to work equitably with all populations due to a lack of cultural sensitivity. This study assesses the cultural sensitivity of "My Toddler's Social Communication" (MTSC), a screening tool currently being developed by the UW Read Lab to assess for social communication deficits in toddlers. Unlike existing screening tools, MTSC employs photographs of toddlers engaging in a variety of common social communication behaviors, along with brief behavioral descriptions. Caregivers are asked to identify the extent to which their toddlers display behaviors such as requesting desired objects and directing someone's attention to items or events of interest. Photos were added to support accurate interpretation of our target behaviors through visual illustrations, and we included a diverse representation of children to allow a range of caregivers to feel that their child is visually represented in our tool.

#### Objectives:

This pilot study aims to assess the cultural sensitivity of the MTSC. Specifically, we aim to: (1) investigate whether caregivers of toddlers find the MTSC to be feasible for use with families from diverse backgrounds and (2) find the photos and target behaviors culturally relevant. We hope that our process will contribute toward elucidating a methodology for developing culturally sensitive and relevant assessment tools.

#### Methods:

The proposed study uses a sequential explanatory mixed-methods design. For the first phase, caregivers of children aged 16-30 months filled out the MTSC and a feedback survey that included two questions regarding the usability and feasibility of the MTSC. For the second phase which will take place between November 2021 – February 2022, 15 caregivers belonging to a culturally or linguistically diverse group will participate in semi-structured interviews about the MTSC. The survey data will be analyzed using descriptive statistics and the semi-structured interviews will be analyzed with a content analysis.

#### Results:

The preliminary results of this study found that 80% of the caregivers found the photos used in the MTSC to be representative of a broad range of cultures. The respondents who disagreed noted that the pictures chosen should show more gender and racial diversity. However, only 30% of the caregivers stated that they agreed with the statement that caregivers from various backgrounds could easily complete the MTSC. The additional comments provided suggest that this tool would need to be translated into multiple languages and that some target behaviors are not used the same in all cultures.

#### Conclusions:

These preliminary results suggest that the MTSC is largely representative in the photos chosen to depict social communication behaviors but can be revised to improve its feasibility and relevance of target behaviors. We hope the results from our planned second phase will gather more specific information and suggestions for improvement.

**418.085 (Poster)** Extending the Usefulness of the Brief Observation of Social Communication Change (BOSCC): Development of the Phrase Speech and Young Fluent Version

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**Background:** Individuals with autism spectrum disorder (ASD) are involved in numerous treatments and interventions throughout their lifespan, the most common of which are those aimed at improving communication or other social communicative behaviors. The ability to quantify and measure the effectiveness of these interventions is a critical component to the development of skills for the individuals involved. However, the field of ASD intervention research faces a number of significant limitations in its current practices of measuring treatment effectiveness, such as the lack of a uniform measurement approach or a reliance on parent or clinician report. Due to these limitations, measuring social communication changes in individuals with ASD in response to treatment and comparing the effects of various interventions has proven to be especially difficult. There is a critical need for the development of outcome measures that adequately address the limitations of the measures historically used in intervention research, and that can reliably detect changes in the social communicative behaviors of individuals with ASD, especially in a short period of time. The Brief Observation of Social Communication Change (BOSCC) has been validated with minimally verbal children (called the BOSCC-MV) but has not yet been validated for use with older or more verbal individuals.

**Objectives:** The aim of the present study is to determine the utility of the BOSCC-Phrase Speech Young Fluent (PSYF) as an outcome measure of treatment response. More specifically, this study will analyze the factor structure of the measure by exploring the relationship between items, examine the initial psychometric properties, including inter-rater and test-retest reliability, and provide evidence of its utility as a measure of change by examining changes in scores over time in autistic individuals receiving various interventions.

**Methods:** The present study applies the BOSCC coding scheme to 345 video administrations over 160 participants diagnosed with ASD. Participants include individuals of any age with consistent and flexible phrase speech (defined as a two-word noun verb combination), or individuals under age 8 with fluent, complex sentences.

**Results:** Initial analyses have concluded that the BOSCC-PSYF has an underlying three-factor structure. Additionally, preliminary analyses have shown changes in various social communication items. We anticipate that the BOSCC will have high inter-rater and test-retest reliability.

**Conclusions:** If validated, the BOSCC would provide a standardized, flexible, and minimally biased assessment of social communication changes in response to treatment. The validation of such measure would have important implications for ASD intervention research, including the possibility of a low-cost measure that reliably measures changes in a short period of time, can be conducted and coded by individuals of various skill levels, and is flexible enough to be used across various sites/studies.

**418.086 (Poster)** Feasibility of Actigraphy for Evaluating Sleep and Daytime Physical Activity in Children with Autism Spectrum Disorder

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**Background:** Sleep disturbances are common in children with autism spectrum disorder (ASD). Daytime physical activity (PA) improves sleep in some children but not others. Little is known about the effect of PA on sleep in children with ASD. Although actigraphy has been used to measure sleep in pediatrics, few studies have used actigraphy in children with ASD.

**Objectives:** The study aimed to evaluate the feasibility of using actigraphy to measure sleep and daytime PA in children with ASD and to gather preliminary data on the association of sleep and parent-reported disruptive behavior.

**Methods:** A sample of 32 children 2 to 8 years (mean = 5.50 ± 1.68, 75% male, 78.1% White) with a community diagnosis of ASD from Midwestern United States participated. Parents were 96.9% female, 90.6% White. Children were recruited through Facebook support groups, autism schools, and centers. To be included, children were screened for an ASD diagnosis with the Modified Checklist for Autism in Toddlers, Revised score ≥ 8 or Social Communication Questionnaire score ≥ 15. Of the 38 children screened, four did not meet the age criteria, one had suspected obstructive sleep apnea, and one did not meet ASD screening and were excluded. Parents completed the Modified Children's Sleep Habits Questionnaire (CSHQ-autism) and Aberrant Behavior Checklist-Irritability subscale (ABC-I) to measure disruptive behavior. The lead investigator (MA) conducted a Zoom session with parents and children on placement of the ActiGraph™ wGT3X-BT on the child's non-dominant wrist for 5 consecutive days and nights to measure sleep total sleep time (TST), sleep efficiency (SE%), and steps per day for PA. Parents completed a sleep diary to report the child's sleep and wake times. The Sadeh (1994) algorithm was used to analyze sleep data. To explore the effect of PA on sleep, children ≥ median steps per day (12,129.40) were compared to those < median on TST and SE%, CSHQ-autism total, and ABC-I total scores.

**Results:** Of the 32 children, 27 (84.4%) had complete actigraphy data. Mean values: TST = 475.31 ± 41.69 minutes, SE% = 75.20 ± 6.88; steps per day = 12,335.24 ± 2,971.98; CSHQ-autism = 39.03 ± 8.58, ABC-I = 16.69 ± 9.80. Based on validated thresholds, 25 children had *poor* SE% (< 85%), 21 had *significant* sleep disturbances (CSHQ-autism ≥ 35), and 17 had *moderate or greater* level of disruptive behaviors (ABC-I ≥ 15). Pearson correlations were -.33 (*p*=.049) and -.38 (*p*=.026) between the CSHQ-autism and SE% and TST, respectively. Children ≥ median on PA had



significantly lower mean TST minutes  $458.44 \pm 25.31$ , compared to  $493.48 \pm 48.81$  in those  $<$  median ( $p=.026$ ). There were no group differences on SE% ( $p=.169$ ) or CSHQ-autism ( $p=.085$ ). Children  $\geq$  median had higher mean ABC-I scores  $20.21 \pm 10.91$ , compared to  $12.23 \pm 8.11$  for those  $<$  median ( $p=.042$ ).

**Conclusions:** Actigraphy is a feasible measure of sleep and PA in children with ASD. Future research could examine the association of daytime behavior and sleep in larger, well-characterized samples of children with ASD.

**418.087 (Poster)** Gender Differences in Autistic Phenomenon and Adaptive Behaviors in the Indian Setting

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**Background:**

Studies that have investigated gender differences in Autism Spectrum Disorders have demonstrated differences in abilities and symptoms. The trend of prevalence of ASD in males and females in India is similar to that reported in the West [1]. Our ASD database shows a 5:1 male to female ratio. Gender differences however have not much been reported from India.

**Objectives:**

We explored gender differences in the clinical profiles of children with ASD in our database, focusing on identifying differences in the autistic phenomenon and adaptive behaviors.

**Methods:**

We had data from 653 children with ASD (530 males and 123 females) in our database for whom clinical and adaptive behavior measures were available. For this analysis, we randomized the male sample to get 123 males (male: female = 1:1). We investigated differences in subdomain and total scores of Social Responsiveness Scale (SRS), Indian Sale for Assessment of Autism (ISAA) and Vineland Adaptive Behavior Scale II (VABS). Statistical analysis was done using SPSS version 26. Frequency analysis, Mann Whitney U test, chi-square test and Fisher's exact test helped comparison across genders and to explore associations.

**Results:**

There were no significant differences seen in age and socio-demographic variables. Mann Whitney U test was carried. On ISAA (48 males and 86 females) there was significant difference in social relationship and reciprocity domain (median- males=34, females=27;  $p<0.001$ ), speech language and communication domain (median- males=27, females=24,  $p<0.001$ ) and ISAA total scores (median- males = 106, females=96,  $p=0.027$ ) with males having higher scores indicating greater severity. VABS scores were available for 108 males and 109 females. There were significant differences in coping scaled score (median – males=11, females=10.50,  $p=0.022$ ), socialization domain (median – males=66, females=63.50,  $p=0.05$ ), with males having higher severity while females had higher severity in the motor skills domain (median – males=77, females=72,  $p=0.043$ ). SRS scores did not show significant difference in total or sub domain scores.

**Conclusions:**

We have reported gender differences in autistic phenomenon and adaptive behaviors in our population. These are not vastly different from international reports[2,3]. The data does not support the notion that only more severely ill females are brought for help in the Indian context. Understanding gender differences can help refine our understanding of the biology of autism.

**418.088 (Poster)** Identifying Features of Minimally-Structured Interaction Activities That Facilitate or Impede Social Opportunities for Autistic Youth

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**Background:** Autism spectrum disorder (ASD) is characterized by pathognomonic difficulties in social interaction (Hobson, 2014). During interactions with familiar or unfamiliar peers, autistic youth participate less in social interactions (Anderson et al., 2004), engage in less cooperative social interactions (Corbett et al., 2016), and display fewer positive (i.e., prosocial) and low-level interaction behaviors (Bauminger et al., 2003). Numerous observational studies have evaluated interaction behaviors of autistic children in structured and unstructured settings (e.g., recess/lunchtime; Humphrey & Symes, 2011; Lock et al., 2016). However, no work to date has directly compared peer interaction behaviors during naturalistic interactions that systematically vary based on the degree of structure and social demands in which those behaviors occur (e.g., unstructured, minimally-structured with a physical/non-physical interaction component). Such an evaluation is crucial for determining which social and environmental contingencies create the most challenge – and opportunity – for autistic youth.

**Objectives:** To 1) assess peer interaction behaviors in autistic youth across peer interactions activities with differing structure and social demands; 2) evaluate the relationship between ASD symptomatology and peer interaction behaviors in specific contexts.

**Methods:** 179 children ( $N_{\text{male}}=127$ ; 11-17 years,  $M_{\text{age}}=13.81$ ,  $SD_{\text{age}}=1.96$ ) with and without ASD (89 autistic, 90 non-autistic; confirmed via ADOS-2) and  $IQ \geq 70$  ( $M_{IQ}=103.53$ ,  $SD_{IQ}=16.08$ ) completed an observed peer interaction assessment comprised of three activities: an unstructured activity, a minimally-structured activity with a physical interaction component, and a minimally-structured activity with a non-physical, but verbal, interaction component (Figure 1). To evaluate differences in peer interaction behaviors (positive, negative, low-level) by activity and diagnostic group, a repeated measures ANOVA was conducted. A follow-up hierarchical multiple regression was performed to assess the relationship between interaction behavior and ASD symptomatology (Table 1).

**Results:** Autistic and non-autistic youth did not differ in amount of positive interaction behaviors during the unstructured activity and minimally-structured activity with a physical interaction component ( $p's > .05$ ). There was an activity by diagnostic group interaction, such that, in the minimally-structured activity with a non-physical, verbal interaction component, fewer positive interactions were observed in autistic than non-autistic youth (Figure 1;  $F_{1,146}=6.97$ ,  $p < .01$ ). Within this activity only, positive interactions predicted ASD symptomatology severity ( $R^2=.177$ ,  $F_{5,142}=6.10$ ,  $p < .001$ ), such that youth who displayed more positive peer interactions were more likely to have fewer ASD symptoms, even after accounting for amount of peer interaction during the task, verbal abilities, IQ, and parent-reported theory of mind skills (Table 1).

**Conclusions:** While autistic and non-autistic youth showed comparable positive interaction behaviors during the unstructured and minimally-structured, physical activities, autistic youth displayed fewer positive interaction behaviors than non-autistic peers when in a minimally-structured activity with a non-physical, but verbal, interaction component. Even among otherwise minimally-structured peer interactions, and after controlling for amount of peer interaction and perspective-taking skills, autistic youth still displayed fewer positive peer-related behaviors in a social context demanding verbal interaction. Present findings highlight important details and nuance to types of social situations that may be especially challenging – and those that may not – for autistic youth to implement positive interaction behaviors and have implications for intervention targets and development.

#### **418.089 (Poster)** Identifying Gender Differences on the Autism Diagnostic Observation Scale: Preliminary Results

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**Background:** The prevalence of autism spectrum disorder (ASD) in Canada is 1 in 66 children and 1 in 54 in the U.S. This prevalence also differs considerably according to genders as males are 4 times more likely to be diagnosed with autism than females. This prevalence is even higher in individuals with higher IQs. Gender differences in the manifestation of autistic traits have been investigated in a range of studies over the past few decades. Some studies (Schuck et al., 2019) indicated that gender-related distinctions in behavioural phenotypes of ASD may be detected differently depending on the type of diagnostic assessments. Currently, the diagnosis of ASD is primarily based on standardized assessment instruments such as the ADOS. Nonetheless, there are several inconsistencies between studies regarding the existence of real differences between women and men on the ADOS. These discrepancies may be attributable to several factors including sample sizes, unequal proportion of male/female, diagnostic heterogeneity, bias in the assessment tool per se, or most likely, a combination of these factors.

**Objectives:** The aim of this project is to clarify whether there are gender differences on the ADOS scoring algorithm using an extensive clinical dataset from the National Institute for Mental Health (NIMH).

**Methods:** Algorithm scores of the ADOS Module 3 were analysed for a total of 1214 participants with a confirmed ASD diagnosis from the National Data Autism Research and the NIMH Autism Genetic Resource Exchange datasets. Reflecting the existing gender ratio discrepancy, the sample consisted of 923 males and 291 females. Descriptive statistics, such as frequency analyses and contingency tables were conducted for each of the ADOS Module 3 criteria by gender.

**Results:** Preliminary results highlight gender differences in scores for some ADOS-Module 3 criteria. The domain of language and social interaction stand out particularly for female subjects. This group recorded lower scores on these two domains compared to males. Due to the unequal group size, these results should be interpreted cautiously.

**Conclusions:** These preliminary results suggest that some subtleties of female autistic expression may not be captured by some of the ADOS criteria. This could partially contribute to the under-diagnosis of women with ASD.

#### **418.090 (Poster)** Infant Effortful Control Predicts Childhood Emotion Dysregulation in Autism-Enriched Cohort.

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**Background:**

Many autistic children experience difficulties with emotion regulation, which may derive from difficulties with self-regulation. In infancy, effortful control (EC), the ability to exert top-down control over behaviour, can be used as an early indicator of later self-regulation. Children learn to self-regulate their behaviours through interaction with the environment and thus, early parenting behaviours may help counter later difficulties with regulation. This may particularly be the case for those children who show lower EC in infancy.

#### Objectives:

We compared children with typical and elevated familial likelihood for autism on a measure of emotion dysregulation at mid-childhood. We examined whether EC at 8 and 14 months predicted emotion dysregulation and if this association was moderated by parenting behaviour measured at 14 months.

#### Methods:

43 children with typical likelihood (TL) and 75 children with elevated autism likelihood (EL) due to having an older sibling with a diagnosis were assessed in mid-childhood (7-11 years) as part of a longitudinal follow-up study. Children had been allocated to diagnostic outcome groups (EL-TD, EL-atypical or EL-autism) based on all available diagnostic data at age 3 years. The parent-rated Strengths and Difficulties Questionnaire Dysregulation Profile (SDQ-DP) was used to index emotional dysregulation in mid-childhood. EC was assessed at age 8 and 14 months by the parent-report Infant Behavior Questionnaire-Revised (IBQ-R). Parenting was indexed at 14 months by parental sensitivity and responsivity coded using the Manchester Assessment of Caregiver-Infant Interaction (MACI) during a 6-min parent-child free-play interaction. 92 children at 8 months and 91 at 14 months had data available on all measures. T-test and ANOVA were used to compare likelihood and 3-year outcome groups on SDQ-DP. Linear regression was used to examine the effect of autism likelihood, EC (at 8 and 14 months, separately), likelihood\*EC, parenting (at 14 months) and parenting\*EC on emotion dysregulation in mid-childhood. Predictors were entered one-by-one and nested regressions were compared using the likelihood-ratio test. For the regression, the SDQ-DP was transformed using zero-skewness log to normalise the data distribution.

#### Results:

Children in the EL group had higher scores on the SDQ-DP compared to the TL group ( $t(116)=-3.52, p<.001$ ). By 3-year outcome ( $F(3,113)=6.85, p<.001$ ), the EL-autism group had higher scores on the SDQ-DP compared to the TL ( $p<.001$ ) and EL-TD ( $p=.031$ ) groups. None of the other differences were significant.

At 8 months, autism likelihood predicted SDQ-DP scores ( $B=.37, p=.001$ ). Adding EC, likelihood\*EC, parenting and parenting\*EC to the regression did not improve the model fit (all  $ps>.125$ ). At 14 months, autism likelihood ( $B=.27, p=.028$ ) and EC ( $B=-.26, p=.039$ ) were significant predictors of SDQ-DP. Adding likelihood\*EC, parenting or parenting\*EC (all  $ps>.075$ ) did not make a significant difference.

#### Conclusions:

Children with elevated likelihood of autism, specifically those who received a diagnosis at 3, showed higher levels of emotional dysregulation in mid-childhood. EC at 14, but not 8, months predicted emotion dysregulation, however parenting did not predict dysregulation, nor did it impact the effect of EC on emotion dysregulation. Future studies should look at the impact of interventions targeting early EC on later emotion dysregulation.

#### 418.091 (Poster) Influence of Gender Differences in Clinical Presentation on ASD Diagnosis

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**Background:** There is a 4.3:1 male-to-female ratio among those who are diagnosed with autism spectrum disorder (ASD) (Maenner et al., 2020). Recent research has suggested that females with ASD may employ social “camouflaging” skills to compensate for deficits caused by core ASD symptomatology which may delay or fully elude clinical ASD diagnosis (Lai et al., 2015; Ratto et al., 2017; Tubío-Fungueirino et al., 2021). Moreover, females who are diagnosed with ASD are thought to present with more severe symptoms and comorbidities when compared to their male counterparts (Ratto et al., 2017).

**Objectives:** The present study aimed to identify gender-based differences in ASD that elucidate the differential rates of ASD diagnoses in males and females by investigating ASD presentation and age at diagnosis from individuals evaluated at a community-based clinic.

**Methods:** Comprehensive psychological evaluations of 116 males aged 3-59 years old (Median = 12.25) and 46 females aged 3-39 years old (Median = 11.83) with presenting concerns of ASD were analyzed. Evaluations were conducted at a university affiliated diagnostic clinic in Albany, NY and included a detailed developmental and psychosocial history review, and formal assessments of intellectual, adaptive, and behavioral functioning. The present study extracted male and female scores for analysis from the following assessments: *Autism Diagnostic Observation Schedule (ADOS-2)*; *Stanford-Binet Intelligence Scales (SB-5)*; *Vineland Adaptive Behavior Scales (Vineland-3)*; *Social Skills Improvement System (SSIS) Rating Scales*.

**Results:** 64.7% males (75 of 116) and 56.5% females (26 of 46) presenting with concerns of ASD received an official ASD diagnosis. Within the subset of ASD diagnoses, males and females were diagnosed at similar ages ( $M_M=13.56, SD=8.09$ ;  $M_F=14.22, SD=8.96$ ). Independent samples t-tests revealed significant differences in male and female *SSIS-Parent Social Skills* ( $M_M=78.56, SD=14.94$ ;  $M_F=65.32, SD=9.57$ ;  $p < .05$ ) and *SSIS-Parent Problem Behaviors* ( $M_M=124.26, SD=15.43$ ;  $M_F=135.41, SD=18.97$ ;  $p < .05$ ). On all other measures, no significant differences were found: *SB-5*

Full Scale IQ ( $M_M=90.52$ ,  $M_F=90.00$ ), *SB-5* Nonverbal IQ ( $M_M=92.43$ ,  $M_F=92.30$ ), *SB-5* Verbal IQ ( $M_M=89.78$ ,  $M_F=88.78$ ), *Vineland-3* Adaptive Behavior Composite (ABC) ( $M_M=65.19$ ,  $M_F=64.00$ ), *ADOS-2* Comparison Scores ( $M_M=6.96$ ,  $M_F=6.32$ ).

**Conclusions:** There were no significant differences in age or clinician rated cognitive, language, adaptive, or behavioral functioning scores in males and females diagnosed with ASD. However, in parent-rated measures of social skills and problem behaviors, females were rated as significantly more impaired than males in each domain. These findings point to the potential influence of gender-norms on ASD diagnosis such that parents may perceive the same ASD symptoms as more distressing in females due to differential social and emotional expectations and tolerance for problematic behaviors.

**418.092 (Poster)** Investigating the Accuracy of People's Judgements about Social Dyads' Autistic Diagnostic Status from Videos of Social Interaction

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Background:

Autism is defined in diagnostic criteria by the presence of "social and communication impairments". However, research has shown that interactions between autistic dyads entail successful communication (in the form of information transfer) and social interaction. Autistic people rate their own rapport with a partner as higher when that social partner is also autistic. In addition, autistic dyads are rated as having equivalent rapport to non-autistic dyads (with mixed autistic and non-autistic dyads having worse rapport ratings), when scored by independent raters.

This suggests that evidence of social and communication atypicalities are dependent on the diagnostic status of the social partner. As a result, it may be more difficult for observers to accurately identify diagnostic status when two autistic people are interacting.

Objectives:

To examine a) whether it is possible to correctly identify people's neurotype based on a video clip and/or photograph of an interaction, b) whether participants are more accurate at identifying people of their own neurotype, and c) whether participants are more accurate at identifying autistic people in mixed dyads and less accurate at identifying autistic people in matched autistic-autistic dyads.

Methods:

78 raters (39 autistic, 39 non-autistic; 28M, 2NB; age mean = 34, range 18-64) watched clips from three of nine total videos showing autistic dyads, non-autistic dyads, and mixed dyads in conversation, and were asked to identify whether each member of the dyad was autistic or non-autistic. A subset of 54 participants repeated the procedure with photographs taken from the six videos they had not viewed clips from.

Results:

Raters correctly identified the neurotype of dyad members at a rate better than chance for videos (0.58,  $p<0.001$ ) and photographs (0.55,  $p<0.001$ ) – though identification of autistic participants within autistic dyads was significantly below chance (videos 0.34,  $p<0.001$ ; photographs 0.27,  $p<0.001$ ). Raters on average were significantly less accurate at identifying neurotype from photos compared with videos.

For videos, both autistic and non-autistic raters showed an own-neurotype accuracy effect across all pair types (autistic raters outperformed non-autistic raters for autistic and mixed pairs; the opposite for non-autistic pairs). Ratings of mixed pairs had the highest accuracy (non-autistic raters 0.71  $p<0.001$ ; autistic raters 0.88  $p<0.001$ ). For photographs, raters performed only slightly above chance overall (0.55,  $p=0.015$ ). Ratings of non-autistic pairs had the highest accuracy rate overall (0.71,  $p<0.006$ ).

GLMM analysis is ongoing to examine the details of the interaction between rater neurotype, pair type, and guess accuracy.

Conclusions:

Mixed dyads appear to make autistic traits more 'visible' in comparison to autistic dyads, which meant that raters were more able to identify autistic people within mixed pairs. This supports the double empathy problem, which suggests communicative differences arise as a result of mismatched neurotypes rather than due to an autistic deficit. Autistic and non-autistic raters also differ in how they guess a person's neurotype, including by data type; more research is needed to determine whether this is an own-group prediction bias, or whether autistic and non-autistic people deploy different strategies to determine a person's neurotype.

**418.093 (Poster)** Limited Specificity across Psychological Domains of Parent Rating Forms in ASD

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**Background:** In psychometrics, there has long been concern that performance-based measures and rater-based measures allegedly of the same psychological construct often do not agree. Such disagreement may be based on the biases within the rater method (e.g., systematic rater subjectivity), within the performance method (e.g., individuals' ability to participate in any sort of testing), or, most concerning, lack of validity of the construct being studied. In particular, poor correlation between performance and rater measures of core autism symptoms (Autism Diagnostic Observation Schedule [ADOS] and Social Responsiveness Scale, second edition [SRS-2]) in some datasets have raised questions as to whether the ASD diagnosis itself is a meaningful construct.

**Objectives:** We examined the degree to which parent-rating forms and clinician-administered performance measures correlate across psychological domains, to determine the relative contribution of method-associated biases by instrument type.

**Methods:** From 83 pediatric participants with ASD, we collected information from specific subtests of motor, attention, inhibition, working memory, and social communication performance and rater instruments. We attempted to match psychological constructs across instrument type with as great a precision as possible. We ran Principal Components Analysis (PCA) independently on data from the rater instruments and from the performance instruments.

**Results:** Across rater instruments, 56% of variance loaded on the first principal component. The second through fifth components all had loadings of less than 16% total. In the group of performance measures, 40% of the variance loaded on the first component, with 25% loading on the second component, and loadings of less than 17% on the remaining three components.

**Conclusions:** These findings demonstrate a greater amount of shared variance across psychological domains in parent rating forms than in clinician-administered assessments of the same abilities. While some covariance across domains is very likely attributable to true, within-subject covariation of performance, the fact that rater scales show greater across-domain covariance than do performance instruments suggests an additional rater-associated biasing factor. Furthermore, with almost 60% of the rater variance being shared across psychological domains, additional work is critical to understand the degree to which domain-specific instruments are truly and validly measuring nuanced psychological constructs.

#### **418.094 (Poster) Objective Measures to Quantify Homophily in the Inclusion Classroom**

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**Background:** Homophily is a tendency for individuals to preferentially interact with others similar to themselves. In classrooms, homophily is evident across a range of ages in a variety of dimensions, including child sex, disability, and academic performance. While teacher-report provides insights into homophilic peer preference, human measurement limits the collection large-scale datasets that characterize children with autism spectrum disorder (ASD), other developmental disabilities (DD) and typical development (TD) in naturalistic settings.

**Objectives:** In the current study, we utilize automated measurements of velocity and proximity to quantify homophily in the classroom through the following dyadic measures: (1) social approach, quantified as a weighted measure of movement toward each peer and (2) shared time in social contact with each peer.

**Methods:** 77 children ( $M=48.26$  months,  $SD=7.47$ ), including 24 children with ASD, 23 children with DD, and 30 TD children were observed in 8 inclusion preschool classrooms. Each child was observed on 3.52 mean occasions ( $SD=1.32$ ) for a duration of mean 138.2 minutes ( $SD=63.6$ ). Objective measurements of position and orientation were collected using ultra-wide radio frequency identification (Ubisense) sensors, which tracked a right and left tag worn by each child in a specially designed vest. Social approach was computed as the distance each child moved toward (or away from) the initial position of each peer, weighted by distance, orientation, and angle of movement. Social contact was defined as proximity between 0.2 and 2 meters and relative orientation (within 45°) and computed as a proportion of available time with each peer. Social approach and shared time in social contact were analyzed using linear mixed effect models, with a term for the type of one child in the pair (ASD, DD, TD) and the homophily status of the pair (concordant vs discordant).

**Results:** Children in concordant dyads (e.g., ASD-ASD) both approached and withdrew from one another at higher velocities than discordant dyads (e.g., TD-ASD) ( $ps < 0.001$ ). Children with ASD and DD did not differ from TD children in the velocities with which they approached other children. Similarly, concordant dyads spent a greater proportion of time in social contact than discordant dyads ( $p<0.001$ ). In addition, concordant pairs including children with ASD and DD (ASD-ASD, DD-DD) were in social contact less than TD-TD dyads, as revealed by significant interaction terms ( $p_{ASD-ASD}=0.014$ ,  $p_{DD-DD}<0.001$ ).

**Conclusions:**

ASD-specific deficits might be expected in both social approach and social contact during naturalistic interaction. However, we did not find evidence of differential social approach by group. Instead, overall, concordant dyads interacted with one another at higher velocities than discordant dyads, indicating early homophilic patterns of social movement in all three groups. We also found strong patterns of homophily in social contact. Here, children with ASD were in social contact with other children with ASD less than TD-TD dyads, and DD dyads showed a corresponding pattern. The results suggest the potential of a new generation of objective measures to quantify the dynamics of social approach and social contact for children with ASD in preschool inclusion classrooms.

**418.095 (Poster)** Output Metrics for Prototype and Reference Standard Hand-Held Pupillometers: Comparison of Pupillary Measures for ASD and Typical Development in Children between 2-4 Years

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**Background:** Recent attention has been given to emerging research investigating the pupillary light reflex (PLR) as a potential biomarker for autism spectrum disorder (ASD) to support first line screening. Studies have demonstrated differences for ASD in comparison to typical development (TD) on measures of constriction latency, constriction amplitude, and return to baseline metrics, indicating accelerated constriction in infants and toddlers, and decreased time for return to baseline measured across developmental levels. These findings were demonstrated using binocular eye tracking systems and handheld pupillometry technology. Hand-held technology may support clinical application more readily, given its mobility, ease of calibration, and ease of use. To determine potential utility of this technology in clinical practice, there is a need to examine validity of hand-held technology tools in relation to the reference standard hand-held pupillometer, as well as to identify PLR metrics presenting differences in young children with and without ASD measured using hand-held technology.

**Objectives:** This exploratory study involved collection of pupillary data to a) analyze output metrics of a hand-held prototype pupillometer made to capture PLR measurements associated with ASD in comparison to output metrics of the reference standard research-based hand-held monocular pupillometer, and b) compare a pediatric comparative PLR dataset obtained using hand-held technology to PLR metrics obtained from those with ASD using the same reference standard tool (N = 28 ASD; 28 TD, 2-4 years of age).

**Methods:** Analyses were conducted by a researcher blinded to group diagnostic status and comparative PLR data were collected by an independent clinical research team trained in monocular PLR data capture. Pearson product-moment correlation was used to determine the relationship between output metrics obtained with the prototype pupillometer and the current reference standard hand-held pupillometer, the Neuroptics PLR 3000. Bland-Altman analysis, a robust statistical method for comparing medical screening and diagnostic measurements, was used to determine limits of agreement within 95% confidence intervals between the two devices for each parameter. PLR data from the comparison sample were then analyzed for differences between ASD and TD for PLR metrics across six parameters.

**Results:** Results indicated agreement between the pupillometer prototype and the Neuroptics PLR3000. Analysis of PLR datasets indicated group differences for mean constriction latency and constriction time for children under three, and differences for constriction latency, constriction time and return to baseline for children beginning at age four. Trends related to age effects reveal accelerated constriction time in ASD and increased return to baseline for children with ASD four and older. Return to baseline measures were not consistent in children under three years of age.

**Conclusions:** These findings support previous studies using binocular systems and PLR parameters associated with ASD. Validation of hand-held pupillometry for PLR data capture have implications for developing technology to support ASD screening. However, further research is still needed to develop PLR metrics for specific age effects by diagnostic status. These results are explained in the context of studies relating pupillometry to ASD biomarkers and translation of these findings to potentially bolster ASD screening within pediatric clinical practice.

**418.096 (Poster)** Patterns of Peer Relations in Youths with Autism Spectrum Disorder: An Analysis of Gender and Age

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**Background:** Autistic youths often experience difficulties in their relations with peers (Sterrett et al., 2017). Indeed, common areas of concern for autistic youth include having few or no friends, being victimized by peers, and having friendships that are characterized as relatively brief and of low quality (Petrina et al., 2014; Storch et al., 2012). Extant research has demonstrated that peer relation concerns are linked with symptoms inherent to ASD, such as impairment in social communication and reciprocity. However, there has been relatively little focus on developmental and gender considerations with regard to peer relations in autistic youths. Identifying potential differences may have implications for intervention for this clinical population.

**Objectives:** The primary aim of this study was to examine the differences in key domains of peer relations in children and adolescents with Autism Spectrum Disorder (ASD) based on age and gender.

**Methods:** Participants were 2,142 caregivers of children and adolescents (ages 6-17) with ASD. Autism symptoms were measured using the Social Communication Questionnaire (SCQ; Rutter et al., 2003). The Missouri Peer Relations Inventory (MPRI; Borduin et al., 1989) was used to assess domains of peer relations: number of friends, emotional bonding, social aggression, and social maturity. The sample was divided into four groups based on gender (younger girls  $n=275$ , younger boys  $n=854$ , older girls  $n=280$ , older boys  $n=733$ ) and mean age ( $M=11.07$  years;  $SD=3.17$ ). Analysis of variance (ANOVA) and post-hoc comparisons (LSD) were used to examine the differences in SCQ scores and the peer relations domains.

**Results:** A one-way ANOVA did not show a significant main effect for gender and age groups on SCQ scores,  $F(3, 2138) = 1.78, p = .149$ . A main effect for gender and age was found for number of friends,  $F(3, 2138) = 3.05, p = 0.28$ , with older girls having more friends than younger boys ( $p = .004$ ). A main effect was also found for social maturity,  $F(3, 2129) = 7.44, p < .001$ , with younger girls having greater social maturity than younger boys and older boys ( $p < .001$ ) and older girls ( $p = .051$ ). No main effects on gender and age were found for emotional bonding,  $F(3, 2138) = 1.65, p = .175$ , or social aggression,  $F(3, 2128) = .33, p = .804$ .

**Conclusions:** The findings suggest that there are differences in peer relations between gender and age in autistic youths, regardless of autism symptoms as assessed by the SCQ. Older girls had the most friends relative to other groups, with younger girls having more social maturity. Girls having more robust peer relations than boys may be consistent with the notion that autistic girls engage in compensatory behaviors (i.e., “masking” or “camouflaging” ASD symptoms) to gain acceptance with peers. The findings may also reflect social and parental expectations of girls, which is notable given the caregiver-report methodology. Future research should examine the contribution of compensatory behaviors in peer relations for autistic youth, as well as other age- and/or gender- specific mechanisms that may affect peer relations.

**418.097 (Poster)** Peer Stress in Adolescence: Differential Coping Strategies Reported By Individuals with Autism Spectrum Disorder and Typical Development

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**Background:** Adolescence is often distinguished by a unique set of interpersonal challenges, including stress related to peers. The Responses to Stress Questionnaire (RSQ; Connor-Smith et al., 2000; Compas et al., 2001), a well-validated and widely used measure of stress-related coping strategies, categorizes the ways in which individuals interact and cope with a particular stressor. Each of these categories (Primary Control Engagement Coping, Secondary Control Engagement Coping, Disengagement Coping, Involuntary Engagement, and Involuntary Disengagement) is distinguished by the degree to which it is cognitively and psychologically adaptive for an individual dealing with stress.

**Objectives:** This study aimed to investigate potential differences between youth with Autism Spectrum Disorder (ASD) and Typical Development (TD) in terms of strategies utilized to cope with stress explicitly related to problems with peers in the past six months.

**Methods:** Participants were enrolled in an ongoing longitudinal study examining stress, pubertal development, and physiological arousal during adolescence. First-year self-report RSQ (Peer Stress Version) data was analyzed from 238 youth with ASD ( $n = 137$ ; 102 males, 35 females) or TD ( $n = 101$ ; 58 males, 43 females).

**Results:** Compared to the TD sample, youth with ASD reported significantly higher Involuntary Engagement ( $M = 0.25$ ,  $SD = 0.043$ ,  $t(215) = -3.76$ ,  $p < .001$ ) and Involuntary Disengagement ( $M = 0.19$ ,  $SD = 0.036$ ,  $t(214.87) = -4.61$ ,  $p < .001$ ). Youth with TD reported significantly higher use of Primary Control Engagement Coping ( $M = 0.19$ ,  $SD = 0.036$ ,  $t(214) = 3.51$ ,  $p = .001$ ) and Secondary Control Engagement Coping ( $M = 0.26$ ,  $SD = 0.048$ ,  $t(215) = 3.99$ ,  $p < .001$ ).

**Conclusions:** Key stress-related coping differences were observed between diagnostic groups. While youth with TD utilized more Primary and Secondary Control Engagement Coping strategies, those with ASD reported more involuntary, maladaptive reactions to peer stress. These findings substantiate the potential clinical utility of evaluating stress-related coping in adolescent populations. A longitudinal approach to future research in this area can potentially elucidate changes in coping strategies as individuals—particularly those with ASD—transition to adulthood.

**418.098 (Poster)** Preliminary Factor Analysis of the Autism Parent Screen for Infants

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**Background:** Early identification of ASD remains an enduring challenge, as the median age of diagnosis remains around four years (Maenner et al., 2020). Level 1 screening with parent report plays a vital role in detecting early emerging signs of ASD. The *Autism Parent Screen for Infants* (APSI) is a 26-item parent-report measure designed to screen for ASD in infants and toddlers (Sacrey et al., 2016). Research has demonstrated the clinical utility of APSI screening in infant siblings of autistic children (Sacrey et al., 2018; 2020). The full psychometric properties of the instrument, including the factor structure and invariance of that structure across key moderators, have yet to be fully elucidated.

**Objectives:** This study aims to characterize the latent factor structure and measurement invariance of the APSI across two samples from different ascertainment strategies.

**Methods:** Parental ratings on the APSI were gathered from participants at the University of Minnesota (UMN;  $n=955$ , 463 females) and a Canadian collaborative including the University of Alberta, Holland-Bloorview, and Dalhousie University (CDN;  $n=463$ , 181 females). The UMN sample included community-ascertained toddlers aged between 17-36 months ( $M=23.29$  months,  $SD=4.20$  months). The CDN sample included younger siblings of autistic children ascertained before age 12 months, with APSI data gathered between 16-32 months ( $M=20.23$  months,  $SD=2.88$  months). The combined sample was stratified by age, sex, and ascertainment group and randomly assigned to either the exploratory factor analysis (EFA) group ( $n=701$ ) or the confirmatory factor analysis (CFA) group ( $n=701$ ). EFA using polychoric correlations, principal axis factoring extraction, and oblique rotation were performed to determine the number of factors. The fit of the factor structure yielded by the EFA was assessed in the CFA group. Finally, preliminary examination of measurement invariance across age, sex, and cohort was conducted using the moderated nonlinear factor analysis (MNLFA) method.

**Results:** One- to five-factor solutions were examined; a two-factor solution best characterized emerging autistic traits as measured by the APSI (see Table 1). Factor 1 was interpreted as Social Communication Behaviors and Factor 2 was interpreted as Restricted and Repetitive Behaviors, Interests, and Activities. Item 18, which didn't load clearly on either factor, was excluded from the model. The subsequent CFA analyses further supported the two-factor solution as the model fit the data well in the other half of the sample (see Table 2). Finally, the preliminary MNLFA analyses showed

differential item functioning (DIF) across the two ascertainment groups on both factor loadings (Q2,Q11,Q20,Q23) and item intercepts (Q2,Q17,Q20,Q25). Age did not affect factor loadings. Sex effects on factor loadings were observed on only one item (Q15).

**Conclusions:** These findings provide preliminary evidence for a two-factor structure of the APSI within both elevated-familial-likelihood and community-derived toddler populations. This two-factor structure is consistent with DSM-5 criteria for ASD – Factor 1 represents atypical social communication, while Factor 2 maps to restricted and repetitive behaviors, interests, and activities. Deriving factor scores that account for differential item functioning may be warranted for future research.

**418.099 (Poster)** Psychometric Properties of the Spanish Version of the Autism Quotient Questionnaire for Children (AQ-Child)

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**Background:** Autism Spectrum Disorder (ASD) is a lifelong heterogenous neurodevelopmental condition characterized by difficulties in social communication and stereotyped patterns of behaviors and interests. Individuals with an ASD are often at a higher risk of experiencing other associated cognitive disorders and adaptive difficulties. The Broader Autism Phenotype (BAP) refers to mild manifestations of autistic-like behaviors present in the general population. The Autism Spectrum Quotient, Child version (AQ-Child), is a report questionnaire for parents that aims to identify the characteristic features of autism in children aged 4 to 11 years. The scores in the AQ-Child range from 0 to 150, where higher scores correspond to behaviors more characteristic of ASD.

**Objectives:** The purpose of this study was to perform an analysis of the psychometric properties of the Spanish version of the AQ-Child.

**Methods:** AQ-Child data was collected from a sample of school-age children aged 4 to 11 years from the general population (n = 635). Diagnostic assessments were completed on a sample of children who scored positive on the AQ-Child. The internal consistency of the Spanish version of the AQ-Child was assessed by calculating Cronbach's Alpha coefficients for the entire measure. The factor model structure of the AQ-Child was evaluated through a Confirmatory Factor Analysis (CFA) of the proposed factor structure model for the AQ-Child.

**Results:** The preliminary results indicate that for the measure as a whole Cronbach's  $\mu$  coefficient was good ( $\mu = .86$ ). Furthermore, the internal consistency of the four-factor model structure was also satisfactory (mind reading = .83; attention to detail = .76; social skills = .80; and imagination = .72). In general, the proposed four-factor model fits well with all the measures ( $p < 0.001$ ) and captures important associations between the variables (SRMR = 0.072). The preliminary results indicate a good model fit (RMSEA = 0.066).

**Conclusions:** As this is an on-going study, the data from the preliminary analyses seem to indicate that the Spanish version of the AQ-Child could be a reliable instrument for evaluating behaviors associated to an ASD. Our preliminary findings suggest that the Spanish version of AQ-Child may be a useful tool to be used in the education system to aid and improve the identification of ASD-related behaviors in children aged 4 to 11 years, who may have gone unidentified by early detection programs and could be at a greater risk of suffering social exclusion and academic failure due to their behavioral difficulties.

**418.100 (Poster)** Psychopathological Correlates of Autism Symptom Severity Change during Middle Childhood

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**Background:** By school age, many children with autism experience a change in the severity of their autism symptoms. It is also during middle childhood when some types of psychopathology begin to emerge at approximately the same time.

**Objectives:** The current study evaluated the hypothesis that change in autism symptom severity across middle childhood (from 6 to age 11), is associated with an increase in co-occurring psychopathology.

**Methods:** A group of 75 autistic children were followed longitudinally and evaluated at three occasions: at approximately 3, 6 and 11 years of age. Autism symptom severity was evaluated using the Autism Diagnostic Observation Schedule-2 (ADOS-2). Co-occurring psychopathology was evaluated using the Child Behavior Checklist (CBCL) and the Anxiety Disorders Interview Schedule/Autism Spectrum Addendum (ADIS/ASA). Change in autism severity was evaluated using the ADOS Calibrated Severity Scores (CSS) across middle childhood (from age 6 to age 11); significant change was determined using the Reliable Change Index. Change in severity was examined separately for social-communication symptoms (SA CSS) and restricted, repetitive behaviors (RRB CSS). Based on their change patterns (decrease, increase or stable severity), children were classified into different groups.

**Results:** Using change in social-communication symptoms, we identified a group of 16 children (21.3% of the sample; SA-I group) that decreased in the severity of social-communication symptoms during early childhood, from age 3 (SA CSS 6.2(1.4)) to age 6 (SA CSS 4.7(1.5)). Across middle childhood, however, children in this group increased substantially in the severity of their social-communication symptoms resulting in a higher mean



severity level compared to other children at age 11 (SA CSS 8.4(1.4)) (Figure 1, Panel A). Based on the CBCL, this group also had elevated psychopathology levels, mainly for ADHD symptoms and externalizing behaviors, across childhood and predominantly at age 11. This group also showed significantly higher mean IQ scores across childhood compared to other children in the sample. Analysis of change in restricted, repetitive behaviors identified a group of 17 children (22.7%; RRB-D group) that did not significantly change in RRB severity across early childhood, from age 3 (RRB CSS 7.9(1.6)) to age 6 (RRB CSS 8.5(1.2)) and their RRB severity was similar to those of the other children in the study. Across middle childhood, however, children in this group significantly decreased in RRB severity, to have a lower severity level at age 11 (RRB CSS 5.8(2.1)) than other children (Figure 1, Panel B). Based on the ADIS/ASA, this group also had a higher anxiety level compared to other children in the study at age 11, with 94% of the children in this group meeting clinical criteria for having an anxiety disorder (compared to 65% of other children).

**Conclusions:** Increase in the severity of social-communication symptoms across middle childhood is associated with co-occurring psychopathology such as ADHD symptoms and externalizing behaviors. Decreases in the severity of RRB may be associated with the emergence of clinically meaningful anxiety later in childhood.

#### **418.101 (Poster)** Remote Assessment of ASD Symptoms in Clinical Trials: Automated Analysis of Repetitive Speech Behaviours in Natural Conversations

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#### **Background:**

Outcome measures currently used in clinical trials for autism spectrum disorder (ASD) have limitations in terms of reliability, validity, burden and ecological validity (Anagonostou et al., 2014). To address this unmet measurement need we have developed novel digital tools for the remote measurement of ASD signs and symptoms and deployed these into an observational study. By measuring symptoms objectively in the home environment, digital health technology tools could reduce participant burden, improve ecological validity and be administered more frequently, which may increase sensitivity to change compared to clinical scales.

Social communication impairments and restricted and repetitive behaviors (RRBs) are the core symptoms of ASD. In natural conversations, these can manifest through low-level features such as the duration which a person talks, acoustic features such as prosody and pitch, and high-level features such as repetitive speech; including focusing on a restricted interest and repetition of another person's speech (echolalia). These features can be quantified by recording natural conversations in the home environment of a participant. We have previously reported differences in expressive communication between low- and high-functioning individuals with ASD (O'Sullivan, 2020). Here we report on differences in repetitive speech during natural conversations. To this end, audio recordings must be segmented according to when each speaker is talking. Whilst segmentation can be done manually, this is labor intensive when applied to large datasets. Instead algorithms can be used for automated segmentation (speaker diarization; SD) followed by machine learning algorithms to perform automatic speech recognition (ASR) to identify repeated words.

**Objectives:** To automatically assess repetitive speech behaviours in ASD via a combination of SD and ASR.

**Methods:** 90 individuals with ASD and 45 typically developing (TD) controls (5-45yrs) were asked to record a conversation with a conversation partner once per week during the 12-week observational period of a non-drug observational study. Individuals with ASD were categorized as low-functioning (IQ<70) or high-functioning (IQ>70). For automated segmentation, a deep-learning based SD pipeline (Profant I.J., 2019) was applied to the conversation recordings, and validated via manual segmentation of a subset of conversations. This was followed by ASR to measure how many times a participant repeated the same words.

#### **Results:**

Task adherence was observed to be between 40-50% throughout the study leading to conversation recordings every 2-3 weeks on average. We found that both low- and high-functioning ASD participants had significantly more repetitive speech than TD controls (Mann-Whitney *U*,  $p < 0.005$ ). In particular, we found that content words (which convey semantic meaning) were repeated significantly more than function words (which connect speech but do not have semantic information).

#### **Conclusions:**

Our results show that the repetitive speech of individuals with ASD can be assessed in the home environment using natural conversation recordings. Analyses of conversational features can demonstrate known-group differences through automated segmentation and speech recognition, which will allow the use of this approach in large clinical trials. Future work will focus on additional repetitive speech behaviours such as preoccupations with certain topics over multiple days, and echolalia.

#### **418.102 (Poster)** School-Based Universal Screening for Autism: Feasibility and Initial Findings

**Background:** Efforts aimed at early identification of autism spectrum disorders (ASD) have focused largely on detecting toddlers with relatively clear behavioral symptoms (e.g., absence of pointing). For children who have less overt signs and symptoms (previously associated with Asperger's disorder or high functioning autism), functional impairment may not be realized until school-age, adolescence, or adulthood. Identifying these children before functional impairments emerge may mitigate potential negative events, including bullying, truancy, and social exclusion. One approach to identifying undiagnosed children with ASD is to conduct universal screenings. Most research on universal screenings, however, has been conducted in younger children, typically at pediatrician offices (e.g., Pierce et al., 2021). No research, to our knowledge, has examined the feasibility, acceptability, and efficacy of school-based universal screening programs for detecting ASD.

**Objectives:** The objective of the current study was to examine the feasibility and efficacy of a school-based universal screening program for identifying undiagnosed school-aged children with ASD.

**Methods:** Teachers from 12 public charter schools in the Phoenix metropolitan area were recruited in 2018 to screen all students in second, fourth, and eighth grades for social challenges using the Social Challenges Screening Questionnaire (SCSQ) (Smith et al., 2015). Students who flagged the SCSQ were eligible to receive a free diagnostic evaluation at the study center. Licensed psychologists evaluated students with the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Gotham et al., 2007; Lord et al., 2009; 2012), Kaufman Brief Intelligence Test, Second Edition (KBIT-2; Kaufman & Kaufman, 2006), and Vineland Adaptive Behavior Scales, Third Edition (VABS-3; Sparrow et al., 2016). Initial indices of program feasibility and efficacy such as rates of screening and diagnostic outcomes were tracked.

**Results:** Over the course of two school years (2018-2019 and 2019-2020), 103 teachers screened 2,521 students. Of the students screened, 110 (4%) scored in the concern range, and parents of 42 students agreed to be contacted by the research team. Out of the 42 families who agreed to be contacted, parents of 17 students declined an evaluation; developmental evaluations were completed for 25 students. Of the students who were evaluated, 88% ( $n = 22$ ) met full diagnostic criteria for ASD.

**Conclusions:** Results provide preliminary evidence that school-based universal screening for social challenges is both feasible and a promising approach for identifying previously unidentified cases of ASD.

#### **418.103 (Poster)** Sensitivity and Specificity of the Autism Diagnostic Interview, Revised (ADI-R) in an Ethnically and Racially Diverse Clinical Sample

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**Background:** Standardized instruments such as the Autism Diagnostic Interview, Revised (ADI-R; Rutter et al. 2003) are routinely used to assess symptoms of Autism Spectrum Disorder (ASD). While rates of clinical ASD diagnosis vary between families from some racial and ethnic minorities (Mandell et al. 2009), other ASD prevalence data indicate no significant differences between ASD diagnostics between White and Black 8-year-olds (Baio et al. 2018). Researchers must validate diagnostic instruments in minority populations to assist clinicians in best understanding the needs of families and making accurate diagnoses. Several factors lead to disparities of diagnosis including ASD awareness, general prejudice, family differences regarding developmental concerns, specialty healthcare accessibility and acceptability, provider responsiveness to caregiver concerns, and performance of standardized diagnostic tools and algorithms (Institute of Medicine, 2002; Mandell et al., 2009). This study focuses on the latter and assesses the sensitivity and specificity of the ADI-R in a clinical sample of children from White and Black households.

**Objectives:** Accurate clinical diagnosis is necessary for many children with ASD to access appropriate interventions and services. Our research seeks to compare the diagnostic accuracy of the ADI-R between families from two different racial backgrounds.

**Methods:** ADI-R data was obtained from a retrospective chart review. Subjects included 441 children ages 2-17 ( $M=5.4$ ,  $SD=3.5$ ) who participated in autism evaluations at a large children's hospital in the Midwestern United States between March 2020 and January 2021. Eighty-four children identified as Black (19%) and 357 (81%) identified as White. The sample was primarily male (73%). A large portion lived in rural areas (40%) and the majority qualified for state insurance (Medicaid; 58%). Families were administered the algorithm items of either the standard ADI-R ( $n=231$ ; *older group*) or the Kim & Lord (2012) updated algorithms for toddlers and young preschoolers ( $n=210$ ; *younger group*). Receiver Operating Characteristic (ROC) analyses were completed, including Area Under the Curve (AUC), for each racial group. DeLong's test was used to test for group differences in AUC.

**Results:** There were no group differences in diagnosis rate for the older group [ $\chi^2(1)=0.03$ ;  $p=.85$ ]. The rate of ASD diagnosis was significantly higher for Black children (95.5%) vs. White children (74.7%) in the younger group [ $\chi^2(1)=7.84$ ;  $p=.005$ ]. See Table 1 for ROC analysis results. The ADI-R Standard has 82% sensitivity and 56% specificity among Black children and 69% sensitivity and 75% specificity among White children. There were no significant differences in AUC values between groups. ADI-R Toddler research cutoffs indicated the Black group had a significantly higher AUC compared to the White group, largely driven by 100% specificity. The ADI-R Toddler Clinical Cutoffs had high sensitivity but low specificity.

**Conclusions:** The ADI-R Standard yielded no significant group differences in diagnosis of ASD for both groups. The ADI-R Toddler Research Cutoffs were more accurate for Black children and indicated 100% diagnosis confirmation rate. Future research should assess how the ADI-R performs among other ethnic, racial, and linguistic, minority groups, differences between referrals, the role of parental concerns, and the influence of ASD symptom severity in rates of diagnosis.

**418.104 (Poster)** Sensitivity and Specificity of the Modified Checklist for Autism in Toddlers: A Systematic Review

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**Background:**

Despite recommendations from The American Academy of Pediatrics that all children receive autism-specific screening, adherence to this recommendation is inconsistent, as is implementation of the most commonly used screening tool, the Modified Checklist for Autism in Toddlers (M-CHAT) and its revision, M-CHAT Revised, with Follow-Up (M-CHAT-R/F). Variation in implementation contributes to equivocal findings regarding the screening tools' properties.

**Objectives:**

The current systematic literature review assessed variations in sensitivity and specificity in studies reporting psychometric properties of the M-CHAT(-R/F) across multiple factors, including false negative detection strategies, sample risk level for autism, screening age, and single vs. repeat screenings.

**Methods:**

Included articles (n=43) 1) were published in English language peer-review journals from 2000-2020, 2) used M-CHAT(-R/F) to identify new cases of autism in children <=48 months, 3) identified at least 10 ASD cases, and 4) reported procedures for identifying false negative cases. Psychometric data was extracted independently by the authors and compared for accuracy, or data was calculated from raw values provided in included studies. In the case of discrepancies, coauthors reviewed papers and reached resolution. Authors used the Quality Assessment of Diagnostic Accuracy Studies – 2 (QUADAS-2 Tool) with adapted signaling questions to evaluate bias in sample selection, implementation, and diagnostic procedures.

**Results:**

M-CHAT(-R/F) sensitivity and specificity varied across studies (sensitivity: 0.33-1.00,  $M = 0.78$ ; specificity: 0.27-1.00,  $M = 0.81$ ). Sensitivity estimates were higher with use of concurrent (0.59-1.00,  $M = 0.84$ ) compared to prospective strategies (0.33-0.91,  $M = 0.55$ ). The lowest sensitivity estimates were found for studies utilizing medical record reviews (n = 5; 0.33-0.70,  $M = 0.45$ ), though specificity was high (0.93-1.00,  $M = 0.97$ ). Most studies that reported data for older and younger samples (n=5) found differences in sensitivity for >30 months (0.69-0.82,  $M = 0.74$ ) compared to <30 months (0.78-0.90,  $M = 0.87$ ). Sensitivity was slightly higher in studies using high-risk samples (0.52-0.94,  $M = 0.80$ ), compared to low-risk (0.33-1.00;  $M = 0.71$ ). In studies which utilized single and repeat screening (n=2), 18-30% higher sensitivity was demonstrated across repeat screens compared to a single screening, without a meaningful decrease in specificity. Studies generally demonstrated low risk of bias across domains, with the exception of flow and timing, for which 30 studies (68%) showed high risk of bias. Regarding applicability, all studies showed low concern for patient selection and reference standard, with only one rated to be of high risk for concern of applicability for the index test domain.

**Conclusions:**

Across studies, sensitivity and specificity of the M-CHAT(-R/F) were generally strong, though variability in sensitivity related to concurrent or prospective study design, as well as age of participants. Repeat screening was found to maximize sensitivity, but was under-utilized. Specificity was impacted by the ASD risk level of samples. Results highlight utility of the M-CHAT(-R/F) and reiterate that screening early and at multiple timepoints is critical to optimal identification of children at risk for ASD.

**418.105 (Poster)** Social Communication and Repetitive Behavior and Interests in Girls with High-Functioning Autism Spectrum Disorder

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**Background:**

Sex may influence symptoms of ASD (Kreiser & White, 2014). Males are four times more likely to be diagnosed with ASD than females (Maenner et al., 2020). However, this ratio is inconsistent when intellectual functioning is considered, and ranges from 2:1 for individuals with intellectual disability (Mattila et al., 2011) to 6:1 (Baird et al., 2006) to 16:1 (Scott et al., 2002) for individuals without intellectual disability. Lower rates of ASD in females with average IQ may suggest that this group has symptoms that are distinctly different from males which may lead to underdiagnosis (Halladay et al., 2015). Examination of ASD symptoms in this group may have implications for assessment and treatment services as well as establishment of diagnostic criteria for females.

**Objectives:**

To investigate deficits in autism symptoms in girls with ASD and average IQ (i.e., high-functioning ASD; HF-ASD) compared to girls who are typically developing (TD), we examined the following:

1. What are the symptoms of social communication and repetitive behavior and interests in girls with HF-ASD compared to girls who are TD based on structured observation and parent report?

## Methods:

Thirty-seven girls between 7;5—15;2 years participated (HF-ASD,  $n=18$ ; TD,  $n=19$ ).  $T$  test confirmed that the groups did not differ in age, verbal IQ, nonverbal IQ, and IQ composite on the Kaufman Brief Intelligence Test-2<sup>nd</sup> Edition (KBIT-2; Kaufman & Kaufman, 2004). The Autism Diagnostic Observation Schedule-2<sup>nd</sup> Edition (ADOS-2; Lord et al., 2012) was administered to confirm symptoms of ASD by a research reliable examiner. All TD participants demonstrated absence of ASD symptoms. The Social Communication Questionnaire—Lifetime Form (SCQ; Rutter et al., 2003) was completed to obtain a parent report of symptoms.

## Results:

Mann-Whitney  $U$  tests were used to examine differences. False Discovery Rate was applied (Benjamini-Hochberg, 1994).

The groups differed in regard to Total scores on the ADOS-2 ( $p=0.000$ ) and SCQ ( $p=0.000$ ).

### Item-Analysis on the ADOS-2 and SCQ

Girls with HF-ASD earned significantly higher scores on 3 of 11 items (27%) from the subdomain of reciprocal social interaction, 2 of 9 items (22%) from the subdomain of communication, and 0 of 5 items (0%) from the subdomain of repetitive behavior and interests.

Girls with HF-ASD earned significantly higher scores on 5 of 15 items (33%) from the subdomain of reciprocal social interaction, 3 of 13 items (23%) from the subdomains of communication, and 7 of 8 items (88%) from the subdomain of repetitive behavior and interests.

## Conclusions:

No significant differences were observed on most items from the subdomains of reciprocal social interaction and communication on the ADOS-2 and SCQ. Girls with HF-ASD were less likely to demonstrate repetitive behavior and interests on the ADOS-2, but presence of these symptoms were noted on the SCQ. Current measures frequently used for assessing ASD may not consider females' relative strengths or advantages over males in social communication or differences in expression of repetitive behaviors and interests. Future studies should aim to include larger samples of females who are TD and females with HF-ASD in the standardization process for such measures.

### 418.106 (Poster) Stability of ASD Outcomes: Expected Change of Commonly Used Social Communication Measures

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**Background:** There is no agreed upon set of measures to track social communication change within the early intervention literature for children with ASD and many measures have not undergone rigorous psychometric evaluation, despite their frequent use (McConnachie et al., 2015). One area of psychometric evaluation of particular relevance to the early intervention literature is the lack information on the sensitivity of measures of social communication to change (Grzadzinski et al., 2020). Further, recent syntheses of intervention studies have combined outcome data based on constructs, such as language, without accounting for the potential error introduced when different measures of the same construct are combined (e.g. Sandbank et al., 2020). Information is needed on whether there is significant heterogeneity in social communication outcomes purported to measure the same constructs.

**Objectives:** The aims of this study were: (1) to examine and compare the expected change of social communication measures used in ASD longitudinal research and (2) to determine whether the presence of treatment, age of children, cognitive ability and type of measure (e.g. standardized versus age equivalent) moderates the expected change.

**Methods:** A systematic search and review of manuscripts from three online databases was conducted to identify any longitudinal study of children with ASD that included a social communication measure at two or more timepoints and that included children between 2 and 8 years old. Effect sizes were generated, representing the standardized mean difference between the two timepoints, and the effect sizes were pooled within each identified outcome measure using a meta-analytic approach. Meta regression was used to determine whether the length of the measurement period was related to the magnitude of change and the moderating influence of the presence of treatment, children's age, cognitive ability and type of measure on the expected change of each measure. Inter-rater reliability was collected at each stage of the search and data extraction process.

**Results:** 7098 articles were culled for review and 203 articles met full inclusion criteria. From those studies, 119 unique social communication measures were identified of which 55 measures were only used in a single study. A total of 1232 effect sizes were generated and pooled across measures.

75% of measures had expected change over time that was considered a small to medium effect, though there was considerable variability across measures of the same construct. Most outcomes were not sensitive to change; there was a positive relationship between change and the length of the study in only 9 of the 42 analyzed measures. Some measures were influenced by cognitive ability, chronological age, and intervention, though no consistent pattern was noted. Age-equivalent scores had approximately twice the expected change as standard scores of the same measure.

Conclusions: These data suggest that careful consideration is needed when selecting an outcome measures, tests of similar constructs can vary considerably in their expected change over time. Some recommendations based on these data include using caution when reporting standard scores to measure change over time and using caution when combining different outcome measures to synthesize intervention data.

**418.107 (Poster)** The Autism-Spectrum Quotient - Hebrew Version (AQ-Heb): A Full and a Short Form, Adapted for DSM-5

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Background: The Autism Spectrum Quotient (AQ) is a self-report scale used to assess autistic traits. It was tested cross-culturally, and a short version was recommended to help identify adults who should be referred for an autism assessment.

Objectives: The current study aimed to examine the psychometric properties of the Hebrew version of the AQ (AQ-50-Heb), and to create a short version based on items which map on to DSM-5 criteria.

Methods: Seventy autistic adults, clinically diagnosed according to DSM-5 (15 female), aged 18-51, and 147 comparable controls (34 female), filled out the AQ-50-Heb. Ten clinicians who specialize in diagnosing autism in adults classified the AQ's items according to DSM-5 criteria.

Results: The AQ-50-Heb showed good internal consistency (.89). At a cut-off of 23 it shows good sensitivity (.84) and specificity (.85). The AQ-10-Heb comprised 5 of the most discriminating items representing each of the DSM-5 diagnostic domains (see Table 1 below). Representing two Social Communication and two Restricted, Repetitive Behaviors criteria of DSM-5, the AQ-10-Heb yielded good internal consistency (.84) and optimal sensitivity (.87) and specificity (.82) at a cut-off of 5.

Conclusions: The AQ-50-Heb, and its short DSM-5 adapted AQ-10-Heb version are reliable and sensitive instruments that can help referring adults for autism assessment.

**418.108 (Poster)** The Consequences of Using Different 10-Item Autism Spectrum Quotient (AQ10) Cut-Offs in Psychological Research

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Background: The 10-item Autism Spectrum Quotient (AQ10, Allison et al., 2012), as recommended by the National Institute for Health and Care Excellence (NICE), is widely used to quantify autistic traits and screen for autism both in the UK and internationally. A worrying discrepancy has recently been found in the screening guidelines for the AQ10, in which NICE has erroneously recommended an incorrect  $\geq 7$  cut-off value, instead of the correct  $\geq 6$  value specified in the original research on the AQ10 (Waldren et al., 2021). A review of the literature shows this discrepancy has proliferated across research, generating confusion and misuse of the AQ10 cut-off over the past decade, with 56% of the research identified using the incorrect  $\geq 7$  or an ambiguous cut-off value.

Objectives: We aimed to quantify how the misuse of the AQ10 cut-off, specifically use of the incorrect  $\geq 7$  value instead of the correct  $\geq 6$  value, has affected autism research over the past decade.

Methods: Open-access data from three published studies in high-ranking journals using the AQ10 (Gollwitzer et al., 2019; Clutterbuck et al., 2021; Livingston et al., 2020; Total  $N = 6997$ ) were reanalysed, using both the correct  $\geq 6$  and incorrect  $\geq 7$  AQ10 cut-offs to classify participants with high and low autistic traits. These high and low autistic trait classifications were then used to re-test the main hypotheses from each of the three studies. The effect sizes produced using the correct  $\geq 6$  and incorrect  $\geq 7$  cut-off values were then statistically compared using the COCOR package (Diedenhofen & Much, 2015), to quantify how a 1-point difference in the AQ10 cut-off affects empirical results.

Results: Using the incorrect  $\geq 7$  AQ10 cut-off value reduced the number of participants who met the screening threshold for autism across all three datasets by up to 56%. The correct  $\geq 6$  cut-off value was also more accurate in classifying participants who had a clinical diagnosis of autism. Most critically, our analyses showed that the one-point difference in the AQ10 cut-off significantly changed effect sizes in two of three datasets by up to 47.62% (Gollwitzer et al., 2019:  $p < .001$ ; Clutterbuck et al., 2021:  $p = .004$ ), demonstrating that the misuse of the AQ10 cut-off has serious consequences for research.

Conclusions: Misuse of the AQ10 cut-off is commonplace in the literature, likely due to NICE recommending an incorrect screening value. Our results demonstrate the consequences of AQ10 cut-off misuse for international autism research, both in terms of sample composition and effect sizes of autism-related associations. We discuss the wider implications of these results for autism research and call for an appropriate AQ10 cut-off value to be established and used consistently in research and clinical practice.

**418.109 (Poster)** The Importance of Language Delays for Early ASD Diagnosis

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**Background:** Early diagnosis of autism spectrum disorder (ASD) enables early access to treatment and better outcome (Hyman et al., 2020; Zwaigenbaum, Bauman, Choueiri, et al., 2015; Zwaigenbaum, Bauman, Stone, et al., 2015). Previous studies have reported that children with more severe ASD symptomatology tend to be diagnosed earlier (De Giacomo & Fombonne, 1998; Mandell et al., 2005; Mishaal et al., 2014; Rhoades et al., 2007; Salomone et al., 2016; Vanegas, 2021). However, it is not clear whether some of these variables affect the age of diagnosis more than others.

Recent studies have demonstrated that the majority of children with ASD (>85%) exhibit language delays that include delays in word learning and the use of phrases (Adamson et al., 2019; Pickles et al., 2014). Hence, while most children with language delay do not have ASD, language delay may still be an important, highly visible, early sign that justifies assessment of ASD symptoms.

**Objectives:** To determine the relative strength of language delay as a predictor of early ASD diagnosis, particularly prior to the age of 30 months, which is the upper age limit of many ASD screening tools (Zwaigenbaum, Bauman, Fein, et al., 2015).

**Methods:** We examined data from 97 Hebrew speaking children with ASD (mean age: 31.6 months old) who completed the Preschool Language Scale, fourth edition (PLS-4) and the Autism Diagnostic Observation Schedule, 2<sup>nd</sup> edition (ADOS-2) during their diagnosis. In addition, 80 of the children (~82.5%) also completed standardized cognitive assessments. We compared children diagnosed with ASD before 30 months of age with children diagnosed at older ages.

**Results:** Our results revealed that the age of diagnosis was positively correlated with PLS-4 scores ( $r(95)=0.61$ ,  $p<0.001$ ) and cognitive scores ( $r(78)=0.27$ ,  $p=0.021$ ), and negatively correlated with ADOS-2 Social Affect (SA) calibrated severity scores (CSS) ( $r(95)=-0.38$ ,  $p=0.0001$ ). A stepwise regression analysis demonstrated that PLS-4 scores were the strongest predictor of the age of diagnosis, explaining >37% of the variability across children. All the children diagnosed before 30 months of age in our sample exhibited moderate to severe language delays. Despite these strong relationships, approximately half of the children diagnosed after the age of 30 months also exhibited moderate to severe language delays that should have been noticeable during the second year of life.

**Conclusions:** While ASD is not defined as a language disorder, clear language delays are apparent in the vast majority of children diagnosed with the disorder. These results suggest that streamlined referral of children with language delays to ASD assessments may help further reduce the age of ASD diagnosis and identify children with ASD who are otherwise diagnosed late.

#### **418.110 (Poster) Trends in Intellectual Ability Among Children with Autism Spectrum Disorder from 2000 to 2016 in a Large Diverse Metropolitan Area**

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**Background:** Early studies found 40-75% of children with ASD had Intellectual Disability (ID). More recently, this trend has shifted, and now multiple epidemiological investigations show 40-60% of children with ASD have borderline to average intellectual ability. Intellectual ability is a strong predictor of functional outcomes, level of impairment, and support needed. Causal pathways for ID and ASD are known to be related.

**Objectives:** In this study, we describe intellectual ability across multiple populations of 8-year-olds between 2000 and 2016. Additionally, we examine sociodemographic shifts over the period.

**Methods:** ASD cases were identified through a population-based active ASD surveillance system. The Autism and Developmental Disability Monitoring (ADDMM) surveillance system utilizes a two-phase process. Data collected by the surveillance includes demographic and clinical information obtained from professional evaluations. ID status was obtained from surveillance data and categorized based on most recent IQ score for each case. A case was classified to have ID if IQ score  $\leq 70$ . ASD cases with missing IQ data were re-reviewed and classified as ID or no ID if they further met specific criteria. Data from seven surveillance cycles (2000, 2002, 2006, 2010, 2012, 2014 and 2016) were used. ASD prevalence estimates overall and by ASD with ID and ASD without ID were determined. ASD prevalence estimates were determined overall, and by sex, race/ethnicity and socioeconomic status (SES). Wilson score method was used to calculate 95% confidence intervals (CI).

#### **Results:**

Across all surveillance cycles, 4,661 cases met the surveillance standard case definition for ASD, and among those 2,760 (59%) ASD cases were classified as ASD without ID, 1,503 (32%) classified as ASD with ID and 398 remained with unknown ID status. While overall ASD prevalence estimates increased 3-fold in the 16-year period, ASD without intellectual disability increased approximately 5-fold (PR = 5.4; 95%CI: 4.4-6.5), and ASD with ID increased 2-fold (PR = 2.0; 95%CI: 1.6-2.5) in the same period. Comparing sex differences among children with ASD and ID, we observed that overall the prevalence ratio by sex was lower among ASD cases with ID compared to the prevalence ratio by sex among ASD cases without ID, which increased steadily over time. Across surveillance cycles, prevalence of ASD without ID was highest in Non-Hispanic White (NHW) children and lowest in Non-Hispanic Black (NHB) children. By 2016, the most recent surveillance cycle, across all race/ethnicities,

prevalence estimates of ASD without ID were higher than estimates for ASD and ID. Multivariate regression showed when we control for time trends, race/ethnicity, sex, and SES, children with ASD were two times more likely to have ASD without ID than ASD with ID (Figure 2).

Conclusions: ASD prevalence estimates among children with ASD with borderline to average intellectual ability has increased 540% between 2000 and 2016. Steeper increases in ASD estimates were seen among children with ASD without ID than children with ASD and ID. Our findings reveal possible disparities in identification of ASD without ID among Black and Hispanic children and children from low SES areas.

#### **418.111** (Poster) Validating a Swedish Measure of Social Camouflaging in Autism

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##### Background:

Research suggests that camouflaging, i.e. the use of behavioral strategies to appear less autistic in social interactions, is associated with increased mental health problems and even suicidality among autistic individuals. While the original English version of the Camouflaging Autistic Traits Questionnaire (CAT-Q) has been validated, previous research reports intercultural differences in autism assessment instruments also between countries often presumed to be similar, underlining the need for language- and culture specific validation of assessment instruments.

##### Objectives:

The aim of this study was to psychometrically evaluate and validate a translated Swedish version of the CAT-Q (CAT-Q/SE) in Swedish settings, in order to provide a valid measurement of camouflaging for research and clinical use. Also, we aimed to evaluate the utility of the CAT-Q/SE among adolescents.

##### Methods:

A sample aged between 10 and 83 years was recruited (N = 652, 59% female), comprising a general population group (n = 549) and a group of autistic individuals (n = 103). Participants completed a web survey including the CAT-Q/SE, as well as self-report questionnaires of autistic traits, stress, depression symptoms, anxiety symptoms, functioning and disability, and quality of life. The CAT-Q/SE will be psychometrically evaluated regarding validity (convergent, discriminant, factor structure), and reliability (test-retest, internal consistency). In addition, Swedish norm scores for the CAT-Q/SE will be developed.

##### Results:

Total scores on the CAT-Q/SE were positively correlated with theoretically linked measures of symptoms of anxiety and depression, and negatively correlated with quality of life, replicating findings in previous studies. The autistic participants scored significantly higher on the CAT-Q/SE total score than participants in the general population group. A subgroup (n = 138) completed the CAT-Q/SE a second time approximately four to eight weeks after the first, and the total scores from the two time points were strongly correlated, suggesting good test-retest reliability.

##### Conclusions:

The preliminary analyses suggest that the CAT-Q/SE demonstrates convergent and discriminant validity as well as test-retest reliability. The additional psychometric analyses described under methods will be conducted before INSAR 2022.

#### **418.112** (Poster) Pediatrician Accuracies in the Early Identification of Autism and Other Developmental Disorders and Delays

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Background: Pediatricians are essential for early ASD detection through timely referrals of children showing early warning signs. With limited time during well-child checkups, research has shown that pediatricians prefer to use their clinical judgment over lengthy developmental screening tools (Gabrielsen et al., 2015). Within this context, it is not surprising that pediatrician clinical impressions are sometimes incorrect (Gabrielsen et al., 2015), resulting in missed referral and evaluation opportunities for children showing delays consistent with ASD.

Objectives: To explore the accuracy of pediatrician clinical judgments concerning early child development, and how factors such as toddler age and sex may impact accuracy.

Methods: Parents filled out a broadband screening tool, the Communication and Symbolic Behavior Scales, Developmental Profile Infant-Toddler Checklist during 12, 18 & 24 month well-baby visits on an iPad. Pediatricians then referred 341 toddlers for a developmental evaluation by a licensed psychologist at UC San Diego's Autism Center of Excellence, and also denoted their clinical impression as ASD, delay (language delay, global developmental delay, or other delay) or typical on the iPad. Pediatrician clinical impressions were compared to diagnoses given by psychologists at the center. Factors that might influence accuracy such as sex and age were examined using logistic regression.

Results: Of 341 pediatrician impressions, 42.82% accurately identified whether a patient was at risk for ASD, typically developing, or had another development delay. However, when toddler classification was simplified as a typically developing versus an atypically developing group, accuracy increased to 70.40%. A binary logistic regression suggests that while sex is not a significant factor ( $p = .762$ ), age significantly influenced the accuracy of pediatrician impressions, (Wald  $\chi^2 = 6.51$ ,  $p < .011$ , Nagelkerke  $R^2 = .029$ ).

Conclusions: During well-child checkups, the majority of pediatricians were able to discern between young children who are typically developing and those that are not. However, accuracy in pediatrician clinical judgment decreased in regard to children at risk for ASD. This demonstrates a need to adapt and possibly change current developmental screening protocols and medical training to enhance the accuracy of pediatrician clinical impressions of ASD.

**418.113 (Poster)** Test-Retest Reliability of Automated Social Communication Algorithms to Support Autism Characterization

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**Background:**

The effort to improve existing measurement paradigms within the autism spectrum disorder (ASD) & neurodevelopmental disorders (NDD) clinical research communities has included several digital health approaches even prior to COVID. These approaches include telehealth and remote assessments as were widely adopted during COVID, as well as automated video and audio analysis and sought to address several challenges with existing measures including limited applications at extreme ends of standard distribution (Tager-Flusberg & Kasari, 2013), poor operationalization of behavior and minimal sensitivity to change over short time frames (Leonard, Cobb, & Downs, 2017).

**Objectives:**

This project utilized ARGUS-MDS, a non-intrusive, digital package utilizing machine learning, automated speech analysis, computer vision analysis (CVA), and computational models to support social communication phenotyping in children (2-11 years). Project goals included evaluating: 1) quality control metrics for machine learning (ML) algorithms, 2) test-retest reliability of biometric output, and 3) communication protocols between computer and clinical science teams.

**Methods:**

17 families with a history of ASD or suspected ASD were recruited from June 2020 to August 2020. We collected demographic information, NIH medical history, ACE family medical history, IQ (Mullen, WISC, WASI-II, Stanford Binet, or DAS-Early Years), ADOS-2 (toddler module or modules 1, 2, 3). We also collected caregiver ratings on the Social Responsiveness Scale-2 (SRS-2), Pervasive Developmental Disorders Behavior Inventory-Screening Version (PDDBI-SV), and the Vineland-3. Families were brought in for an initial screening and testing visit for the full battery, and a second a retest visit 1-4 weeks later for the ADOS-2 with biometric protocol to assess test-retest reliability. A software program was tested using sample videos to facilitate communication between software developers at Argus Cognitive, Inc. and clinician raters in house.

**Results:**

After screening, 15 participants with confirmed diagnoses of ASD met eligibility criteria (3 female, 12 male), between the ages of 1.5 to 12 years ( $M=4.27$ ,  $SD=3.20$ ). Quality control (QC) metrics were evaluated through hand-coding of biometric data by trained computer scientists. Several key social communication behaviors exceeded both quality control, test-retest reliability, and ICC targets including eye gaze (% of time patient looking at clinician), facial emotions (% of time action units 4, 9, 10), prosody (number of pauses), conversational exchanges (average duration), synchronized gaze, facial emotions, gestures (% of time), and initiation. Metrics that did not reach reliability thresholds included gesture analysis and word repetitions. Clinician feedback on coding interface and output suggested a need for the system to capture several subtle behaviors (e.g. ambiguous facial expressions), low frequency but atypical behaviors (e.g., unusual laughing), and more refined gesture analysis.

**Conclusions:**

Argus-MDS produces high quality and reliable data during naturalistic observations taken during routine clinical evaluations on several key social-communication behaviors including eye contact, responsive gaze, facial action units associated with speech and emotions, integration of eye gaze and emotions, nonverbal social initiation bids. Test-retest data for individual variables are commensurate with global reliability scores on the conventional measure (e.g., ADOS-2). Areas for development include speech recognition and gestural analysis.

**418.114 (Poster)** A Systematic Review of the Use of Telehealth to Facilitate a Diagnosis for Children with Developmental Concerns

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**Background:**



Telehealth holds the potential to reduce the gap between time of first developmental concern and diagnosis (McSwain et al., 2017), especially for families residing in rural locations with limited access to specialty input (Vitrikas et al., 2017). However, there is a critical need to evaluate the use of telehealth methods for facilitating a diagnosis for children with developmental concerns to provide evidence for providers to make informed decisions about using telediagnostic assessments in practice.

#### Objectives:

Although prior systematic reviews (SR) examined telehealth in the diagnosis of ASD (Alfuraydan et al., 2020), this SR evaluates telehealth to facilitate a diagnosis in children with other developmental concerns including suspected genetic syndromes (e.g., FXS). This SR lends insights into whether multidisciplinary evaluations are conducted and identifies the range of developmental domains assessed using telediagnostic services. Research questions included 1) what specific populations of children with developmental concerns received a diagnosis via telehealth methods and what type of diagnostic evaluation was conducted? 2) What telehealth technologies were used to facilitate a diagnosis and how did they compare with face-to-face diagnostic methods? 3) Where the telehealth technologies feasible and acceptable to use?

#### Methods:

Following PRISMA guidelines for SR, we searched for empirical peer-reviewed studies indexed in PsycINFO, CINAHL, Web of Science, PubMed, Embase, Cochrane, and relevant journals (*Pediatrics; Telemedicine and e-Health; Telemedicine and Telecare*) published from January 2000 to July 2021 using a combination of keywords: “telehealth” AND “developmental concern” AND “diagnosis”. Data extraction was conducted for type of population, type of diagnostic evaluation, telehealth technology, and specific outcomes: diagnostic accuracy, feasibility, and acceptability. The NHLBI Quality Assessment tool was used to assess the methodological quality of the included articles.

#### Results:

A total of nine studies were identified for inclusion in the SR (Figure 1). 1) Children with suspected fetal alcohol syndrome (FAS), newborns who failed their hearing screen, children with mental health/social-emotional concerns, and children with a suspected genetic condition(s) associated with developmental concerns received a diagnosis via telehealth methods. Children with suspected FAS received a multidisciplinary diagnostic evaluation (physical/dysmorphology, feeding, neurological, and developmental assessments), newborns who failed their hearing screen received a comprehensive tele-audiology diagnostic hearing evaluation, children with mental health concerns received psychiatric assessments, and children with suspected genetic conditions associated with developmental concerns received a neurological exam and dysmorphology assessment. 2) Seven studies used videoconferencing technology and two studies used Store-and-Forward telehealth methods. Overall high agreement was found when comparing face-to-face and telehealth-based diagnostic methods. 3) Families and providers reported high levels of satisfaction and feasibility in the use of telehealth methods to facilitate a diagnosis.

#### Conclusions:

Findings underscore the importance of collaborative partnership models between local providers and remote specialists. Telehealth holds the potential in facilitating a timely diagnosis for families of children with developmental concerns residing in remote locations with limited access to specialty care. However, more rigorous study designs with larger samples covering a wider range of developmental domains and including multidisciplinary assessments are needed to provide a stronger empirical base for providers using telediagnostic services.

## VIRTUAL POSTER SESSION — DIAGNOSTIC, BEHAVIORAL & INTELLECTUAL ASSESSMENT

### 509 - Diagnostic, Behavioral & Intellectual Assessment I --- (V)

**509.028** (Virtual Poster) A Training Needs Analysis to Determine Professionals' Needs for Asdetectpro: An Early Autism Training Program and Early Identification Tool

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Background: Medical and primary health (MPH), allied health (AH), and early childhood education (ECE) professionals play an essential role in identifying children with developmental conditions, including autism. Previous research indicates they often have limited knowledge about autism and early identification; furthermore, there is no known research comparing the needs of these groups.

ASDetectPRO is an online autism training program and early identification tool for such professionals, based on the award-winning parent/caregiver mobile app, ASDetect (Barbaro & Yaari, 2020) and using the highly accurate SACS-R tool (Barbaro et al., under review). Currently under development, ASDetectPRO aims to address the need for autism knowledge training and an accurate early autism identification tool in a more accessible format, increasing access for professionals who cannot attend in-person training. While lockdown restrictions due to the COVID-19 pandemic have highlighted this need, professionals based rurally, regionally, and internationally, have long had this barrier.

Objectives: The objective of this study was to investigate MPH, AH, and ECE professionals' autism knowledge and training needs, to inform the development of ASDetectPRO. Differences in knowledge and training needs between the professional groups were examined.

**Methods:** MPH, AH, and ECE professionals who regularly work with children aged 11-36 months were invited to complete an online survey regarding their early autism knowledge, current use of early autism screening tools, and their autism training needs. Participants were recruited by sharing the study information and link through various means, including Facebook and Twitter posts, newsletters, and email. A total of 81 participants (25 MPH, 38 AH, 18 ECE) completed the survey. Mean participant age was 40.8 years (SD=10.8); most were female (96.3%) and based in Australia (74.1%), though participants were based in other countries such as New Zealand (16.0%) and the US (2.5%).

**Results:** MPH and AH professionals had significantly greater knowledge of the early signs of autism in comparison to ECE professionals, though no significant differences were found between MPH and AH professionals. While most (88%) of MPH professionals reported currently using an early autism screening tool, only 34.2% of AH and 5.6% of ECE professionals reported doing so.

All groups ranked “*information on the early signs and symptoms of autism*” as their top training need to be addressed in an autism training program. However, the importance of subsequent autism training needs differed. MPH professionals ranked “*training on effective communication strategies with children suspected of having autism*” as their second highest training need. AH professionals selected “*training on how to effectively communicate results with parent/caregivers*”, with ECE professionals’ preference being “*training on how to use and access an autism screening tool*”.

**Conclusions:** These findings highlight the need for access to training on the early signs of autism for ECE professionals, while also emphasising the need and desire for all professional groups to increase their knowledge of autism and use of autism screening tools. The study also emphasises the similarities and differences in these professionals’ autism training needs, which will ensure ASDetectPRO can be developed to meet the needs of its target users.

#### **509.029 (Virtual Poster) Early Autism Identification Training for Maternal and Child Health Nurses**

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**Background:** Early identification of children on the autism spectrum is an important precursor to accessing diagnosis, services, and supports, which can enhance development and wellbeing. Previous research has demonstrated that maternal and child health (MCH) nurses can be trained to accurately identify infants and toddlers who have a ‘high likelihood’ of autism. This study was part of a Victorian Government (Australia) funded autism surveillance training program for all MCH nurses.

**Objectives:** The overall objectives of this study were to identify areas of training need in the early detection of young children with autism and ‘pain points’ for MCH nurses when assisting these children and their families, and to address these as part of a training program that included the Social Attention and Communication-Revised (SACS-R, Barbaro et al, under review) tool. Additionally, the early autism knowledge, self-efficacy, and confidence of MCH nurses pre- and post-training, to determine predictors of these outcome variables pre-training, as well as a follow up to establish the impact of the training were examined.

#### **Methods:**

**Training Needs Analysis (TNA):** 303 MCH nurses completed a pre-training questionnaire, covering aspects such as current autism knowledge, self-efficacy in identifying children with a ‘high likelihood’ of autism, and their self-identified training needs. A referral pathway session with 43 MCH co-ordinators uncovered current referral pathways, barriers for families and nurses in accessing the pathways, and perspectives on an ideal pathway. Focus groups with parents/caregivers and autistic adults were conducted to understand their needs and preferences for the training program.

**Training:** A full-day in-person workshop with online pre- and post-training modules were developed. From May-June 2019, 29 workshops were held, training 1700 MCH nurses to use the SACS-R tool. Additional resources were developed based on the needs identified in the TNA, including a referral form and pathway, and parent/caregiver poster and booklet resources.

**Follow-up questionnaires:** Attendees were asked to complete online questionnaires establishing their training feedback (n = 344), and SACS-R implementation and follow-up of the TNA variables (n = 113), with 36 participants completing both pre- and post- questionnaires.

**Results:** Findings of the pre-training questionnaire indicated completing previous autism training and knowledge of autism community services were positively related to MCH nurse self-efficacy and confidence in speaking with parents/caregivers about autism. Working in a metropolitan location was also correlated with higher confidence levels, while nurse age and tenure were inversely related with both self-efficacy and confidence.

Responses to the training feedback questionnaire indicated nurses were satisfied with the training and resources and felt confident in implementing the learnings in their practice. The implementation questionnaire responses revealed 91.1% of nurses were using the tool, with over three-quarters indicating the tool was easy to implement, had a positive impact on their practice, and was adaptable for families.

The results of the pre-/post-training questionnaire comparison found a statistically significant increase in mean levels of autism knowledge, self-efficacy, and confidence post-training.

**Conclusions:** These results have implications for future autism surveillance training and present opportunities to better support mature nurses and those in rural and regional locations.

**509.030 (Virtual Poster)** An Update on the TAP: Diagnostic Agreement, Diagnostic Certainty, and Analysis of Scoring Procedures

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**Background:** The COVID-19 pandemic has accelerated the use of telemedicine for evaluation of toddlers at risk for ASD. The TAP (formerly TELE-ASD-PEDS) is one of the first instruments designed explicitly for parent-led, clinician-guided assessment of characteristics of ASD in young children. The TAP is comprised of a series of brief activities designed to allow a trained clinician to observe a child's social interactions, communication, and play, including observation of potential behaviors indicative of ASD. The TAP was disseminated broadly during the COVID-19 pandemic and has been used widely both within the United States and internationally. In 2021, our team presented interim results of a clinical trial (ClinicalTrials.gov: NCT03847337) comparing use of the TAP and another tool for ASD tele-assessment (the TELE-STAT).

**Objectives:** This presentation will share the results of our completed clinical trial, with a focus specifically on the diagnostic accuracy of the TAP, as well as an analysis of two options for scoring the TAP.

**Methods:** Seventy-two children (mean age = 2.54, range 18-36 months, 64% male) received telemedicine evaluation using the TAP. Tele-assessment was completed in a clinic setting (i.e., family located in a clinic room with clinician interacting remotely) and immediately followed by in-person ASD evaluation with a clinician blind to tele-assessment results. Following tele-assessment, clinicians assigned scores on seven behavioral domains (e.g., socially directed speech and sounds; unusual or repetitive play) using two distinct scoring options. Clinicians first assigned Likert ratings for each item (1 = the behavior characteristic of ASD is not present; 2 = the behavior is present but at subclinical levels; 3 = the behavior is present and clearly consistent with ASD). Next, clinicians provided dichotomous ratings for each domain, indicating simply whether the behavior was present or not present. Current research and scoring recommendations rely on Likert ratings. The present study will analyze and compare Likert and dichotomous ratings.

**Results:** Comparison of diagnostic impressions following tele-assessment versus blinded clinicians' diagnoses following in-person evaluation indicated diagnostic agreement of 93%. Four children diagnosed with ASD after in-person evaluation were not identified as having ASD via telemedicine. One child was inaccurately identified as having ASD following tele-assessment. One-way ANOVA indicated that clinician diagnostic certainty via telemedicine ( $F(2, 67) = 12.17, p < .01$ ) differed as a function of diagnostic agreement, with clinicians reporting greater certainty when assigning ASD diagnoses than when ruling out ASD. The included table displays mean scores on the TAP using Likert vs. dichotomous ratings. We will present results of analysis utilizing an IRT approach to investigate whether and to what degree the scoring method used predicts whether a child received a diagnosis following in-person assessment.

**Conclusions:** Parent-mediated, telemedicine-based ASD assessment using the TAP yields a high level of diagnostic agreement with blinded in-person evaluation. As new work on the TAP investigates in-home use in a community sample, and as clinicians continue to use the TAP as part of ongoing tele-practice, this work intends to inform and further refine our understanding and use of this instrument.

**509.031 (Virtual Poster)** Comparison of Telehealth & Adapted Protocols Vs. Standard-of-Care Evaluations for the Diagnostic Assessment of Autism Spectrum Disorder Due to the COVID-19 Pandemic

**G. Binion<sup>1</sup>, H. Tokish<sup>2</sup>, E. McQueen<sup>3</sup>, A. Rudrabhatla<sup>2</sup>, J. Pincus<sup>4</sup>, J. Ferguson<sup>5</sup>, S. P. White<sup>1</sup>, C. Klaiman<sup>6</sup> and S. Sivathanan<sup>7</sup>,** (1)Marcus Autism Center, Emory University School of Medicine, Atlanta, GA, (2)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (3)Department of Allied Health Sciences, Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine, Chapel Hill, NC, (4)Department of Pediatrics, Emory University School of Medicine, Marcus Autism Center, Atlanta, GA, (5)Clinical Assessment and Diagnostics, Emory University School of Medicine, Marcus Autism Center, Atlanta, GA, (6)Marcus Autism Center, Emory University, Atlanta, GA, (7)Educational & Counseling Psychology, McGill University, Montreal, QC, Canada

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**Background:** Guidelines and restrictions surrounding the current global COVID-19 pandemic have necessitated significant changes to supporting children and families seeking diagnostic evaluation for autism spectrum disorder (ASD). Through this pilot study, we aimed to explore the feasibility and efficacy of using remote telehealth options, as well as adaptations to in-person assessment methods.

**Objectives:** To assess the diagnostic accuracy/concordance and convergent validity between traditional ASD assessment batteries with telehealth and adapted in-person protocols.

**Methods:** Children were recruited to participate if they had received an ASD diagnosis following a standard diagnostic evaluation (i.e., Mullen Scales of Early Learning [MSEL] or Differential Ability Scales-2 [DAS-2], and an Autism Diagnostic Observation Schedule-2 [ADOS-2]) by a licensed psychologist and/or supervised trainee, between January and March 2020, prior to assessment modifications due to the COVID-19 pandemic (original evaluation). The study evaluation comprised of either a Telehealth or an In-Person protocol. The Telehealth protocol included the Childhood Autism Rating Scale, 2nd Ed. Zoom Observation (CARS-OBS; an 8-item, 15-minute observation) and the full CARS-2 protocol completed with the AutismEYES Interview Guide (CARS-EYES), or ADOS-2 Module 3 adapted for telehealth (ADOS-Mod3-Tel). The In-Person protocol included an adapted ADOS-Mod1 or ADOS-Mod2 during which clinical administrators wore face masks and certain activities were modified to accommodate COVID-19 safety protocols. All families then completed the Developmental Profile-4 Parent/Caregiver Interview (DP-4). To compare scores across differing measures, standardized nonverbal and verbal IQ scores were calculated from the MSEL and DAS-2. Study protocols were administered by trained clinical/research staff. Interrater reliability via video coding (for ADOS-Mod3-Tel, CARS-OBS & CARS-EYES) was  $\geq 75\%$ .

**Results:** Twenty-five families completed this pilot study ( $n=19$  completed the Telehealth protocol,  $n=6$  completed the In-Person protocol). Participant ages ranged from 3.75-14.67 years. Mean time between original evaluation and the study evaluation was 15.24 months ( $SD=1.67$  months). Concordance of ASD diagnostic classification (i.e., participant met total score cutoffs) was 100% on the In-Person ADOS and 83% on the ADOS-Mod3-Tel. Concordance was 62% on the CARS-OBS, which improved to 91% with the addition of the CARS-EYES interview. Correlations between original and study evaluation ADOS scores varied by protocol. For In-Person ADOS' ( $n=6$ ) correlations ranged from  $r=.48-.91$  across Social Affect, RRB, Total, and Comparison scores, whereas for ADOS-Mod3-Tel ( $n=6$ ) they ranged from  $r=-.24-.52$ . Original ADOS Total Scores were correlated with CARS-OBS total scores ( $n=12$ ,  $r=.65$ ) but less so with CARS-EYES total scores ( $n=10$ ,  $r=.36$ ). Finally, original NVIQ and VIQ scores were significantly correlated with DP-4 Cognitive and Communication scores, respectively ( $n=24$ ;  $rs=.72-.74$ ).

**Conclusions:** Overall, diagnostic accuracy/concordance between pre-pandemic ASD evaluations and adapted protocols was high when completing an ADOS or a CARS observation with a follow-up caregiver interview. However, convergent validity was more variable; adapted in-person protocols were better able to capture the range of symptomatology observed in traditional assessments than did telehealth assessments. Adapted telehealth protocols may be particularly helpful in evaluating or confirming clearer cases, but may not capture more subtle symptom presentations that may be observed via traditional in-person assessment methods.

**509.032 (Virtual Poster)** Diagnosing Autism Spectrum Disorder during COVID-19 Pandemic: A Model Utilizing the Bosa  
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**Background:** The arrival of the COVID-19 pandemic presented a challenge for diagnosing Autism Spectrum Disorder (ASD) in children. As professional staff transitioned to telehealth and/or utilizing significant personal protective equipment (PPE), diagnostic tools and clinical judgement were less reliable in accurately diagnosing ASD. The Brief Observation of Symptoms of Autism (BOSA) (Lord, 2020) was created to provide standardized observations in the context of social distancing and use of PPE. The BOSA incorporates parent/caregiver interaction without the use of PPE while clinicians observe from a separate location. Based on clinicians' experience with the ADOS-2, some supplemental assessment tasks from the appropriate ADOS-2 module were conducted using PPE following the BOSA

**Objectives:** 1)Describe the use of the BOSA in the diagnosis of ASD in an urban ethnically diverse multidisciplinary center 2) Determine clinical confidence in diagnosis of ASD using BOSA alone versus with supplemental assessments 3) Identify phenotypes of children associated with more/less confidence in the BOSA.

**Methods:** At our multidisciplinary center, children are typically referred for ADOS-2 assessment for the purpose of diagnostic clarification when other assessment tools (e.g. Childhood Autism Rating Scale-CARS, DSM-5 checklist, etc) and clinical judgment yield uncertainty. The BOSA was utilized during COVID-19 pandemic in place of the ADOS-2. Clinicians administering the BOSA rated their level of certainty of ASD/no ASD diagnoses based on the BOSA alone and after supplemental tasks. Reviewed Data included: demographics, clinical phenotype, CARS-2, BOSA algorithm score with/without supplemental tasks, and clinician confidence in ASD/ no ASD. Statistics included correlation, chi-square, and t-test.

**Results:** Since December 2020, 53 children were seen for BOSA: 43 boys (81%), 10 girls (19%), age  $6\pm 3$  years, 17(32%) Hispanic, 9(17%) bilingual English/Spanish, CARS-2 score  $28\pm 4$ , 11(21%) minimally verbal, 13(25%) with phrases/simple sentences, and 29(55%) with complex sentences. Of the 53, 36(68%) scored on the BOSA or on the supplemental assessments. Of the 36 children who scored, 32 were verbal (phrases or sentences) versus 4 minimally verbal (89% vs.11%  $p=0.02$ ). Children who were minimally verbal were less likely to score on the BOSA (27% vs. 73 %  $p=0.04$ ). There was a negative correlation between BOSA algorithm score and age of child ( $r=-.33$   $p=0.02$ ) and positive correlation between BOSA algorithm score with CARS ( $r=.37$   $p=0.01$ ). The evaluators' confidence rating scale in diagnosis of ASD/no ASD increased with supplemental materials (1 not confident to 5 very confident:  $3\pm 1$  to  $4\pm 0.8$   $p=0.001$ ). The level of evaluators' certainty of ASD/no ASD was optimal (Scores 4-5 in Likert scale) in 25 patients (47%) with BOSA alone versus 30 (56%) adding supplemental materials ( $p=0.06$ ).

**Conclusions:** The BOSA aided in ASD diagnostic clarification for children with milder social impairment. The addition of supplemental materials increased clinicians' ability to clarify ASD/no ASD. The BOSA was more likely to capture ASD diagnosis in younger children and those who had phrase speech/simple sentences. The BOSA, with supplemental ADOS-2 assessments tasks, may represent a useful tool for Autism diagnosis while PPE is necessary.

**509.033 (Virtual Poster)** Diagnostic Stability of Autism Spectrum Disorder in Preschool Children: A Systematic Review and Meta-Analysis  
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**Background:**

The clinical pathway for children with autism spectrum disorder (autism) is varied and current research suggests some children may not retain their diagnosis over time.

**Objectives:**

The primary objective was to synthesise available evidence on the proportion of preschool children diagnosed with ASD who maintain a diagnosis at follow-up one or more years later.

#### Methods:

The search strategy (conducted up to end of 2017 and currently being updated) was sensitive and applied to eight databases. We included prospective and retrospective longitudinal studies that used the same measure and process to diagnose ASD at baseline and follow-up. Studies were required to have  $\geq 1$  year of follow-up and contain at  $\geq 10$  participants. Participants were  $<6$  years at baseline assessment and followed up  $< 19$  years of age. Two authors independently extracted data on study characteristics and assessed risk of bias. We conducted random effects meta-analysis as data allowed. We conducted subgroup analyses to explore factors that may predict diagnostic outcome. Planned sensitivity analyses of methodological differences was not completed because only two (6%) studies were rated low risk of bias.

#### Results:

In total, 40 studies met inclusion criteria (11350 participants). Of these, 28 (70%) were conducted in North America, nine (22%) in Europe/United Kingdom and three (8%) in Asia. Most (63%) studies were published before 2013. Mean age of participants at baseline was 3.10 years (range 1.13-5.0) and 5.6 years (range 3.0-11.6) at follow-up. Mean length of follow up was 2.6 years (range 1-7) and most children were male (79%). 53% of studies primarily included participants with intellectual disability ( $IQ < 70$ ). Mean sample size was 284 (range 10-8564). 55% of studies used one diagnostic assessment tool, 30% used two and 15% used three or more. Diagnosis was decided by a multidisciplinary team (MDT) in 53% of studies. Data was suitable for metaanalyses for 34 studies ( $n=11126$ ). In summary, 92% (95% confidence interval (CI): 89%-95%) of participants retained their ASD diagnosis one or more years later (Figure 1). The overall certainty of the evidence was judged as very low. Subgroup analyses did not identify any significant associations between diagnostic outcome and age at baseline diagnosis, age at follow-up diagnosis, duration of follow up, decade of publication, adaptive behaviour, language ability and mean IQ. A significantly higher proportion of children diagnosed by an MDT retained their diagnosis (98% [95% CI .94,1.0]) than those that did not have an MDT assessment (87% [95% CI .82,.92]). See Figure 2.

#### Conclusions:

Overall, most children (92%) who were diagnosed with ASD before six years of age retained their diagnosis a year or more later. A significant association was found between diagnosis by an MDT and a higher proportion of participants who retained their ASD diagnosis at follow-up. However, certainty of the evidence was rated very low due to high heterogeneity and risk of bias. Studies with low risk of bias that are relevant to the children seen in clinical diagnostic settings are needed to improve the utility of available evidence for families, clinicians and services.

**509.034** (Virtual Poster) Microanalysis of Daily Living Skills in Adolescents with Autism Spectrum Disorder without an Intellectual Disability  
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**Background:** Adolescents with autism spectrum disorder (ASD) without an intellectual disability (ID) have daily living skills (DLS) that often fall far below their chronological age and affect their ability to achieve successful outcomes in independent living, employment, and college. Research has shown that DLS deficits are linked to a more positive adult outcome, but we know less about the specific DLS that are challenging for adolescents with ASD and critical for interventions to target.

**Objectives:** The primary goals were to utilize the Vineland Adaptive Behavior Scales, 3<sup>rd</sup> Edition (VABS-3) in a sample of 151 adolescents with ASD without an ID to (1) explore the profile of the DLS subdomains of Personal, Domestic, and Community; (2) identify interview topics that were Mastered/Acquiring, Emerging, and Challenging; and (3) identify specific DLS items that were relative strengths and challenges.

**Methods:** All adolescents had confirmed diagnoses of ASD and IQs  $\geq 70$ . The VABS-3 computer-assisted parent/caregiver interview was administered. A total score for each interview topic within the DLS subdomains was first calculated and then a mean interview topic score was calculated by dividing the total score by number of items. Interview topic and item mean scores from 1.5 to 2 were classified as *Mastered/Acquiring*, scores from 1 to 1.5 were *Emerging*, and scores below 1 were *Challenging*. Descriptive statistics and t-tests were used to examine VABS-3 DLS domains, subdomains, interview topics, and item scores. One-way MANOVAs were conducted to examine the relationship between demographics and VABS-3.

**Results:** There were no significant relationships between VABS-3 DLS domain and subdomain raw scores and sex at birth ( $p$  values of 0.14-0.91), race ( $p$  values of 0.50-0.91), primary caregiver education ( $p$  values of 0.08-0.55), and annual income ( $p$ 's of .06-.23). The VABS-3 DLS Community subdomain v-scale score was the highest ( $M=10.2$ ,  $SD = 2.3$ ), followed by the Domestic subdomain v-scale ( $M=9.0$ ,  $SD=3.7$ ), and then followed by the Personal subdomain v-scale ( $M=8.8$ ,  $SD=3.5$ ). See Table 1 for VABS-3 Domestic subdomain means for each interview topic and item. In the Personal subdomain, the interview topics that were identified as *Challenging* included weather and health. In the Domestic subdomain, the interview topics that were identified as *Challenging* included basic household chores, cleaning up after meals, more complex food preparation, and advanced household chores. In the Community subdomain, the interview topics that were identified as *Challenging* included understanding rights, being on time, shopping skills, achieving goals, earning money, traveling, and managing money.

**Conclusions:** The emerging DLS profile found Community DLS as a relative strength, followed by Domestic DLS, and then Personal DLS. Adolescents with ASD demonstrated significant challenges in all interview topics on the DLS subdomains. The majority of these age-appropriate,

challenging areas are skills that could actually be taught and mastered much earlier in development (e.g., basic chores such as putting belongings away) using evidence-based strategies (e.g., task analysis, reinforcement, video modeling). Clearly, more intervention is needed to increase acquisition and mastery of age-appropriate DLS in order to facilitate the most successful transition possible for individuals with ASD.

**509.035 (Virtual Poster) ASD Symptomatology in Females: Data from a Community Clinic**

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**Background:** Current literature suggests a 4:1 ratio of males: females with autism spectrum disorder (ASD). Although the level of impairment varies across the spectrum, females with ASD tend to have greater cognitive impairment and more behavioral problems than males (American Psychiatric Association, 2013; Centers for Disease Control and Prevention, 2020; Dworzynski et al., 2012). For those on the spectrum with average or above-average cognitive functioning, the sex ratio is more skewed towards males, reporting ten males for every female (Hiller et al., 2014; Loomes et al., 2017; Maenner et al., 2020). Among individuals with below-average cognitive abilities or more severe behavior problems, the ratio of males to females drops to about 2:1 (Halladay et al., 2015; Lai et al., 2015; Postorino et al., 2015).

**Objectives:** The study's objectives are: (1) Among individuals who met criteria for ASD on the ADOS-2, are there sex differences in scores on either the ADOS-2 or parent-reported variables (e.g., SSIS, SRS, CBCL)? (2) Are there differences between females who did versus did not meet criteria for ASD on the ADOS-2 on parent reported measures (e.g., SSIS, SRS, CBCL)?

**Methods:** Participants were screened at a free community autism center using the appropriate module of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2); module selection was based on child language ability. Caregivers completed the following questionnaires about their child's behaviors: Child Behavior Checklist (CBCL) to assess the child's behavioral and emotional difficulties; Social Skills Improvement System (SSIS) to describe the child's social skills, academic competence and problem behaviors; Social Responsiveness Scale, Second Edition (SRS-2) to provide information about the child's social abilities associated with ASD. One-way ANOVA and post-hoc Bonferroni tests were conducted to determine if there were sex differences across the described measures; these were conducted for each ADOS-2 module separately. For question 1, participants were included if they met ASD criteria on the ADOS-2 (Males = 144, Females = 51).

**Results:** There were sex differences for those who met ADOS-2 criteria. Children administered Module 1 significantly differed on the SSIS social skills total score, such that females with minimal language abilities demonstrated poorer social skills compared to males ( $p = 0.01$ ). Children administered the Module 2 significantly differed on the SSIS social skills total score and the SSIS problem behavior total score. Based on parent reports, females with phrase speech displayed poorer social skills ( $p = 0.048$ ) and more behavioral problems ( $p = 0.04$ ) compared to males. Children administered Module 3 did not significantly differ significantly on any diagnostic measure or parent questionnaire. There were no significant differences for parent report between females who did ( $N = 51$ ) versus did not meet criteria for ASD ( $N = 38$ ).

**Conclusions:** The results of this study suggest that females who were referred for an ASD evaluation displayed more severe social impairments and/or significant behavioral problems. Thus, caregivers or community professionals should recognize social impairments and behavioral concerns in females and provide referrals for an ASD specific evaluation.

**509.036 (Virtual Poster) Caregiver Concerns Predict Specific Areas of Adaptive Functioning in Infants and High- and Low-Risk for Autism**

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**Background:** Caregiver concerns have been shown to be predictive of their child's developmental outcomes, including autism spectrum disorder (ASD). This literature demonstrates the importance of encouraging caregivers to raise concerns with providers, which may lead to earlier evaluation and intervention. However, these studies have used varying modalities to survey caregiver concerns (e.g., questionnaire, open-ended discussion), suggesting the need to identify an administration format that best captures caregivers' impressions of their child's development.

**Objectives:** (1) Characterize caregiver developmental concerns regarding their 12-month-old infants at high- and low-familial risk for ASD; (2) Examine whether caregiver concerns predict caregiver-reported adaptive behavior and whether concerns are specific to the domain of concern; (3) Test whether ASD risk status moderates this relationship.

**Methods:** Caregivers of infants ( $N=45$ ; 33 LR, 12 HR) completed an open-ended, semi-structured parent concerns interview (modeled from Ozonoff, et al., 2009), where clinicians asked about concerns in 11 developmental domains. Clinicians subsequently administered the Vineland-3 Comprehensive Interview. Fisher's Exact tests compared proportions of concerns across risk group and t-test compared concerns and Vineland-3 scores. For concern domains measured by the Vineland-3 (i.e., Communication, Socialization, Motor Skills), regression analyses examined main effects of concern and risk status and their interaction on Vineland-3 scores.

**Results:** Caregivers of high- and low-risk infants were equally likely to report concerns in all domains, except for sensory/repetitive behavior and communication/language concerns, which were endorsed more often for high-risk infants (see Table 2). Infants with a communication concern had significantly lower Vineland-3 Communication scores than infants without a communication concern ( $p=.03$ ). However, this finding was specific to the Communication domain, as communication concerns did not predict Vineland-3 Adaptive Behavior Composite (ABC) scores. The same pattern was observed for fine motor concerns. Infants with a fine motor concern had lower Fine Motor v-scale scores ( $p=.001$ ), but comparable ABC scores.

However, gross motor concerns did not significantly predict Gross Motor or ABC scores. Social concerns also did not significantly predict Socialization or ABC scores. However, regression analyses revealed significant main effects of social concerns and risk status on Socialization scores ( $p < .001$  and  $p = .003$ ), as well as a significant interaction ( $p = .006$ ), suggesting that the relationship between caregiver social concerns and Vineland-3 Socialization scores differed across risk groups. Interactions between concern and risk status were not significant for Communication, Fine Motor, and Gross Motor.

**Conclusions:** Results suggest that caregiver concerns regarding their 12-month-olds' communication, fine motor, and social skills were predictive of lower scores in those adaptive behavior domains, regardless of autism risk status. Importantly, caregiver concerns were also specific, as they did not predict behavior broadly, only in the specific area of concern. Results are consistent with previous literature demonstrating the accuracy of caregivers in identifying areas of developmental concern. Results also highlight the importance of specifically probing for concerns by 1 domain, as many caregivers reported additional concerns when specifically probed. Given the accuracy and specificity of caregiver concerns, providers should consider incorporating concern into early screening efforts, as this method may improve upon the accuracy of questionnaire-based tools.

**509.037 (Virtual Poster)** Biological and Phenotypic Markers in the Contribution of ASD Subtypes and Prognosis.

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**Background:** Autism Spectrum Disorders (ASD) manifest in early stages of development. The growing focus on the constellation of ASD behavior brings the complexity of the phenotype and associated behaviors and, therefore, great challenges for diagnosis, prognosis and therapeutic response. There is great heterogeneity in the phenotypic presentation of ASDs and severity of behavioral symptoms, determining great variability in the levels of adaptive functioning to activities of daily living, cognitive, clinical, psychiatric, neurological and emotional regulation comorbidities. Complex genetic architecture also contributes to phenotypic heterogeneity. In Brazil, in addition to the difficulty of training professionals, there is a lack of translated, adapted, standardized and validated instruments. This emphasizes the importance of early development of accurate methods. Well-characterized phenotypes are important in the search for these biological markers, allowing for more homogeneous groupings of patients, identifying as causes and being clinically useful in directing the intervention.

**Objectives:** Develop biological and phenotypic markers using eye tracking and multidisciplinary assessments, contributing to a definition of ASD subtypes and prognosis.

**Methods:** 150 children aged 0 to 17 years from the Institute of Psychiatry at FMUSP (Brazil). All children were followed up at the FMUSP Psychiatry Institute. The evaluation was performed by a psychiatrist according to the diagnostic criteria of the DSM-5. Screening scales (MCHAT, ASQ or ABC), CARS, Vineland, CBCL and SRS were applied with parents. The children were evaluated with the ADOS-2, WASI and eye tracking with the Tobii PRO equipment, according to the paradigms of biological movement, shared attention and shift in attentional focus. All data were collected in an electronic form and sent to a relational database.

**Results:** 1) Creation of a database of signals to monitor eye movements and typical development of Brazilian children with ASD. 2) Classification algorithm considering different types of input data (data from phenotypic scales, epidemiological signs and eye movement monitoring) and processing techniques together, to test whether the two types of data together increase accuracy to aid diagnosis and ASD subtypes.

**Conclusions:** Brazilian study to work on the development of biological, phenotypic and epidemiological markers, to contribute to the definition of ASD subtypes, prognosis, training and expansion in the national territory.

**509.038 (Virtual Poster)** Characterizing Cognitive Rigidity and Thought Disruption in Autism

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**Background:** Cognitive rigidity and thought disruption (CR) refer to the impaired capacity to sustain coherent discourse and maintain the organization and expression of thought. For autistic youth, these features are often collapsed into broader measures of repetitive behavior or executive functioning. This creates challenges for quantifying CR independently. Research in non-autistic clinical populations indicates that CR plays an important role in real world functioning; however, these relationships have been characterized incompletely in autistic youth. Characterizing CR independently from other related constructs will provide valuable insight in how this specific feature impacts the lives of autistic youth.

**Objectives:** To generate a measure of CR, characterize this feature in autistic youth, and examine its associations with adaptive behavior outcomes.

**Methods:** 46 autistic youth (ASD: mean age 11.8 years, 78.3% Male), and 31 typically developing youths (TD: mean age 12.3 years, 74.2% Male) were included in this secondary data analysis study. To create the CR score, relevant items were selected the following measures: Social Responsiveness Scale - 2<sup>nd</sup> Edition (SRS-2), Behavior Rating Inventory of Executive Function (BRIEF), Behavior Assessment Scale for Children - 2<sup>nd</sup> Edition (BASC-2), and the Child Behavior Checklist (CBCL). The nine items selected for inclusion in the novel CR score captured rigid thinking and cognitive inflexibility, while excluding items related to intense interests and behavior rigidity. Analyses included: 1) psychometric properties of our CR score (internal reliability and factorial validity), 2) testing for group differences in CR scores, 3) associations of CR with age and IQ, and 4) associations of CR with functional outcomes (The Vineland Adaptive Behavior Scales-2<sup>nd</sup> Edition (VABS-II)).

**Results:** Test of Cronbach's alpha revealed high internal reliability ( $\alpha=0.94$ ). All CR items sufficiently loaded onto one factor explaining 65% of the variance. Factor loadings ranged from 0.70-0.89. To generate the CR total score, items were summed, resulting in a possible score range from 0-18. The ASD group endorsed more CR than the TD group, and the effect was large (See Table 1). Among autistic youth, CR scores did not significantly correlate with age or IQ, but CR scores had moderate, significant correlations with Communication and Daily Living subscales (See Table 2).

**Conclusions:** This is the first study to show that autistic youth experience challenges specifically with CR, and that these challenges are associated with difficulties in adaptive functioning. These findings align with that of other clinical populations, providing additional evidence that CR may be a transdiagnostic feature. Psychometric analyses reveals that the novel CR measure is internally consistent and captures some latent construct of rigidity, however more rigorous analyses are needed to demonstrate scale validity. Data entry of item-level data is ongoing for an additional 259 participants and will be completed by the conference, allowing for a robust evaluation of psychometric properties of CR. Our current analysis supports further investigation of CR as distinct from other repetitive features of autism and identifies CR as a potential mutable factor that could be targeted as part of an adaptive behavior intervention designed to support the independence of autistic youth.

**509.039 (Virtual Poster)** Concurrent Validity of the Brief Observation of Symptoms of Autism (BOSA)

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**Background:** The Autism Diagnostic Observation Schedule, 2<sup>nd</sup> Edition (ADOS-2; Lord et al., 2012) is considered the “gold standard” observational measure in the diagnostic assessment of autism spectrum disorders (ASD). However, the COVID-19 pandemic has presented challenges to diagnostic assessment, as the ADOS-2 cannot be validly administered when examiner/examinee faces are obscured by masks. In response to this challenge, Lord et al. (2020) developed the Brief Observation of Symptoms of Autism (BOSA), an observational measure that can be administered through pandemic-friendly procedures (e.g., observation of parent-child interactions through a one-way mirror). Activities and coding procedures for the BOSA were derived from the ADOS-2 and the Brief Observation of Social Communication Change (BOSCC; Grzadzinski et al., 2016). Although the BOSA was widely adopted by ASD assessment clinics and research programs to meet pandemic-related challenges, limited research has evaluated its validity.

**Objectives:** To assess the validity of the BOSA in relation to established measures of social communication.

**Methods:** 191 participants with an existing diagnosis of ASD were administered the ADOS-2 Module 3 or 4 (pre-pandemic, without mask restrictions; N=152) or the BOSA Module F1 or F2 (coded on ADOS-2 Module 3 or 4; N=51). 12 of these participants received an ADOS-2 pre-pandemic and a subsequent BOSA; 21 received two ADOS-2 administrations prior to pandemic protocols (mean time between administrations: 51.56 and 52.56 months, respectively). Participants were administered additional social communication measures, including the Social Responsiveness Scale-2<sup>nd</sup> Edition (SRS-2), the Autism Diagnostic Interview-Revised (ADI-R), and the Vineland Adaptive Behavior Scales-3<sup>rd</sup> Edition (Vineland-3). Participants receiving the BOSA were also administered the Childhood Autism Rating Scale-2<sup>nd</sup> Edition (CARS-2).

**Results:** The BOSA algorithm total was significantly correlated with the CARS-2 T-score (Module 3:  $r(12)=-.68$ ,  $p=.008$ ; Module 4:  $r(34)=-.74$ ,  $p<.001$ ) but was not correlated with any other social communication measures. The ADOS-2 comparison score (CSS), in contrast, was significantly correlated with the ADI-R Reciprocal Social Interaction ( $r(109)=.22$ ,  $p=.021$ ) and Communication ( $r(109)=.26$ ,  $p=.005$ ) domain totals, and the Vineland-3 Communication ( $r(112)=-.19$ ,  $p=.049$ ) and Socialization ( $r(112)=-.20$ ,  $p=.034$ ) domain standard scores. The BOSA Module 4 did not correlate with ADOS-2 CSS administered at a prior timepoint ( $r(7)=.07$ , n.s.). However, the ADOS-2 CSS similarly did not correlate with the ADOS-2 CSS obtained at a previous timepoint ( $r(19)=-.004$ , n.s.).

**Conclusions:** The BOSA showed concurrent validity with another clinician-rated measure (CARS-2) but not with parent- or self-report measures of social communication. This is in contrast to the ADOS-2, which exhibited concurrent validity with several parent-report measures. Counter to predictions, neither the BOSA nor the ADOS-2 correlated with prior ADOS-2 administration, although results were limited by a small sample size. These findings suggest that the BOSA holds promise as a brief measure of ASD-related symptoms but may not be as robust a clinical measure as the ADOS-2. Additional research is needed to replicate these findings with a larger sample size and to expand the validity investigation to additional BOSA modules. BOSA validity should also be revisited when a cross-module BOSA comparison score, comparable to the ADOS CSS, has been developed.

**509.040 (Virtual Poster)** Discriminating Features of Autism through a Play Assessment Method - Inter Rater Reliability

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**Background:**

Autism Spectrum Disorder (ASD) assessments include professionals using interviews and observation schedules that require intensive training and are time consuming. Impairments in social interaction in children with ASD are observed as early as 12-24 months (Zwaigenbaum et al., 2015) but



ASD is not diagnosed before age 3 years (Bussu et al., 2018). Research has shown that play can be used to elicit early social behaviours (Dominguez et al., 2006). There is a need for ASD screening measures that are cost-effective, observational and culturally appropriate to the Indian context.

#### Objectives:

- To identify discriminating features of autism using a newly developed play behaviour protocol in toddlers
- To explore the inter-rater reliability of scoring such features using videos.

#### Methods:

For the pilot study, we recruited 12 children (4 children with ASD, 4 children with developmental delay and 4 Typically developing children) in the age ranges 12- 42 months and engaged them in structured and semi-structured play activities involving an examiner, parent and the child. 26 social behaviours and play behaviours categories were identified and defined. The session was video recorded with parental consent and coded for chosen play and social responses. We studied the distribution of those social and play responses across different stages of the play protocol for all three groups. Two trained psychologists independently coded a sample of three videos to establish inter-rater reliability. Concordance of ratings was recorded while Cohen's Kappa statistic was computed using SPSS version 26.

#### Results:

The most discriminating behaviours between the 3 groups was social smile, eye contact, initiation of social interaction and social engagement. TD children had frequent reciprocal social behaviours and this was not observed in DD and ASD children. Similar findings were reported by Zwaigenbaum et al., (2005) that children with ASD lacked social responsiveness and social engagement and these behaviours can be observed as early as 12 months. In terms of play skills, all 3 groups had similar frequency of sensorimotor play and functional play. Symbolic play was present in children with TD and DD. Although the mean age of children in the TD group was lower than that of the other two groups, they displayed more symbolic play. Similar findings were reported by Rutherford (2003) that deficits in symbolic play were specific to children with ASD. Cohen's Kappa statistic results indicate moderate agreement for ASD group ( $k = 0.552$ ,  $p=0.000$ ) and DD group ( $k= 0.447$ ,  $p= 0.000$ ) and substantial agreement for the TD group ( $k=0.624$ ,  $p=0.000$ ). The overall Cohen's Kappa statistic indicated moderate agreement ( $k= 0.554$ ,  $p=0.000$ ).

#### Conclusions:

The pilot study findings support discriminating validity of the play behaviour protocol. It has the potential to be a screening measure for autism.

#### **509.041** (Virtual Poster) Do ADHD Symptoms Accelerate Diagnostic Timing of Autism in School-Age Youth?

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Background: Autism spectrum disorder (ASD) is characterized by social communication difficulties and restricted and repetitive behaviors, whereas attention deficit/hyperactivity disorder (ADHD) is characterized by inattention, hyperactivity, and impulsivity.<sup>1</sup> Previous literature documents a strikingly high comorbidity rate, estimating 30-80% of autistic youth have a co-occurring diagnosis of ADHD.<sup>2</sup> Individuals with co-occurring ASD+ADHD are at significant risk for delayed ASD diagnosis, in part due to symptom overlap and diagnostic overshadowing from the presence of ADHD symptoms.<sup>2,4,6</sup> This is particularly true for youth first identified after the early intervention period.<sup>4</sup> Delayed identification of ASD poses risk for social and emotional difficulties.<sup>4</sup> As such, it is important to parse ADHD-specific symptoms to identify predictors of age of ASD diagnosis in individuals with co-occurring ASD+ADHD.

Objectives: To investigate whether ADHD symptoms (inattention and hyperactivity) predict age of ASD diagnosis in individuals with co-occurring ASD+ADHD who receive a first diagnosis of ASD after early childhood (age  $\geq 5$  years).

Methods: Archival data from a clinical database was extracted for 208 individuals with co-occurring ASD+ADHD seen for neuropsychological evaluation who received a first diagnosis of ASD after the age of 5 (76.0% male; 38.9% white). Age of ASD diagnosis ranged from 5 to 18.3 years ( $M = 9.97$ ). Full-scale IQ (FSIQ) ranged from 45 to 137 ( $M = 95.68$ ). Pearson correlations examined the relations between age of ASD diagnosis and a) sex-assigned-at-birth, b) FSIQ, c) ASD symptom severity (SRS total T-scores), and d) ADHD symptoms (ADHD Rating Scale subdomain T-scores). Hierarchical linear regressions further probed significant relations to determine whether specific ADHD symptoms predicted age of ASD diagnosis, after controlling for sex-assigned-at-birth, FSIQ, and ASD symptom severity.

Results: Age of ASD diagnosis was negatively correlated with hyperactivity,  $r(208) = -.159$ ,  $p=.022$ , such that increased hyperactivity symptoms were associated with earlier diagnosis. Age of ASD diagnosis did not have a significant association with inattention ( $r=.019$ ,  $p=.785$ ). A hierarchical linear regression model examined the association of hyperactivity with age of ASD diagnosis, after controlling for sex-assigned-at-birth, FSIQ, and ASD symptom severity. Increased hyperactivity,  $\beta = -.053$ ,  $t = -2.84$ ,  $p=.005$ , significantly predicted earlier age of ASD diagnosis. For every one-point increase in hyperactivity T-score, age of ASD diagnosis decreased by approximately 0.053 years.

Conclusions: Hyperactivity predicts age of ASD diagnosis in individuals with co-occurring ASD+ADHD who have not yet been diagnosed by the age of 5. Findings suggest youth with more hyperactivity are being diagnosed with ASD earlier, despite concerns about symptom overlap and diagnostic overshadowing putting youth with ASD+ADHD at risk for delayed ASD diagnosis. It is possible that increased hyperactivity elevates

familial distress about symptoms or raises the salience of a developmental disorder for teachers, who serve as a primary source of referral for further assessment for the school-age youth who comprise our sample. These youth also may have failed initial treatments for ADHD, bringing them to additional clinical attention. In turn, findings suggest youth with co-occurring ASD+ADHD without significant hyperactivity may be at greater risk for delayed ASD diagnosis.

## VIRTUAL POSTER SESSION — DIAGNOSTIC, BEHAVIORAL & INTELLECTUAL ASSESSMENT

### 518 - Diagnostic, Behavioral & Intellectual Assessment II --- (V)

**518.081** (*Virtual Poster*) Mealtime Problem Behaviors in Italian Children with Autism Spectrum Disorders: Insights into the Role of Sensory Atypicalities Assessed with the Italian Child Sensory Profile 2

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**Background:** Mealtime is crucial for the child's development due to its impact on nutritional state and weight, on autonomy acquisition, and on experiencing rewarding social relationships. Since children with Autism Spectrum Disorders (ASD) often show mealtime problem behaviors, a dedicated assessment tool has been developed, the Brief Autism Mealtime Behavior Inventory (BAMBI). As sensory peculiarities often characterize the functional profile of ASD children, a possible impact on mealtime problem behaviors has been studied, but which sensory patterns are specifically implicated is still under debate. Moreover, since a cultural influence on sensory patterns must be taken into account, tools standardized on study population are needed. Thanks to the recent standardization of the Child Sensory Profile 2 (SP-2) on the Italian population, sensory atypicalities can now be studied also in Italian ASD children.

**Objectives:** The purpose of this study was to explore if specific sensory patterns and sensory channels, as conceptualized and measured by the Child SP-2, are associated with mealtime problem behaviors in Italian children with ASD.

**Methods:** Parents of 40 ASD children aged 3-7 years (mean age 4.88 years  $\pm$  1.10, 34 males and 6 females), completed the Child SP-2 and the BAMBI. Spearman correlation was calculated between sensory patterns/sensory sections and BAMBI total score. A linear regression model with BAMBI total score as the dependent variable and sensory patterns as independent variables was tested. Moreover, a linear regression model for the BAMBI total score was explored with the sensory sections as independent variables. A stepwise procedure was run on both regression models. A Bonferroni correction for multiple comparisons was applied to all analyses.

**Results:** 73% of the participants had at least one sensory pattern and 70% at least one sensory section with a higher than normal score. 22 children resulted as problematic feeders according to BAMBI cut-off score ( $\geq 34$ ). The patterns Sensitivity ( $p < 0.0001$ ) and Seeking ( $p = 0.004$ ) correlated positively with the BAMBI total score. Sensitivity was the only independent variable significantly related to the BAMBI total score in the corresponding reduced model ( $p < 0.00001$ ). The BAMBI total score also correlated positively with the sensory sections Touch ( $p = 0.01$ ) and Oral ( $p < 0.0001$ ), the latter being the only variable included in the reduced model ( $p < 0.00001$ ).

**Conclusions:** As expected, most ASD participants showed sensory atypicalities and mealtime problem behaviors. High Sensitivity and Oral processing scores were associated with worse mealtime behavior. Sensitivity is characterized by a low sensory threshold and a passive attitude of the child, which does not help preventing sensory overload. Thus, problem behaviors could be the expression of this discomfort. Moreover, mealtime is rich in oral stimuli, therefore oral sensory atypicalities can plausibly be related to greater discomfort and problem behaviors. A better understanding of the impact of sensory pattern on mealtime behaviors can lead to a deeper reflection on the characteristic of the sensory stimulation during mealtime and refine the intervention in this direction to reduce problem behaviors and boost the child's and caregivers' wellbeing.

**518.082** (*Virtual Poster*) Objective Measurement of Gaze and Social Smile in Children with Suspected Autism Spectrum Disorder during Autism Diagnostic Observation Schedule-2

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**Background:** Autism spectrum disorder (ASD) is defined in part by persistent disturbances of social communication and interaction, such as eye contact (i.e., social gaze) and facial expressions (e.g., shared smiles). Current best practice for measuring children's ASD symptom severity is based on expert, but subjective, clinician observation during the Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al., 2012). Objective, automated processing of children's gaze behaviors from videos captured with economical recording sensors has the potential to provide quantifiable measures for key behavioral features of ASD during clinical assessments. The current study examined associations between objective measurement of children's gaze behaviors and ASD symptom severity during the ADOS-2.

**Objectives:** To investigate associations between objectively quantified gaze behaviors (i.e., social gaze and gaze involving smile) measured with a low-cost adult-worn video camera and examiner-adjudicated ADOS-2 SA calibrated severity scores (CSS).

**Methods:** Sixty-six children (49 boys,  $M_{age}=39.97mo$ ,  $SD=10.58$ ) with suspected ASD (61 confirmed ASD) were administered the ADOS-2. A hypothesis-blind examiner provided a Social Affect calibrated severity score (SA CSS). Children's gaze and gaze involving smile directed toward adults during the assessment were recorded with a small camera (Pivothead or Orca) contained in eye-glasses worn by the examiner and parent. We processed first-person video from the camera with a gaze detection algorithm (Chong et al., 2020) and FACET's facial action unit detection algorithm (Littlewort et al., 2011; iMotions, 2016) to automatically detect child gaze and gaze involving smiles. Measures included the duration of gaze expressed as proportions of ADOS-2 duration and proportion of that gaze duration involving smiles.

**Results:** There were negative associations between the proportion of gaze at parent and SA CSS ( $r = -.32$ ,  $p = .01$ ). SA CSS was also negatively associated with the proportion of gaze involving smile directed toward parent ( $r = -.34$ ,  $p = .01$ ) and the proportion of gaze involving smile directed toward examiner ( $r = -.29$ ,  $p = .02$ ). The proportion of gaze at parent ( $b = -.29$ ,  $t(55) = -2.40$ ,  $p = .02$ ) and the proportion of gaze toward parent that involved smiling ( $b = -.37$ ,  $t(55) = -3.09$ ,  $p = .003$ ) significantly predicted variance in the SA CSS ( $F(2,55) = 9.53$ ,  $p < .001$ , adjusted  $R^2 = .23$ ).

**Conclusions:** The current study examined associations between objective measures of child gaze and smile behaviors (i.e. social gaze and gaze involving smiles) during the ADOS-2. Children who demonstrated more gaze toward parent and whose gaze involved more smiles tended to receive lower SA symptom severity scores. The objective measurement of key behavioral features of ASD appears to have the potential to produce quantitative indices of ASD symptoms.

**518.083 (Virtual Poster)** Problematic Internet Use Among Adolescents with Autism: Analyzing the Psychological Motives for Using the Internet  
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**Background:**

It has been shown that individuals with Autism Spectrum Disorder (ASD) are engaged in internet use to higher extent than their peers without ASD (Mazurek & Engelhardt, 2013), being at higher risk of Problematic Internet Use (PIU) (Murray et al., 2021; Normand et al., 2021). However, only few recent studies have compared samples with ASD and peers with Typical Development (TD) in their PIU levels, yielding contradictory results (MacMullin et al., 2016; Shane-Simpson et al., 2016; Umeda et al., 2019).

Previous studies revealed that problematic online behaviors are likely to be driven by relevant psychological motives among youths (Marino et al., 2018). However, no study, so far, has explicitly analyzed the psychological motives for using the Internet expressed by adolescents with ASD as compared to TD peers.

**Objectives:**

The present study aims to examine the levels of PIU in children and adolescents with ASD compared with a matched TD group. The motivations for Internet use will be investigated, in order to highlight similarities and differences between groups. The relationships between PIU, psychological motives, ASD symptoms, and loneliness/social dissatisfaction will be also considered.

**Methods:**

A total of 140 Italian children and adolescents (ASD group with no ID=70 (62 M); matched TD group = 70 (62 M); aged 8-18 years; mean age=13.5 years,  $SD=2.95$  years; no difference between groups in the Full Scale Intelligence Quotient ( $F(1, 138)=.98$ ,  $p=.32$ )) were recruited. Self-reports on the Internet use, psychological motives, loneliness/social dissatisfaction were administered. Participants in the ASD group received a clinical diagnosis following the DSM-IV-TR or ICD-10 criteria and they had also scored above the threshold for ASD in the Autism Diagnostic Interview-Revised (ADI-R; Rutter, Le Couteur, & Lord, 2005). Data were analyzed using R (R Core Team, 2015). First, a series of univariate ANOVAs were performed in order to highlight similarities and differences between ASD and TD groups. Second, correlation analyses were conducted to test for the associations among the variables of interest.

**Results:**

The levels of PIU were similar in the two groups  $F(1, 138)=.26$ ,  $p=.61$ . A different pattern of psychological motives for using the Internet emerged for adolescents with ASD as compared to the TD. Higher scores for enhancement  $F(1, 138)=19.99$ ,  $p<.001$ , coping  $F(1, 138)=8.26$ ,  $p=.005$ , and conformity  $F(1, 138)=4.26$ ,  $p=.04$  motives emerged in the former, while higher scores for social motive were found in the latter  $F(1, 138)=4.04$ ,  $p=.04$ . Interestingly, for the ASD group a positive correlation between repetitive behaviors/interests (ADI-R) and conformity ( $r=.312$ ,  $p=.008$ ) and a negative correlation between loneliness/social dissatisfaction and enhancement motivation ( $r=-.253$ ,  $p=.034$ ) emerged.

**Conclusions:**

Overall, our findings show similar levels of PIU in both ASD and TD groups. However, different psychological motivations for Internet use characterize the experiences of the two groups. In addition, repetitive behaviors/interests and loneliness/social dissatisfaction are associated with specific motivations. The clinical and preventive implications of these findings are discussed.

**518.084** (Virtual Poster) Stress Physiology: Cross-Sectional Comparison between Adolescents on the Autism Spectrum and Typically Developing Peers

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**Background:** Lower cardiac vagal modulation has been found in individuals on the autism spectrum as compared to control groups. These lower levels have been associated with higher levels of autism-specific symptoms as well as more internalizing symptoms. However, methodological shortcomings in previous research prohibit the formulation of firm conclusions. Therefore, further research has been recommended.

**Objectives:** Research about this topic in adolescents on the autism spectrum is scarce. Therefore, the presented cross-sectional data comparisons provide more insight into differences in autonomic functioning between adolescents on the autism spectrum and their typically developing peers. To overcome some of the methodological shortcomings of prior research, a standardized stress-provoking protocol is used.

**Methods:** An age and gender matched group of adolescents on the autism spectrum (n=38) and typically developing peers (n=38) is included in this cross-sectional study, based on an a priori power-analysis with a medium effect size (g=0.59). A standardized stress-provoking protocol is used which contains a baseline measurement and the 'Stroop Word-Color Interference task' and the 'Social Stress Recall Task' as stress-provoking tasks. Physiological data is continuously gathered using the NeXus-10 MKII biofeedback device and Biotrace+ Software to register heart rate, breathing frequency, fingertip temperature and skin conductance. Saliva samples are collected to determine the level of cortisol at three time points during the assessment, reflecting the cortisol level at baseline and after both stress-provoking tasks. Behavioral data on physical activity, autism symptoms and internalizing and externalizing behavior is collected using questionnaires. Cardiac vagal modulation is used as the primary outcome measure to test the hypothesized aberrant levels of cardiac vagal modulation in adolescents on the autism spectrum. Additional physiological and behavioral parameters as well as cortisol measurements are included as secondary outcome measures to evaluate whether aberrant cardiac vagal modulation is associated with clinical and behavioral indices. A combination of Kubios HRV Premium (version 3.4.3, University of Eastern Finland, Kuopio, Finland), researcher-developed scripts in MATLAB R2020b (MathWorks, Natick, Massachusetts, USA) and SPSS (IBM SPSS Statistics, version 27) will be used for preprocessing and statistical analyses. A repeated-measures ANOVA with group (adolescents on the autism spectrum versus typically developing peers) as between-group factor will be used on the primary outcome measure. Pearson correlation analysis will be performed to examine correlations between the primary outcome measure and secondary outcome measures.

**Results:** The results of this cross-sectional study will be presented in line with the hypotheses as mentioned in the methods-section as data-collection is still on going.

**Conclusions:** More conclusive evidence will be provided for the hypothesized presence of aberrant cardiac vagal modulation during baseline measurement and the stress-provoking tasks in adolescents on the autism spectrum. In addition, the hypothesized association between these aberrant values of cardiac vagal modulation and physiological and behavioral indices will be clarified.

**518.085** (Virtual Poster) Synchrony Influences Intra-Individual Context-Related Social Communication in Minimal-Verbal Children with Autism  
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**Background:** Standardized *child-clinician* interaction has been established as part of the gold standard of the Autism Spectrum Disorder (ASD) diagnostic procedures. Blinded ratings of *child-clinician* interaction also have been recommended to establish the generalization of intervention effects. In addition, several measures of *child-parent* interaction have been proposed as valid outcome measures of clinical trials. A key methodological issue is the comparability of *child-clinician* or *child-parent* interaction measures. Parental synchrony has been found as relevant mediator of autism-symptom change and shows great variability across parents. In contrast clinician synchrony and its influence on child behavior has not been investigated yet. To date only a few studies have directly compared autism-symptom scores in different settings with different interaction partners, and none of these studies investigated a possible influence by the interaction partner's behavior, i.e. the responsiveness to the child.

**Objectives:** To explore intra-individual symptom differences across 4 different contexts (parent-child free play, play sessions and more standardized settings with unknown clinician) and examine the possible influence of the degree of synchronous behavior of the interaction partner.

**Methods:** A subsample of the A-FFIP randomized controlled, multi-center early intervention study was included (Kitzerow et al. 2020). Cross-sectional baseline data of the first N = 28 minimally verbal children, aged 2.5-5.5 years old are reported. The coding system from the *Brief Observation of Social Communication Change* for minimally verbal children (BOSCC MV, WPS publishing) was applied to four different standardized 12-minute video scenes: parent-child free play, BOSCC play session (with unknown clinician), Autism Diagnostic Observation Schedule (ADOS-2, unknown clinician), and Early Social Communication Scales (ESCS, unknown clinician). Synchronous behavior of the interaction partner was coded according to the *Dyadic Communication Measure for Autism – Revised* (DCMA). Three models with the BOSCC scores as dependent variable were compared by linear mixed models, model 1: main effect of setting; model 2: main effects of setting and synchrony; model 3: main and interaction effects of setting and synchrony. The most parsimonious model was chosen.

Results: For the BOSCC social communication subscale (SC) the third model explained the most variance ( $R^2=.28$ ;  $\chi^2=8.73$ ,  $p=.03$ ). A main effect for synchrony ( $F_{(1/95.6)}=37.78$ ,  $p<.001$ ) and an interaction effect of setting x synchrony ( $F_{(3/79.8)}=2.85$ ,  $p=.04$ ) was observed. For the BOSCC repetitive behavior subscale (RRB) models 2 & 3 were not superior to model 1 ( $\chi^2=0.17$ ,  $p=.68$ ;  $\chi^2=2.17$ ,  $p=.54$ ). Modell 1 showed a significant main effect of the setting ( $F_{(3/81)}=5.15$ ,  $p=.003$ ), which explained 7.7% of the variance. More details of the effects are presented at the conference.

Conclusions: Synchronous behavior of the interaction partner seems to have a great influence on the situational child's social communicative behavior. In contrast, restrictive, repetitive behaviors differed according to the setting and independent of synchrony. Context and interaction partner should sensitively be chosen according to the relevant research question. The degree of synchrony might be instructed in a more standardized way and additionally be assessed to ensure comparability.

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**518.086 (Virtual Poster)** Validity and Acceptability of the Telehealth Autism Diagnostic Assessments (TADA) for Adults

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Background: Research and clinical need for autism (ASD) diagnostic assessments for adults was exacerbated by the transition to telehealth during the COVID-19 pandemic (Hus & Lord, 2014). Early shifts to telehealth (e.g., TELE-ASD-PEDS; Wagner et al., 2020) and in-person assessments that utilized parents as administrators (e.g., BOSA; Lord et al., 2020) have been identified as feasible alternatives to the gold-standard ADOS-2 for young children. However, there are no fully remote options for adults who reside alone or are unable to complete assessments with others. Telehealth assessments may be particularly useful for adults with ASD, as these visits are more accessible to remote populations (Reese et al., 2013), occur in relatively comfortable, predictable, and consistent environments, and are more resource efficient (Lopez et al., 2018). Additionally, adults with ASD may feel relatively more comfortable in computer-based interactions, as suggested by elevated rates of screen-based media use among individuals with ASD (MacMullin et al., 2016).

Objectives: To assess the validity and acceptability of the Telehealth Autism Diagnostic Assessment (TADA) for adults, a semi-structured observational assessment of ASD based on the ADOS-2 (Lord et al., 2012).

Methods: Data collection is ongoing (n=50 projected), with preliminary report on 16 adults with ASD (18 to 30 years;  $M_{age}=23.4$ ; 7 females) who have completed the TADA and Childhood Autism Rating Scale 2<sup>nd</sup> Edition (CARS-2) via telehealth as well as the self-report SRS-2. Additionally, 7 participants have completed an in-person ADOS-2 Module 4. Participants were interviewed about their assessment experiences.

Results: Regarding feasibility, all participants reported that they could be their authentic selves during the TADA (16/16) and most believed the assessment was a good representation of their in-person interactions (13/16). Participants reported that some of their hand mannerisms could not be observed via telehealth as they were fidgeting under the table (8/16), but many appreciated the comfort of completing the assessment in their home (6/16). The TADA and ADOS-2 total scores were not correlated with the CARS ( $r=.40$ ,  $p=.14$ ;  $r=.08$ ,  $p=.87$ ) or the SRS-2 ( $r=-.210$ ,  $p=.513$ ;  $r=.198$ ,  $p=.706$ ). Two-way random ICCs for the in-person ADOS-2 and TADA were significant for the social affect scores (ICC = .808,  $p=.032$ ) and total score (ICC = .908,  $p=.006$ ), but not for the RRB scores (ICC = .535,  $p=.211$ ).

Conclusions: Test-retest reliability was better for the ADOS-2 and TADA social affect and total scores than it is for just the ADOS-2 (Janvier et al., 2021). A specific remote assessment for RRBs may be needed as some movements were out of view, although it is not clear these would have been captured by an in-person assessment. Based on participant interviews, self-report, interview questions related to RRBs should be considered. The CARS does not appear to be correlated with other ASD measures for adults via remote assessment. Feedback interviews about participant experiences provided significant guidance as to further development and modifications to remote adult autism measures.

**518.087 (Virtual Poster)** The DSM 5 Parent Interview on ASD - Preschool

**R. E. Nickel, OHSU, Eugene, OR**

Background: Obtaining information from parents or caregivers is a critical part of the diagnostic evaluation for autism spectrum disorder (ASD) in young children. There are few validated comprehensive interviews currently available for use with the families of young children. The Autism Diagnostic Interview-Revised (ADI-R) is widely used in research studies of children with ASD. Its length, however, makes it difficult to implement in clinical settings. The Toddler Autism Symptom Inventory (TASI) has recently become available and shows acceptable psychometric properties for 12-36 month olds (Coulter et al, 2021). Most diagnostic centers, however, continue to use structured interviews that are not normed or validated.

The DSM parent interview for ASD has been used regularly in a center-based diagnostic clinic for several decades, however, has not been formally studied (\_\_\_\_, 1988). It has been updated based on DSM 5 criteria and reformatted as a preschool form for use with community-based autism identification teams (\_\_\_\_, 2015, 2018). Questions are organized for each domain in both DSM 5 criteria. Each question is scored by checking Rarely, Sometimes or Often (R, S, O boxes). Boxes on the scoring form that indicate behaviors associated with ASD are shaded, for example, [Rarely]. In the past, domain scores and the interview rating were determined qualitatively and based on the authors experience and the information presented.

Objectives: Obtain preliminary data on the accuracy of a semi-quantitative scoring system for the DSM 5 Parent Interview on ASD – Preschool.

**Methods:** A semi-quantitative scoring system was developed to assist with scoring of interview domains and in part to address the needs of teaching use of the interview to trainees. In the current pilot project, the scores generated by the new scoring system were compared with qualitative domain and interview scores generated in diagnostic clinics by different experienced examiners. Clinical staff made copies of each DSM interview scored in clinic and shared copies with research staff. Research staff scored each interview with the new semi-quantitative scoring system and compared those scores with the interview scores determined in clinic and compared both scores with clinical diagnoses.

**Results:** 30 DSM 5 interviews have been scored in clinic and now scored by the new domain scoring system. Domains rated as likely or probably meeting criteria for ASD by the new scoring system were considered positive for ASD. Ages ranged from 19 to 57 months. 23 interviews were rated positive for ASD by clinical staff and 7 interviews were scored as negative. The new scoring system agreed with clinical scoring for all interviews and all save 4 domains (B1, B4, B4 and A2) which did not affect the interview scores. The rating for all interviews agreed with the clinical diagnosis (ASD or not) save one time. Clinical staff considered this child probably to have ASD and recommended re-evaluation.

**Conclusions:** Preliminary data support the accuracy of the semi-quantitative scoring system for the interview which may prove to be especially helpful in training programs. Further research is necessary.

**518.088 (Virtual Poster)** The Impact of Gender and “Disruptive” Behaviors on Identification of Autism Spectrum Disorder  
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#### Background:

Autism has historically been described as a male condition (Asperger, 1944). Autistic females are often diagnosed late or not at all (Goldman, 2013). Autistic traits may be more accepted in males (Cola et al., 2020) and clinicians may not recognize autism in women. Autistic women may exhibit more withdrawn behaviors relative to autistic men, who may exhibit more “disruptive” behaviors (Barglia et al., 2016). Educators more accurately identified autism in vignettes depicting a more “disruptive” vs a more “withdrawn” child and when the vignette character had a male rather than a female name (Whitlock et al., 2020). We evaluated if similar biases are observed among a larger sample of university students (who have less experience with children).

#### Objectives:

Examine whether males are rated more likely to be autistic than females despite the same behaviors. Explore whether “disruptive” or “withdrawn” characteristics of autism are associated with greater autism identification.

#### Methods:

960 participants from five universities participated in a 2 (vignette type: “withdrawn” vs “disruptive” behaviors) x 2 (character gender: male vs female name) between-subjects design. Participants read one of two vignettes depicting an autistic individual displaying either “disruptive” or “withdrawn” behaviors. Half of the participants read a vignette with a male character and half of the participants read a vignette with a female character. They rated the likelihood (Very Unlikely - 1 to Very Likely - 5) that the character had each of several diagnoses and/or characteristics (e.g., ASD, shy, etc.). They also wrote in responses for the following question: “What condition or disorder do you think this child has, if any?” Responses were coded into the diagnoses and characteristics mentioned above.

#### Results:

Two-way ANOVAs compared ratings based on vignette type and character gender (Table 1). Participants were more likely to rate a character as having ASD when the character presented “disruptive” (as opposed to “withdrawn”) behaviors. Participants rated the “disruptive” character as more disruptive yet more likely to be accepted, more likely to have: ADHD, LD, ODD, and CD, and less likely to: be “typically developing” or shy and to have anxiety or depression. Male characters were rated more likely to have CD, ADHD and ODD. No interactions between character gender and vignette were observed.

Logistic regressions were used to compare open-ended responses based on vignette type and character gender (Table 2). Participants reported significantly more ASD and ADHD for the “disruptive vignettes” and more anxiety and shyness for the “withdrawn” vignettes. Males were rated more likely to have ADHD.

#### Conclusions:

Findings extend upon prior work with educators (Whitlock et al., 2020) by showing that the tendency to overlook more “withdrawn” characteristics of autism is present among students who have likely received little education about autism. This suggests a possible bias in preventing autistic females from obtaining needed evaluations and services. Furthermore, findings suggest that the underidentification of females may be extended to other diagnoses. In ongoing work, we are examining if implicit biases contribute to the explicit biases documented here.

#### Background:

There is strong consensus that early, specialized intervention for children with Autism Spectrum Disorder (ASD) can have a profound impact on outcomes, and a concurrent rise in autism prevalence and screening rates has led to an increase in the number of children accessing ASD-specific early intervention. With large numbers of children engaging in early intervention services, it is important to have tools that can quickly and accurately measure behavior change to track developmental gains or regressions and assess the efficacy of intervention. The 118-item Parent Interview for Autism (PIA; Stone and Hogan, 1993), and its condensed version, the 93-item Parent Interview for Autism-Clinical Version (PIA-CV; Stone et al., 2003), are parental-report measures that were developed out of the pressing need for instruments to document behavioral change in young children with ASD in research and clinical settings. The PIA-CV provides information about the presence and severity of ASD symptomatology across 11 behavioral rationally derived domains and has been shown to have strong psychometric properties for children under the age of three (Stone et al., 2003). The four domains of social relating, language understanding, nonverbal communication, and imitation comprise the social communication section, which has been used as a stand-alone measure and has been shown to be sensitive to change (Stone et al., 2003). However, the construct validity of this shortened version has not yet been examined.

**Objectives:** To examine whether a confirmatory factor analysis supports the four rationally derived PIA-CV domains comprising the social communication section.

**Methods:** Participants were 242 caregivers of children ranging in age from 16–35 months-old (Mean = 26.81, SD = 4.72) who completed the PIA-CV social communication section: social relating (17 items), language understanding (7 items), nonverbal communication (12 items), and imitation (4 items). The PIA-CV is scored using a 5-point Likert scale, ranging from 1 (“almost never”) to 5 (“almost always”). Item scores are summed to obtain total scores for each domain. Participant data from four different studies were included. The data were prepared for analysis using R software and the confirmatory factor analysis was performed using M-Plus.

#### Results:

Overall, summary CFA fit indices indicate support for the four rationally derived domains (Table 1). Item-level fit reveals that 13/17 (76%) of items in the social relating factor have good fit ( $>.70$ ); 7/7 (100%) of items in the language understanding factor have good fit ( $>.70$ ); 9/12 (75%) of items in the nonverbal communication factor have good fit ( $>.70$ ); and 4/4 (100%) of items in the imitation factor have good fit ( $>.70$ ). Table 2 includes a complete list of items and factor loadings.

**Conclusions:** A CFA revealed statistical support for the four rationally derived categories that comprise the social communication section, adding strength to the validity of the PIA-CV.

**518.090 (Virtual Poster)** Topography and Clinical Correlates of Restricted and Repetitive Behaviors in Autism Spectrum Disorder  
**M. Udhnani, S. Y. Kim and L. Lecavalier, Nisonger Center, The Ohio State University, Columbus, OH**

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#### Background:

Repetitive and restricted behaviors and interests (RRBI) serve as one of the two core features of autism spectrum disorder (APA, 2013). There is general agreement on the multi-dimensionality of RRBI as well as the relationship between clinical correlates and subtypes of RRBI (Uljarevic et al., 2021). However, little is known about the prevalence of specific topographies within subtypes of RRBI and their association with key demographic and clinical variables.

#### Objectives:

The current study investigated the prevalence of specific RRBI topographies and domains, and their association with key demographic and clinical variables (i.e., age, gender, IQ, social communication, adaptive functioning, and behavior problems). We hypothesized great variability across specific RRBI topographies, as well as different relative prevalence and associations with demographic and clinical variables across gender.

#### Methods:

A large sample from the Simons Simplex comprising 2,757 children with ASD was used ( $M_{age} = 9$  years,  $SD = 3.6$ ; 86% male; 30% co-occurring intellectual disability [ID]). Prevalence of RRBI were calculated by the proportion of individuals who endorsed individual items as a *moderate problem* or a *severe problem* on the Repetitive Behavior Scale-Revised (RBS-R; Bodfish et al., 2000). The relationship between RRBI and demographic and clinical variables was examined with Chi Squares, correlations, and regression analyses.

#### Results:

Fifty-nine percent of the sample endorsed stereotyped behavior, 17% endorsed self-injurious behaviors (SIB), 48% endorsed compulsive behaviors, 65% endorsed ritualistic behaviors, 67% endorsed need for sameness, and 60% endorsed restricted interests. Rates of overall RRBIs did not differ across genders, with both demonstrating highest rates in need for sameness (M: 66%, F: 68%) and lowest rates in SIBs (M: 26%, F: 32%). The prevalence varied by IQ. The group with IQ > 70 reported highest rates in ritualistic behaviors (65%) whereas the group with IQ < 70 reported highest rates in stereotyped behaviors (75%). The most prevalent topography was *Fascination and preoccupation with a subject or activity* (52.4%), while the least common one was *Hits self with object* (2.8%). Topographies of all 43 RRBIs will be presented in a Figure by gender and IQ.

Some of the associations with key demographic and clinical variables follow. Age and gender were not significantly correlated with any of the RBS-R scales. IQ ( $r = -.33, p < .001$ ) and adaptive functioning ( $r = -.32, p < .001$ ) were negatively correlated with stereotyped behavior. Both social communication challenges and behavior problems were positively correlated with ritualistic behaviors ( $r = .33, r = .32$  [ $ps < .001$ ]) and need for sameness ( $r = .41, r = .39$  [ $ps < .001$ ]). Additional analyses will be presented.

#### Conclusions:

This is one of the only reports on the relative prevalence of specific RRBIs using a large and well-characterized sample of youth with ASD. There was great variability across specific RRBIs topographies. Different RRBIs, as well as their association with clinical variables, varied across level of functioning. Efforts at refining the behavioral phenotype will ultimately help to unravel the etiology of ASD.

**518.091** (Virtual Poster) Translation and Cultural Adaptation of the Malay Version of Social Responsiveness Scale Second Edition (SRS-2) N. F. Sulaiman<sup>1</sup>, S. Kamaralzaman<sup>2</sup>, A. N. Rauf<sup>3</sup>, F. B. Adnan<sup>3</sup>, K. Ilias<sup>4</sup>, H. Toran<sup>5</sup> and H. Harun Rasit<sup>6</sup>, (1)GENIUS Division, GENIUS Kurnia Centre, Kuala Lumpur, Malaysia, (2)Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia, (3)GENIUS Division, GENIUS Kurnia, Kuala Lumpur, Malaysia, (4)Department of Psychology, Jeffrey Cheah School of Medicine and Health Sciences, Monash University Malaysia, Bandar Sunway, Malaysia, (5)Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, Malaysia, (6)Regional Centre for Special Educational Needs, Southeast Asian Ministers of Education Organization, Melaka, Malaysia

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**Background:** The Social Responsiveness Scale-Second Edition (SRS-2) is a 65-item self-rating scale designed to measure deficits in social behavior associated with autism spectrum disorder (ASD).

**Objectives:** The main objective of this study is to translate and cross-culturally adapt the original version (English) of Social Responsiveness Scale Second Edition (SRS-2) into a Malay version.

**Methods:** The adaptation process of the SRS-2 questionnaire was done on 50 parents in a school setting in the Klang Valley, Malaysia. This adaptation involved three phases: 1) translation and adaptation of the original Social Responsiveness Scale Second Edition (SRS-2), English version into Malay version 2) content validation and 3) pre-testing, which were cognitive interviewing and internal consistency.

**Results:** The Content Validity Index (CVI) showed a high agreement among expert reviewers which was relevant (CVI= 94.3%), simple (CVI=96.4%), clear (CVI=97.2%) and no ambiguity (CVI=97.2%). Through the pretest among 10 parents, 5 out of 65 items were mostly commented on and suggested for improvements. The total SRS-2 translated Malay Version subscale showed adequate and good internal consistency with Cronbach's Alpha 0.958.

**Conclusions:** The findings from the present study provided preliminary support for the psychometric properties of the SRS-2 Malay Version as a valid and reliable instrument to be used in Malaysia.

**518.092** (Virtual Poster) Using Machine Learning to Improve Diagnostic Assessment with the ADOS-2 in the Light of Specific Differential Diagnosis M. Schulte-Ruther<sup>1</sup>, T. Kulvicius<sup>1</sup>, S. Stroth<sup>2</sup>, V. Roessner<sup>3</sup>, P. B. Marschik<sup>1</sup>, I. Kamp-Becker<sup>2</sup> and L. Poustka<sup>1</sup>, (1)Department of Child and Adolescent Psychiatry and Psychotherapy, University Medical Center Göttingen, Göttingen, Germany, (2)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Marburg, Germany, (3)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany

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#### Background:

The diagnosis of Autism Spectrum Disorder (ASD) requires substantial clinical experience. The diagnostic decision is particularly difficult in the context of other disorders with behavioral symptoms in the domain of social interaction and communication, e.g. anxiety related disorders (ANX), attention deficit hyperactivity disorder (ADHD), or conduct disorder (CD). Observation measures such as the Autism Diagnostic Observation Schedule (ADOS) together with anamnestic information and further clinical information are currently the "Gold Standard" of clinical assessment.

#### Objectives:

Using machine learning methods we aimed to i) train specific models for the classification of ASD vs. differential diagnoses for improved sensitivity and specificity, and ii) to reveal item importance profiles of the specific models to identify those ADOS-items which are of particular relevance for the differential diagnostic decision of ASD versus ANX, ADHD, or CD.



## Methods:

We used a well-characterized clinical sample of individuals (n=1262) that had all received detailed outpatient evaluation for the presence of an ASD diagnosis (n=481) but also covered a range of additional differential or overlapping diagnoses (including ANX (n=100), ADHD (n=440), and CD(n=192)). We focused on ADOS module 3, covering the age range with particular high prevalence of such diagnoses. Using the clinical best estimate diagnosis of ASD as the target, we trained random forest models on ADOS single item scores in the context of specific differential diagnoses (i.e. ASD vs. ANX, ASD vs. ADHD, ASD vs. CD) and an unspecific model using all available data. We used nested cross-validation for parameter optimization (Bayesian tuning and averaging after 5 x 5 repeated cross-validation), training, and model evaluation (averaging of 10x5 repeated cross-validation) to calculate unbiased estimates of classification performance (ASD vs. non-ASD). To demonstrate the potential of this approach for translation into clinical practice, we programmed a web app ([https://msrlab.shinyapps.io/ml\\_beta\\_app\\_v3/](https://msrlab.shinyapps.io/ml_beta_app_v3/)) that allows for easy testing of our final models with ADOS item level data.

## Results:

We obtained very good overall sensitivity (0.89-0.94), specificity (0.87-0.89), and area under the receiver operant characteristic curve (ROC- AUC, 0.94-0.96). In particular for individuals with less severe symptoms (around the ADOS cut-off) our models showed increases of up to 20% in sensitivity or specificity in comparison to the ADOS-2 algorithm. Furthermore, we analyzed item importance profiles of the ANX-, ADHD- and CD-models in comparison to the unspecific model. These analyses revealed distinct patterns of importance for specific ADOS-items with respect to differential diagnosis (Fig. 1).

## Conclusions:

We could demonstrate, for the first time, the feasibility of constructing optimized models of ASD-classification in the context of specific differential diagnoses in a typical clinical population. This strategy may improve clinical decisions by utilizing the full range of information from comprehensive and detailed diagnostic observation such as the ADOS. Importantly, this might be of particular relevance for individuals with less severe symptoms that typically present a very difficult decision for the clinician.

**518.093 (Virtual Poster)** Using Smartphone-Recorded Vocalizations for Assistive Diagnoses of Children with Autism Spectrum Disorder  
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**Background:** According to the world health organization 1-2% of the global population has autism spectrum disorder (ASD). Diagnosis and early intervention for children with ASD is crucial for their healthy development. However, diagnosis of children with ASD may not be feasible on a large scale, especially in countries with less developed medical infrastructure. In the last five years, many proof-of-concept scientific works, from both academia and industry, have shown the significant potential of Artificial Intelligence (AI). This study demonstrates the viability of such an approach. Non-invasive biomarkers, aim to distinguish typical from atypical development via objective methods, such as voice samples captured using a widely available digital device like a smartphone.

**Objectives:** Our goal was to provide a reliable tool that helps shorten the journey to a diagnosis of ASD. Providing diagnosis as early as possible would increase children's opportunities to have multidisciplinary interventions during the early stages of life. Several studies have shown the value of early intervention on outcomes for at-risk infants and their parents' quality of life experience on multiple levels.

**Methods:** After signing Informed Consent forms and with the help of legal guardian, voice samples were collected using an app on their own smartphones. To obtain the voice samples, participants were asked to name a set of pictures. Our cohort consists of N = 82 [25 ASD, 57 CTRL] children between the age of 2.0 and 16.0 (All: Min Age: 2.0, Max Age: 16.0, Mean Age  $\pm$  std: 7.43  $\pm$  3.44. ASD: Min Age: 3.0, Max Age: 16.0, Mean Age  $\pm$  std: 7.37  $\pm$  3.8. CONTROL: Min Age: 2.0, Max Age: 16.0, Mean Age  $\pm$  std: 7.46  $\pm$  3.26).

**Results:** Children with ASD showed a higher variability in their pitch spectrum. The pitch standard deviation in Hertz was 112.84  $\pm$  19.55 for children with ASD and 91.77  $\pm$  27.76 for controls (AUC: 0.71). The pitch spectra were binned into pitch histograms. The square root sum of squares of the pitch histograms represents a metric which is capable of distinguishing between ASD and CTRL with a ROC AUC of 0.77. Furthermore, we utilized machine learning techniques to combine several features obtained from the pitch histograms to further leverage the performance. The best machine learning models reached an ROC AUC of 0.80 (95% CI: 0.7599 - 0.8463) in a cross-validation setting.

**Conclusions:** Using the square root sum of squares of the pitch histograms, we created a metric to clearly discriminate the variability density estimation of the pitch of the vocalizations that can be used to indicate ASD. By combination of several metrics using traditional machine learning methods such as SVMs we can further improve the decision boundaries for diagnosis. Since our diagnosis system relies on self-reported voice samples recorded by smartphones, our approach has enormous potential in terms of scalability and is therefore a convenient option to pre-screen children for autism.

**518.094 (Virtual Poster)** Validating a the Counseling Center Assessment of Psychological Symptoms for Autistic College Students: A Step Toward Better Understanding of Mental Health

#### Background:

Autistic college students advocate for mental health services on campus from providers with experience with autism (Freedman, 2019). Nationally, many college counseling centers use the Counseling Center Assessment of Psychological Symptoms (CCAPS-62) to screen for mental health concerns when a student initiates services. However, this instrument is not validated for the autistic population. Also, little is known about the mental health challenges exhibited by autistic college students compared to non-autistic counterparts. A better understanding of experiences in mental health can lead to the design of more targeted interventions for the college autism community.

#### Objectives:

- Aim 1: Examine the internal construct validity of the CCAPS-62 for students on the autism spectrum
- Aim 2: Understand the mental health needs of college students with autism when compared to college students with other disabilities and no disabilities
- Aim 3: Explore predictors of mental health needs of autistic college students

#### Methods:

Aim 1: Autistic students (n=1268) were matched (3:1) with non-autistic students on race, gender, international status. A confirmatory factor analytic framework was used to conduct invariance testing of model fit by autism status. General model fit was assessed (Table 1) and invariance was established if there was a decrease of 0.01+ in CFI or increases of 0.01+ in RMSEA or 0.015+ in SRMR.

Aim 2: Descriptive analysis using t-tests and graphs were used to determine CCAPS subscale differences between the autism, other disabilities, and no disability groups.

Aim 3: Logistic regression was used to examine socio-demographic predictors of poor mental health outcomes in the autism group.

#### Results:

(see tables in image)

Aim 1: An 8-factor model displayed optimal fit (Table 1). The CCAPS displayed strong invariance (RMSEA of 0.000, a change in CFI of 0.0013 and a change of SRMR of 0.0005.)

Aim 2: Autistic students had higher scores in depression, general anxiety, family distress, frustration/anger, and social anxiety ( $p < 0.05$ ). Autistic students had similar scores in academic distress and eating concerns and lower scores in substance use. Compared to peers with other disabilities, autistic students had elevated scores in all subscales except academic distress and substance use.

Aim 3: Due to limitations with missing data, we were only able to examine trauma and sexual orientation as predictors. Table 2 highlights statistically significant odds ratios.

Following the analysis, the results were then shared with an autistic advisory group at the University of Delaware in order to discuss, interpret and consider implications and recommendations.

#### Conclusions:

The CCAPS-62 has evidence of internal construct validity. Counseling professionals and researchers may use the instrument to assess mental health in autistic college students. Higher levels of social anxiety and anger/frustration compared to other populations of college students suggests that colleges might consider targeted interventions in these areas for autistic college students, and incorporate stronger trauma-informed practices. Colleges should consider how their infrastructure contributes to increased social isolation and frustration among college students with autism and how this might be improved to promote inclusion on campus.

**518.095 (Virtual Poster)** The Anxiety Scale for Autism-Adults Is a Valid Tool for Autistic but Not Non-Autistic Cis-Gender Males and Females  
**H. L. Moore<sup>1</sup>, J. Rodgers<sup>2</sup> and S. A. Cassidy<sup>3</sup>,** (1)Newcastle University, Newcastle upon Tyne, United Kingdom, (2)Population Health Sciences Institute, Newcastle University, Newcastle upon Tyne, United Kingdom, (3)School of Psychology, University of Nottingham, Nottingham, United Kingdom

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#### Background:

High rates of anxiety are found in autistic adults. Previous research indicates that autistic people may experience different symptoms to non-autistic adults, and may interpret questions on anxiety questionnaires differently to non-autistic adults. Tools designed to assess anxiety in non-autistic people may, therefore, not be suitable for identifying anxiety in autistic individuals. An autism-specific measure of anxiety called the Anxiety Scale for Autism-Adults (ASA-A) has been proven reliable and valid for autistic adults, and cut-offs indicative of anxiety developed. However, research has not yet assessed whether the measurement properties are the same for males and females, nor for autistic and non-autistic individuals.

#### Objectives:

To assess the measurement invariance of the ASA-A for 1) autistic cis-gender males and females, 2) non-autistic cis-gender males and females, and 3) autistic and non-autistic adults.

#### Methods:

Autistic and non-autistic adults were recruited through volunteer databases and social media. Individuals who do not identify with their birth gender assignment may have a different mental health experience to cis-gender individuals, and sample size did not allow invariance in alternative gender identities to be explored, so cis-gender adults only were included in these analyses. Data were available for 342 autistic participants and 316 non-autistic participants. Among other measures relevant to the wider study, participants completed the ASA-A. The previously established bi-factor model was first tested using confirmatory factor analysis (Figure 1). Configural, metric, scalar, and residual measurement invariance were assessed using SPSS AMOS Version 27. Invariance was established through three measures of degradation of model fit: A nonsignificant change in chi-square compared to the configural model, a decrease in CFI of  $<.01$ , and a decrease in RMSEA of  $<.015$ . If invariance was found, then the next level was tested.

#### Results:

Confirmatory factor analysis established good model fit for the whole sample (CFI=.983, TLI=.978, RMSEA=.043, PCLOSE=.966), and both autistic (CFI=.965, TLI=.955, RMSEA=.049, PCLOSE=.581) and non-autistic adults (CFI=.966, TLI=.957, RMSEA=.052, PCLOSE=.356). Residual invariance was confirmed for both cis-gender autistic males and females ( $\Delta\text{CFI}=-.003$ ,  $\Delta\text{RMSEA}=.006$ ,  $\Delta\chi^2=68.494$ ,  $p>.05$ ), and also cis-gender non-autistic males and females ( $\Delta\text{CFI}=-.005$ ,  $\Delta\text{RMSEA}=.007$ ,  $\Delta\chi^2=61.902$ ,  $p>.05$ ). However, metric non-invariance was established between autistic and non-autistic adults ( $\Delta\text{CFI}=.014$ ,  $\Delta\text{RMSEA}=-.005$ ,  $\Delta\chi^2=141.516$ ,  $p<.001$ ). Exploration showed metric invariance on most items in the three-factor structure, but  $>50\%$  of item loadings on the general factor structure were non-invariant.

#### Conclusions:

The ASA-A is a suitable measure of anxiety in cis-gender autistic males and females, suggesting that the same clinical cut-offs can be used for both groups, and it can be used to compare the groups. However non-autistic adults did not respond to the ASA-A in the same way as autistic adults, suggesting (unsurprisingly) that this measure does not adequately capture anxiety for non-autistic adults. While the individual factors might be used with some modification for comparisons in research, the general factor is not appropriate to compare anxiety in autistic and non-autistic adults.

#### **518.096** (Virtual Poster) What Is the Concordance between Parent- and Teacher-Reported Adaptive Functioning in Autistic Children Using the VABS-II?

**H. L. Moore<sup>1</sup>**, A. Le Couteur<sup>2</sup>, T. Charman<sup>3</sup>, J. Green<sup>4</sup>, V. Grahame<sup>5</sup> and P. G. C. PACT-G Consortium<sup>6</sup>, (1)Newcastle University, Newcastle upon Tyne, United Kingdom, (2)Newcastle University, Newcastle Upon Tyne, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)University of Manchester, Manchester, United Kingdom of Great Britain and Northern Ireland, (5)Cumbria, Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (6)The University of Manchester, Manchester, United Kingdom

#### Background:

Autistic children often experience adaptive functioning difficulties, i.e. difficulties with the practical, everyday skills that an individual needs to meet the demands of their environment. Informant-report measures, such as the Vineland Adaptive Behaviour Scales-II (VABS-II) are frequently utilised. Autistic children may vary their behaviour depending on context, such as between home and school, and parent/teacher concordance rates in previous research have varied, from small-large correlations, as well as variation in who rated performance higher. Research is limited on lower ability autistic children, and it is not clear whether agreement at the domain level translates to similarities in reported behaviour at the item level. Differences could indicate behaviour varying by context or differences in understanding/perception of abilities.

#### Objectives:

Using a lower ability sample of autistic children, this study explored domain- and item-level concordance between parents and education professionals on the VABS-II, as well as patterns in reporting disparities.

#### Methods:

Data were available from 235 children, aged 3-11yrs, who took part in the Paediatric Autism Communication Trial-Generalised (PACT-G). The baseline characterisation data for this study includes VABS-II survey form (parent) and teacher questionnaire (Adaptive Behaviour Composite

(ABC), domains: Communication, Daily Living Skills (DLS), Socialisation, Motor Skills), as well as child ability measures of nonverbal ability, language, and autism severity. The education professional most familiar with the child completed the teacher VABS-II. To investigate domain level concordance, we compared means, and examined inter-rater reliability using ICCs. Linear regression enter method explored child factors that influenced the level of disagreement, calculated as the difference between parent and teacher VABS-II ABC/domain scores. There were 165 identical (or near identical) parent and teacher VABS-II items (43% of parent items and 74% of teacher items), and we compared item level concordance using weighted kappa cross-tabulations for non-unique raters, with simes correction for multiple comparisons.

#### Results:

Parents scored their children higher than education professionals on VABS-II ABC scores, as well as Socialisation and Motor Skills, but not Communication or DLS (see Table). Difference in VABS-II scores was significantly negatively associated with child nonverbal , predicting 10-35% of the variance. Autism severity and language were not significantly associated with discrepancy. Weighted kappa scores were calculated for 147 items (89.1%), and 32.7% had significant inter-rater agreement (see Table). Where disagreements arose (99/147), education professionals rated behaviour in the 'sometimes or partially' category more frequently, whereas parents were more likely to rate behaviours as 'never' or 'usually'.

#### Conclusions:

Inter-rater agreement at both the domain and item level is low, but domain-level agreements are closer when child nonverbal ability is higher. Parents and education professionals chose different item level rankings but it is not clear whether this is due to differences in perception/understanding, or context-dependent differences in performance, which future research should explore further. Multiple informant ratings are necessary to gain a full picture of a child's adaptive abilities.

#### **518.097** (Virtual Poster) Using the Brief Observation of Social Communication Change (BOSCC) to Measure Longitudinal Changes in Social Communication Behaviors

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**Background:** The Brief Observation of Social Communication Change (BOSCC) was designed as an observational instrument for reliable and objective measurement of changes in the social-communication behaviors of children with ASD. To date, most published research using the BOSCC has consisted of cross-sectional studies or smaller clinical trials. Only one longitudinal study examines whether the BOSCC can reliably capture changes in social-communication behaviors over a 1-year period.

**Objectives:** The present analysis aims to test whether the BOSCC coding scheme can be used to assess social communication changes in children with ASD longitudinally across a 2- to 3-year period. We will specifically examine whether skills observed in the context of a standard parent-child interaction can be coded across age and developmental level during the preschool period, because the current BOSCC coding scheme has not been applied to children with fluent speech.

**Methods:** Data collection and coding is ongoing (to date, n = 10 with ASD age 28 to 90 months) with an anticipated sample of n=50. Children completed the Autism Diagnostic Observation Schedule (ADOS-2) with varying levels of language ability from minimal spontaneous speech to fluent speech (spanning ADOS-2 Module T to Module 3). Participants and their parents were asked to play freely and recorded for 10 minutes, twice, 2 to 3 years apart and BOSCC rating was applied to the videos. Total, social affect (SA), and restricted/repetitive behaviors (RRB) change scores (T1-T2) were created for the BOSCC and ADOS-2 calibrated severity scores (CSS). Spearman rank correlation coefficients were used to compare the BOSCC's sensitivity to change over time relative to the ADOS-2.

**Results:** We first examined the feasibility of coding the BOSCC in this age range by checking floor or ceiling scores at either time point. No children earned minimum or maximum scores for the possible range of 0-75 points. Next, we examined whether scores improved for children between timepoints at an individual level. Seventy percent of children earned total BOSCC scores that were lower at the second timepoint (i.e., stronger social communication skills and lower levels of repetitive behavior); 10% obtained scores that differed by 0-1 points (i.e., no change); 20% obtained higher scores (i.e., worse skills at the second time point). Finally, we examined whether changes on the BOSCC corresponded with changes on the ADOS-2 CSS score. For the total and social affect domains, ADOS-2 CSS changes did not significantly correlate with BOSCC changes. However, the change score of ADOS-2 RRB CSS significantly correlated with changes on the BOSCC restricted and repetitive behavior items ( $\rho(8) = 0.64, p = 0.045$ ).

**Conclusions:** Our preliminary results suggest that the BOSCC is a feasible measure of change that can capture differences related to autism symptomatology over a 2–3-year period among children with language abilities ranging from minimally verbal to verbally fluent. As expected, most children showed some progress in their skills over this period and data suggest that changes detected by the BOSCC track with changing levels of symptom severity on an established measure in the restricted/repetitive behaviors domain.

#### **518.098** (Virtual Poster) Initial Validation of the Mandarin Translation of the Stanford Social Dimensions Scale (SSDS)

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**Background:** Impairments in social functioning are a diagnostic feature of autism spectrum disorder (ASD). Importantly, social functioning is a complex and multifaceted domain, encompassing several distinct processes, each of which can be differently affected in individuals with ASD. However, despite its prominence and multifaceted nature, there is a paucity of open-source instruments specifically designed to quantify individual differences in different aspects of social functioning. A recently developed Stanford Social Dimensions Scale (SSDS), was specifically designed for such a purpose. Initial validation has shown preliminary evidence that the SSDS can capture different aspects of social motivation, social communication and mental state understanding in a valid and reliable way.

**Objectives:** To provide an initial validation of a Mandarin translation of the Stanford Social Dimensions Scale (SSDS) by investigating its factor structure, discriminant, convergent and divergent validity.

**Methods:** Parents of 468 children with ASD ( $Mean_{age}=9.02$ ,  $SD=3.79$ ), 74 children with intellectual disability (ID) without ASD ( $Mean_{age}=10.44$ ,  $SD=3.69$ ), 54 children with language delay (LD) ( $Mean_{age}=5.36$ ,  $SD=1.80$ ) and 160 children who were typically developing (TD) ( $Mean_{age}=7.16$ ,  $SD=3.66$ ) from 22 provinces and Municipalities in China completed the translated SSDS and the appropriate versions of the Social Responsiveness Scale (SRS-2) and the Strengths and Difficulties Questionnaire (SDQ). Data on children's full-scale intellectual quotient (FSIQ) was also available.

**Results:** Confirmatory application of the Exploratory Structural Equation Modelling indicated that an original five-factor model encompassing Social Motivation (SM), Social Affiliation (SA), Expressive Social Communication (ESC), Social Reception (SR) and Unusual Approach (UA) provided adequate to excellent fit to the data in ASD group (comparative fit index [CFI]=.962, Tucker Lewis Index [TLI]=.949, root mean square error of approximation [RMSEA]=.058 [95% CI: .054, .062], standardized root mean square residual [SRMR]=.032). With the exception of items on UA factor that showed lower loadings when compared to the original validation in the US sample, majority of items constituting SM, SA, ESC and SR factors. Discriminant validity was excellent with ASD group showing significantly lower scores (poorer ability) across all SSDS subscales when compared to ID, LD and TD groups, in turn, ID and LD groups showed poorer performance than TD group. Convergent and divergent validity across all SSDS scales was strong as indexed by the pattern of correlations with relevant SRS-2 and SDQ domains and with FSIQ scores.

**Conclusions:** The ability to characterize and quantify individual differences in key processes crucial for social functioning in ASD is an essential step towards better understanding concurrent functioning and long-term outcomes as well as for informing personalization of treatments. This study provided preliminary validation of the Mandarin translation of the SSDS by largely replicating the original factor structure and showing evidence for a strong discriminant, convergent and divergent validity. This study has also identified potential aspects where further refinement and potential expansion of the SSDS are needed. Our findings provide initial validation of a new scale designed to comprehensively capture individual differences in social motivation and other key social dimensions in ASD.

**518.099 (Virtual Poster)** Examining Sources of and Interventions for Distress in Autistic Individuals with Complex Needs – a Systematic Review of Procedural and Measurement Issues and Practice

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Background:

Autistic individuals are disproportionately susceptible to experiencing forms of distress e.g. anxiety or depression. Existing reviews of distress literature focus primarily upon individuals with average or above-average levels of adaptive or cognitive functioning and language ability. Studies examining distress in those with additional intellectual disabilities (ID) remain scarce, potentially due to methodological challenges. Consequently, underpinning causes and contributing factors remain poorly understood. Additionally, relevant literature has not been reviewed comprehensively because distress is often narrowly operationalised in terms of specific externalising behaviours e.g., challenging behaviour or aggression. Distress, however, may also be felt and expressed differently in autistic individuals with ID.

Objectives:

To comprehensively review methodological approaches used to operationalise and measure distress in autistic individuals with ID including strategies used for engaging, recruiting and retaining this group in research processes. Current knowledge concerning the sources of, and interventions for distress are also examined systematically.

Methods:

Electronic databases were searched using a broad range of keywords relating to distress and autism and ID, to identify English-language primary studies reporting relevant outcome measures. Data extraction and synthesis followed PRISMA guidelines. Quality appraisal was completed with an adapted grid method used in Glod et al., (2015), facilitating concurrent utilisation of multiple frameworks. Full details of the review methodology are available in the pre-registration protocol [PROSPERO CRD42021249840].

Results:

Of 2955 studies screened, 256 were selected for full text review and analysis. Distress operationalised in terms of measures of anxiety, depression and different forms of behaviour labelled as 'challenging' (including repetitive behaviour and aggression). Consensus was limited regarding the most appropriate distress measure, the most common involved caregiver, teacher or clinician reports. Self-report, neurological, behavioural, and psychophysiological measures were less common. Measures relying on reports from others risk biases and rely on the verbalisation of experiences to

a parent or clinician. Such measures potentially limit the voice of the autistic individual with ID. Additionally, there was little reporting of how recruitment and retention processes were managed or adapted for this population.

In synthesising findings, several conceptual challenges were found. First, literature varied regarding how ID within autistic individuals was defined and operationalised. ID was most often defined as  $<70$  on an IQ scale. Alternatively, or in conjunction with IQ scales, a measure of adaptive functioning was given ( $<70$ ). Additionally, participant groups often involved autistic individuals with and without ID, making it difficult to assess the role of additional ID in distress-related outcome measures more.

Distress was attributed to different sources e.g., atypical sensory processing, sleep quality, inability to cope with environmental changes and anxiety or frustration at poor communication with others.

#### Conclusions:

The voice and collaboration of autistic individuals with ID is underrepresented in distress research. A key output from this review will be the development of guidelines to support inclusion and partnership of this population. Future research should focus on development and use of inclusive participatory approaches supporting collaboration across research processes, and more objective means of capturing distress such as psychophysiological measures could mitigate reliance upon caregiver/clinician reports.

#### **518.100** (Virtual Poster) Me Reporting on Myself: Further Evidence in Support of the Validity of the Theory of Mind Inventory-Self Report When Completed By Autistic Adults

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**Background:** Although self-report is being more widely used to assess a variety of characteristics in autism spectrum conditions (e.g., anxiety, depression), self-assessment of social cognition remains a woefully understudied topic. The Theory of Mind Inventory: Self-Report-Adult (ToMI-SR-Adult) was recently developed for this purpose. The ToMI-SR-Adult consists of 60 statements tapping advanced aspects of social cognition (e.g., metalinguistics, humor, deception) as applied in real world behavior. Initial examination of the ToMI-SR-Adult showed that it reliably distinguished autistic adults with subtle symptomology from neurotypical adults matched on age, gender, and socioeconomic status.

**Objectives:** Our objective was to further evaluate the psychometric properties of the ToMI-SR-Adult in a pilot sample of autistic adults who were capable language users but who were more diverse in their autism, language, and intellectual profiles.

**Methods:** Participants were 13 autistic adults ages 22-64 years ( $M = 41$ ; 7 male, 6 female) representing a range in symptom severity and language and intellectual abilities. Participants completed the ToMI-SR-Adult at two time points (retest interval approximately 4 weeks). At time 1, they also completed assessments of intelligence (Kaufman Brief Intelligence Test, K-BIT-2), receptive vocabulary (Peabody Picture Vocabulary Test, PPVT-4), autism symptomology (ADOS-2; Autism Quotient, AQ; Social Responsiveness Scale, SRS-2), empathy (Empathy Quotient, EQ-10-Adult), and psychological conditions (Achenbach System of Empirically Based Assessment, ASEBA-Adult-Self-Report). Our examinations involved a variety of self-report indices only to control for methods variance. Test-retest reliability and convergent and discriminant validity were assessed using Pearson's correlations. For the purposes of this pilot, an alpha of .10 was adopted to guard against the potential for type II errors.

**Results:** The ToMI-SR-Adult demonstrated good test-retest reliability ( $r = .89, p < .01$ ). To assess convergent validity, we reasoned that a construct valid measure of advanced ToM would demonstrate strong correlations with theoretically-related constructs. As expected, we observed significant associations between scores on the ToMI-SR-Adult and the EQ10, the AQ, the SRS composite score, the SRS Social Awareness subscale, the SRS Social Cognition subscale, and the ASEBA thought disturbances subscale (Table 1). Surprisingly, we also observed a significant correlation with the SRS-RRB subscale. We also conducted tests of discriminant validity, reasoning that a construct valid measure of advanced ToM would demonstrate weaker correlations with constructs with more tenuous conceptual links to theory of mind. As expected, we observed weaker, non-significant associations between scores on the ToMI-SR-Adult and the SRS Social Motivation subscale, the ASEBA withdrawn subscale, and the ASEBA anxiety subscale (Table 1). We also observed a non-significant correlation with the SRS social communication subscale although this appears to be an artifact of insufficient power.

**Conclusions:** We found support for the test-retest reliability and convergent and discriminate validity of the ToMI-SR-Adult. This justifies further development and validation of the measure and supports the notion that autism does not preclude self-awareness and that often, autistic adults may be the best judges of their own subjective social-cognitive experiences.

#### **518.101** (Virtual Poster) Examining Provider Perspectives on the Process of Conducting Virtual Diagnostic Evaluations: A Double-Edged Sword

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**Background:** Serving autistic children is a significant public health concern. A diagnosis is typically the first step to obtaining services. Accessing an ASD diagnostic evaluation (DE) has historically been challenging (Wiggins et al., 2006), especially for families from underserved communities (e.g., rural, low-income, ethnically/racially diverse populations, populations with low English proficiency) (Robins et al., 2014). Access to DE's was further reduced during the COVID-19 pandemic. Virtual DE (DE-v) can improve access for underserved families (Maheu et al., 2001) and address the current safety concerns due to the pandemic (Narzisi et al., 2020). The minimal extant research on family perceptions of DE-v is generally positive (Gibbs et al., 2021). However, several challenges exist to delivering DE-v's for ASD. Beyond the lack of valid assessment tools, delivering DE-v's can be challenging given DE-v relies on parent-elicited interactions with the child as the primary source of observational data.

**Objectives:** To examine providers' attitudes about and experiences related to the DE-v process, including: 1) reasons for shifting to DE-v's during the pandemic; 2) adaptations for DE-v's; and 3) barriers to implementing DE-v's.

**Methods:** The ten psychologists that provided eligibility DE-v's for children ages 0-5 for the San Diego Regional Center (SDRC), purveyor of Developmental disability services, were invited to participate; 6 agreed. SDRC serves two racially/ethnically and geographically diverse counties. Participants were 66.7% female and all Non-Hispanic White; four reported working with early intervention populations and five with preschool populations and one provided DE-v's in Spanish. Participants took part in 60-minute semi-structured interviews that asked about: 1) reasons for shifting to DE-v's; 2) the structure of their DE-v's; and 3) similarities and differences between DE and DE-v's. Interviews were recorded and transcribed. Interview data were analyzed using elements of the Rapid Assessment Procedure (Palinkas & Zatzick, 2019), which included independent coding of transcripts using a summary template, template comparison and discussion to achieve consensus, and entering consensus templates into a matrix to generate themes. Participants also completed an electronic barriers to DE-v survey (14 items; 1 (not perceived barrier)-5 (highly perceived barrier), analyzed with descriptive statistics.

**Results:** For objective 1, primary reasons providers pivoted to DE-v's include family need for services and provider need for income. For objective 2, DE-v adaptations included: 1) a telephone call and/or preparatory session ahead of the evaluation; 2) coaching the parent to elicit interactions the provider needs to see; 3) inviting a sibling or neighbor to interact with the target child if applicable; 4) inability to conduct cognitive testing or use existing valid diagnostic assessment tools; and 5) inability to use typical engagement and comforting strategies during diagnostic feedback if needed. For objective 3, providers indicated low overall barriers ( $M=2.4$ ). Barriers to conducting DE-v's, with highest mean scores included available valid assessment measures ( $M=3.5$ ) and minimal professional benefits of providing DE-v ( $M=3.2$ ).

**Conclusions:** Results indicate several adaptations for DE-v and generally low perceived barriers to providing DE-v's. Future research with a diverse range of providers and families can further inform efforts to develop supports for psychologists and families to optimize the DE-v process.

**518.102 (Virtual Poster)** Factor Analyses of the Gilliam Autism Rating Scale-Third Edition Using Special Education Staff Ratings in Samples with ASD and Other Developmental Disabilities

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**Background:** The Gilliam Autism Rating Scale (GARS-3; Gilliam, 2013) is a commonly used level two screener for ASD (Aiello et al., 2017; Benson et al., 2019; Norris & Lecavalier, 2010). The GARS-3 is a substantial revision from the prior version, however, there is no independent research examining its factor structure. Previous GARS editions had notable psychometric issues (e.g., with screening performance, factor structure, and item-to-scale correspondence) when evaluated independently (Lecavalier, 2005; Pandolfi et al., 2010; South et al., 2002; Volker et al., 2016). This presentation will provide an independent examination of the internal structure validity of the GARS-3 in an ASD student sample rated by special education staff.

**Objectives:** Study one examined the internal structure of the GARS-3 via exploratory factor analysis (EFA) of special education teaching staff ratings in a sample of 204 students with ASD. Study two examined the fit of the published six-subscale model (Gilliam, 2013) and the model derived from the study one EFA using confirmatory factor analysis (CFA) in a separate validation sample of 200 students with ASD and other developmental disabilities with similar support needs.

**Methods:** GARS-3 data were collected at a large special education agency that serves students with ASD. For study one, an EFA was conducted on the inter-item polychoric correlation matrix using principal axis factoring with promax rotation. Factor retention criteria included: Kaiser criterion, scree plot, Velicer's MAP, parallel analysis, and factor interpretability. For study two, a CFA was conducted on a validation sample's inter-item polychoric correlation matrix using the Mplus weighted least squares mean variance estimator. The original GARS-3 six-factor model and the study one EFA-based model, with and without cross-loadings, were compared.

**Results:** In study one, a correlated six-factor model was retained that very closely aligned with the GARS-3 six-subscale structure. Noteworthy differences were a single item that loaded on a different factor and the presence of several cross-loadings. Five of the six factors had substantive positive inter-factor correlations, while the negative to near zero correlations involving the remaining factor suggested that minimum language requirements may need to be revisited for its items. In study two, both models showed evidence of good fit and did not substantively differ (i.e., original model [ $\chi^2 = 2323.440$ ,  $df = 1580$ ,  $p < .001$ ; RMSEA = 0.049; SRMR = 0.081; CFI = 0.981; TLI = 0.980; MLR-based AIC = 26367.365 and BIC = 26990.747], model from study one EFA [ $\chi^2 = 2361.659$ ,  $df = 1580$ ,  $p < .001$ ; RMSEA = 0.050; SRMR = 0.081; CFI = 0.980; TLI = 0.979; MLR-based AIC = 26338.297 and BIC = 26961.679]). Additional analyses indicated models that included cross-loadings fit significantly better.

**Conclusions:** The EFA and CFA generally supported the proposed six-factor structure of the GARS-3. However, results also suggested one item may be more appropriate for a different subscale, the pattern of inter-factor correlations implied a possible problem with the minimum language requirement for one subscale, and several significant cross-loadings indicated that the inclusion or interpretability of some items should be reconsidered.

**518.103 (Virtual Poster)** Identifying Patient Characteristics to Understand Which Children May Receive Diagnostic Clarity in a Virtual Autism Spectrum Disorder Evaluation

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**Background:** Given long waitlists for autism spectrum disorder (ASD) evaluation coupled with the COVID-19 pandemic, it is crucial to triage patients to services where they are likely to receive diagnostic clarity. ASD evaluations are traditionally completed in-person and often include a diagnostic interview, behavioral observations, cognitive testing, and ASD specific measures, with some tools requiring in-person administration. Due to of COVID-19 safety precautions, ASD virtual evaluation (VE) has become common practice. VEs have potential to increase access to evaluation and expedite patient access to treatment. It remains unclear which patients are likely to receive diagnostic clarity during VE and which patients are likely to be referred for further testing. Additionally, it is unclear how information collected during VE may inform diagnostic outcomes during in-person evaluation (IPE).

**Objectives:** The current study investigates which patients are likely to receive diagnostic clarity during an ASD VE and which patients are likely to be referred on for further IPE. Bivariate relations between VE data and IPE data are investigated.

**Methods:** Eighty-seven youth (33% female;  $M_{age}=9.14$ ,  $SD_{age}=3.89$ ) and caregivers engaged in VE. A subset also completed an in-person evaluation. VE data included demographic variables, adaptive skills (i.e., Adaptive Behavior Assessment System, 3<sup>rd</sup> Edition; ABAS-3), psychiatric history, behavior and psychiatric concerns (i.e., Behavioral Assessment System for Children, 3<sup>rd</sup> Edition; BASC-3), educational services for ASD, ASD symptom severity (i.e., Childhood Autism Rating Scale, 2<sup>nd</sup> Edition (CARS-2), and outcome of virtual evaluation (i.e., ASD diagnosis, further testing recommended). IPE data included Brief Observation of Symptoms of Autism (BOSA) and diagnostic outcome. Of 87 participants who completed a VE, 38 received an ASD diagnosis, 7 had ASD ruled out, and 49 were referred for IPE. At time of analysis, 22/49 participants completed IPE.

**Results:** Group differences indicated older youth and those with more historical psychiatric diagnoses were more likely to be referred for IPE while those with school supports for ASD were more likely to receive ASD diagnosis at VE (see Table 1). Logistic regression suggested youth with educational services for ASD and higher ASD severity scores were more likely to receive ASD diagnosis at VE (see Table 2). Regarding the relations between VE and IPE behavioral observation, data did not yield significant relations between variables collected during VE and the BOSA. The majority of VE data did not relate to IPE diagnostic outcomes; however, the CARS-2 severity score ( $r=0.34$ ;  $p=.016$ ) and having a first degree relative with ASD ( $r=-0.46$ ;  $p=.031$ ) did relate to diagnosis of ASD at IPE.

**Conclusions:** VE have limitations such that not every patient is able to receive diagnostic clarity during virtual care, at which time a referral for IPE may be deemed appropriate. Age, psychiatric conditions, educational services for ASD, and ASD severity are important to consider for triaging patients to appropriate evaluation services. Ultimately, VE may decrease burden on families who may not require IPE and assist in addressing lengthy ASD evaluation waitlists.

#### **518.104 (Virtual Poster) Linkages Among Age of Diagnosis, Assigned Sex, Cognitive Functioning and Mental Health in ASD**

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#### **Background:**

Timely Autism Spectrum Disorder (ASD) diagnoses are critical for establishment of care, including early intervention during a plastic period of development, and receipt of services, which ultimately drive long-term outcomes. Posited predictors of late ASD diagnosis include: sex assigned female at birth, co-occurring psychopathology (i.e., diagnostic overshadowing), relatively stronger cognitive skills, and relatively reduced ASD symptom severity.<sup>1-3</sup> Late diagnosis of ASD is associated with poorer quality of life and increased depressive/anxious symptoms.<sup>4,5</sup>

#### **Objectives:**

Examine the relationship between age of ASD diagnosis and key variables of interest: sex assigned at birth, anxious/depressive symptoms, and intellectual functioning.

#### **Methods:**

Participants included youth from a large clinical database ( $N = 1198$ ) who received their first clinical diagnosis of ASD at the time of a neuropsychological evaluation at an outpatient academic medical center. The children were predominantly male (77.3%) and were diagnosed with ASD between the ages of 1.3-19.7 years ( $[y]$ ;  $M = 7.26$ ,  $SD = 4.30$ ). For those over 6y who received IQ assessment at the time of diagnostic evaluation ( $n = 590$ ), full scale IQ (FSIQ) scores ranged from 37 to 141 ( $M = 96.29$ ,  $SD = 18.70$ ). FSIQ was obtained from the Wechsler intelligence assessments, Differential Ability Scales, or the Leiter International Performance Scale, as appropriate. Anxiety ( $n = 590$ ) and depressive ( $n = 582$ ) symptoms were captured from caregiver report on the Child Behavior Checklist, DSM-oriented scales.<sup>6</sup>

#### **Results:**

On average, youth assigned male ( $M = 7.10$ ,  $SD = 4.19$ ) versus female ( $M = 7.83$ ,  $SD = 4.61$ ) at birth received earlier diagnoses;  $t(411) = -2.34$ ,  $p = .006$ . A linear regression predicting age of ASD diagnosis from sex assigned at birth, FSIQ, and the interaction between sex and FSIQ was significant ( $R^2 = .03$ ,  $F = 5.85$ ,  $p = .001$ ); the interaction between sex and FSIQ emerged as the lone significant predictor of age of ASD diagnosis ( $\beta = .50$ ,  $t(589) = 2.31$ ,  $p = .02$ ). A linear regression predicting depressive symptoms from age of ASD diagnosis and assigned sex was significant ( $R^2 = .04$ ,  $F = 12.75$ ,  $p < .001$ ); age of ASD diagnosis was the sole predictor of depressive symptoms ( $\beta = .20$ ,  $t(581) = 4.79$ ,  $p < .001$ ). A linear regression



predicting anxiety symptoms from age of ASD diagnosis and assigned sex was significant ( $R^2 = .03$ ,  $F = 8.13$ ,  $p < .001$ ); age of ASD diagnosis emerged as the lone predictor ( $\beta = .16$ ,  $t(588) = 3.96$ ,  $p < .001$ ).

#### Conclusions:

These findings highlight that not only are assigned females diagnosed later than assigned males, but females with higher IQ experience later ASD diagnosis, suggesting a key group “missed” in either referral and/or diagnostic processes. Corroborating previous literature, later age of ASD diagnosis was associated with greater depressive and anxiety symptoms, regardless of assigned sex. Ultimately, these findings illustrate the importance of timely ascertainment and highlight factors that may be associated with diagnostic delay.

#### **518.105** (Virtual Poster) Measurement Invariance of the Vineland Adaptive Behavior Scales in Minimally Verbal Versus Verbal Autistic Individuals

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#### Background:

Adaptive behavior comprises a broad set of skills needed to function in everyday life. The Vineland Adaptive Behavior Scales, 3<sup>rd</sup> Edition (VABS-3; Sparrow et al., 2016) Parent/Caregiver Form divides adaptive behavior into 11 subdomains assigned to four domains (Communication, Daily Living Skills, Socialization, and Motor). Though there is general agreement that adaptive behavior is defined by the regular performance of skills in these areas, the factor structure of the VABS-3 has not been validated in autistic samples. Considering the widespread use of the VABS in autism research, it is necessary to establish its validity in autistic individuals across a wide range of abilities, including those who use minimal verbal language.

#### Objectives:

To examine measurement invariance (MI) of the VABS-3 Parent/Caregiver Form across minimally verbal (MV) and verbal autistic individuals, which would support use of the measure across a wide range of abilities represented in autism samples.

#### Methods:

The VABS-3 survey was electronically administered to parents of 9,549 autistic individuals aged 6-79 years ( $M=12.51$ ,  $SD=5.79$ ). The sample was split into two groups: minimally verbal (MV;  $n=913$ ) and verbal ( $n=8,636$ ; see Table 1 for demographic characteristics), based on a VABS-3 Expressive Communication raw score threshold of 34, which reflects use of up to 50 single words. MI between the MV and verbal groups was examined using the theoretical factor structure of the VABS-3, excluding the Motor domain which is administered only to children younger than 9 years (Figure 1). Due to the high number of items, subdomains were utilized as item-units, similar to previous research (Dovgan et al., 2019; Farmer et al., 2020). The fits of models using both raw scores and V-scale subdomain scores were evaluated.

#### Results:

The initial confirmatory factor analysis of the three-factor structure in the full sample yielded mediocre-to-poor fit (Raw scores: CFI=.910, TLI=.865, RMSEA=.185; V-scale scores: CFI=.948, TLI=.921, RMSEA=.134). Mediocre-to-poor fit was also observed within the MV (Raw: CFI=.883, TLI=.825, RMSEA=.155, V-scale: CFI=.922, TLI=.883, RMSEA=.130) and verbal (Raw: CFI=.898, TLI=.847, RMSEA=.171, V-scale: CFI=.935, TLI=.903, RMSEA=.129) groups. Because the structural model was not appropriate for either group, indicating lack of configural invariance with the population, MI between the MV and verbal groups could not be further examined.

#### Conclusions:

The three-factor structure of the VABS-3 Parent/Caregiver Form was not appropriate for the subdomain-level raw or V-scale scores in either the MV or verbal groups of autistic individuals. These findings reflect that the VABS-3's three-domain structure is based on the authors' theoretical construct of adaptive behavior, rather than an empirically-derived model. The lack of support for the factorial validity of the VABS-3 Parent/Caregiver Form indicates that scores from children with autism may not adequately assess these theoretical dimensions. Thus, autism research using the domain scores should exercise caution in interpretation. Future work should explore alternative latent structures for the VABS-3 Parent/Caregiver Form, and analyses are underway to evaluate a unidimensional model, which has some support in the VABS-3 normative sample (Farmer et al., 2020) and could support interpretation of the Adaptive Behavior Composite in autism research.

#### **518.106** (Virtual Poster) Play Behaviour Assessment for Children with Autism – Development and Feasibility

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## Background:

Play assessments can elicit a wide range of social behaviors and have been adapted for autism assessments like ADOS and AOSI. However, these assessments are set in a clinical environment, professional lead, require extensive training and are expensive. There is a need for assessments that are focused on observations of semi-structured, play-based social interaction between parent-child as well as examiner-child dyads and have the potential for implementation in low-resource settings.

## Objectives:

We aimed to develop a semi-structured play-based assessment to help screen children below 2 years for autism. Enabling this within tele-health care models using videos and computational approaches are additional objectives. We report here on the development and preliminary assessment of feasibility in our clinical setting.

## Methods:

After a detailed review of play behavior literature, in-depth interviews were conducted, by the authors with psychologists, psychiatrists and pediatricians. Based on the themes that emerged, such as availability of culturally appropriate toys, safety of children, early social and play behaviors and need to reduce distractions, a play protocol was designed having caregiver-child sessions and examiner-child sessions to elicit social and play responses. The activities were selected based on stages of play development which progressed from simple exploration (ball) to complex symbolic play (putting a doll to sleep). Informed consent was taken to video record the session for computational analysis. The cameras selected were such that they could be used in low-resource settings. To evaluate the feasibility of the protocol, it was pilot-administered to three groups of children (Autism Spectrum Disorder, Developmental Delay and Typical Development).

## Results:

The protocol was seen to take approximately 20-25 minutes for administration: the first five minutes included parent-child interaction and the following 15-20 minutes included structured examiner-child interaction. Based on the checklist of social and play responses, the videos were coded on a number of parameters by trained psychologists. To evaluate feasibility, the protocol was administered to three groups of children, n=30 (19 ASD, 6 TD, 4 DD). The sample consisted of 22 male (73.3%) and 8 female (26.7%) children. Mean age of the three groups is 24.7 months (SD= 8.220). The play protocol designed was seen to make children comfortable and remain at ease as they interacted with known adults. Feasibility was indicated by prompt consent and complete participation till the end of the protocol. Not having to abort any session appears to indicate acceptability of the protocol. We are further improving the protocol accordingly. We plan to develop computational models using machine and deep learning algorithms to understand and characterize child behaviors across three different groups. Though not a primary objective, it was noted that the play protocol was also able to elicit differences in social and play responses amongst the three groups. .

## Conclusions:

A culturally relevant play protocol has been developed. It was easy to administer. The acceptance by children with and without autism has been encouraging. Discriminant validation using computational approaches is currently underway.

## **518.107** (Virtual Poster) Psychometric Properties of Broadband Screening Tools for Developmental Delays in Infants at High- and Low-Risk for Autism

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**Background:** Early developmental screening tools provide insight into a critical period of development and help predict developmental trajectories and outcomes. Given this, the American Academy of Pediatrics recommends that children be screened with a validated tool at 9, 18, and 30 months. A positive screen prompts providers to initiate further evaluation or intervention, which has been shown to improve developmental outcomes. Many factors contribute to the utility of screening tools, such as psychometric properties and feasibility in the target population. To date, few studies have examined how well broadband developmental screening tools predict performance on concurrent developmental assessment in infants at high and low familial risk for autism spectrum disorder (ASD). Performance of screening tools in this high-risk cohort is particularly important given their elevated rates of developmental delays.

**Objectives:** (1) Examine results of two developmental screening measures in high- and low-risk infants; (2) Analyze the relationship between screening outcomes and scores on subsequent clinical assessment.

**Methods:** Participants were 55 infant-parent dyads, including 19 infants at high familial risk for ASD (see Table 1). Parents completed two age-appropriate broadband screeners, the Survey of Well-being of Young Children Developmental Milestones (SWYC) and Ages and Stages Questionnaire, Third Edition (ASQ-3), up to 5 weeks before an in-clinic developmental assessment at ~12 months of age with the Bayley Scales of Infant and Toddler Development, 4th edition (Bayley-4).

**Results:** On the SWYC, 32 infants (58%) screened positive. Compared to the 23 infants that screened negative, the screen positive group had significantly lower standard scores on Bayley-4 Cognitive ( $p=0.03$ ), Language ( $p=0.02$ ), and Motor ( $p<0.001$ ) domains (see Table 2). However, only six infants (11%) showed developmental delays on the Bayley (i.e.,  $<85$  on one or more Bayley-4 domains). Despite the small sample, SWYC outcome significantly predicted developmental delay (Fisher's Exact Test  $p=0.04$ ). Overall, the SWYC's sensitivity in detecting delays and negative predictive value were 100%, but specificity (46.9%) and positive predictive value (PPV; 18.8%) were much lower. Parallel results will be presented for the ASQ-3, as well as results by ASD risk group.

**Conclusions:** Results suggest that the SWYC effectively detected developmental delays in infants at high and low risk for ASD at 12 months. It also falsely identified many who were found to be developmentally on track, resulting in a low PPV. Although this low PPV is partially due to the low base rate of developmental delays in this sample, it also suggests that a positive screen on the SWYC alone may not be sufficient to warrant referral for early intervention. The SWYC is becoming widely used in clinical practice, therefore it will be important to develop methods of reducing false positives, perhaps with a Level II screening tool. Future analysis will utilize a larger sample, including more high-risk infants, allowing for a broader range of developmental outcomes in analysis. ASQ-3 metrics in this sample will be contrasted with the SWYC, a meaningful comparison given that the ASQ is more established but also less feasible in practice due to its length and administration cost.

**518.108 (Virtual Poster)** Sensory Sensitivity in Adolescents with ASD: An Experience Sampling Study with Context Tracking

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**Background:** Sensory processing difficulties are highly prevalent in individuals with ASD and have been associated with poorer outcomes regarding distress and behavioral difficulties. Current insights into sensory abnormalities in adolescents with ASD are obtained through parent or caregiver reports and standardized self-report questionnaires. However, the reliability of these is limited as individuals with ASD encounter difficulties in delayed reporting of their internal states. Therefore, studies in daily life, combining both subjective and objective measures, might result into a better understanding.

**Objectives:** This study aimed to examine the relationship between self-reported sensory sensitivity and context measures in the daily life of adolescents with ASD. In addition, the study set out to investigate if this relationship is modulated by items of the Adolescent-Adult Sensory Profile (AASP).

**Methods:** 41 adolescents with ASD ( $M_{age} = 13.6$  years,  $SD_{age} = 1.1$  years,  $N_{female} = 8$ ) participated in an experience sampling methodology (ESM) study for 14 consecutive days. Using a smartphone application, they completed momentary questionnaires at randomly varying times between 08:00 and 21:30, up to ten times a day. In this study, we focused on the following ESM item: "There are a lot of sensory stimuli in my environment." Participants expressed their agreement on a 7-point Likert scale. Objective measurements of context were gathered through the same smartphone application. In combination with a wearable sensor, clipped onto the participants' clothing, this application tracked location, sound characteristics, temperature, and light intensity. At the end of the study, participants were asked to complete a set of standardized questionnaires, including the AASP. A total of 35 participants completed all questionnaires.

A preliminary analysis was done by means of multilevel modelling. Firstly, a linear mixed effects model was built, predicting the stimulus sensitivity rating based on the previous stimuli rating, the covariates age and sex, and four context measures (location and the averages for sound level, temperature and light intensity) extracted from a 10-minute window prior to the ESM questionnaire. Secondly, a grouping variable based on AASP items was added to the model in interaction with the significant context measures.

**Results:** We collected 2863 ESM answers, of which 1824 answers included successful measurements of physical context. The previous stimulus sensitivity rating was a positive predictor of the next rating. Regarding the context measures, participants reported significantly more sensory stimuli at school in comparison to home and with increasing average sound level. In the follow-up analysis, a significant interaction appeared between the average sound level and a grouping based on the auditive items of the AASP for sensory sensitivity and sensory avoiding: participants in the high sensitivity group (based on subjective measures, gathered through the AASP) reported more sensory stimuli in case of loud noise (based on objective quantification in daily life).

**Conclusions:** This is the first study to examine sensory sensitivity in adolescents with ASD by combining subjective and objective measures in daily life. Momentary self-reported sensory stimuli were found to vary with changes in context. Self-reported sensory sensitivity, registered by the AASP, affected the strength of this relationship.

**518.109 (Virtual Poster)** Simple, High-Performance Classification Model for Autism Based on Machine Learning and Pupillary Response

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**Background:**

Early diagnosis of autism spectrum disorder (ASD) in clinical practice is very important for improving autism treatment. Recent studies have investigated the early diagnosis of children with ASD using machine learning and eye-tracking. Many studies have proved that eye tracking and machine learning are feasible for the early diagnosis of ASD. However, the processing of eye-tracking data, especially pupillary response data, can

be further optimized. We are trying to find an eye-tracking and pupillary response feature extraction method based on relative pupil response to explore the abnormal pupillary response in children with autism. Furthermore, we hope to establish a classification model for autism.

### Objectives:

Find out the significant differences of pupillary response characteristics between children with ASD and children with typical development(TD), and explore a high-performance classification model for autism.

### Methods:

Twenty-five children with ASD and 50 children with TD were recruited. An SMI RED500 desktop eye-tracking system was used for stimulus presentation and data acquisition. The experiment consists of six white pictures, six black pictures and one gray picture. Firstly, we presented a 10s gray stimulus for baseline calibration, and then pictures were presented alternately in the order of black and white, each picture lasting for 5s.

Collecting the pupillary data of all subjects and the original data were interpolated and filtered. Seventy features are extracted from the minimum, middle, maximum, average and standard deviation of relative amplitude, time, velocity and latency of pupil response, and the feature of adequate picture number is added. Further statistical analysis and modeling classification was done by Python.

### Results:

In the two types of the subject (children with ASD and children with TD), there are 24 characteristics with significant differences ( $P < 0.05$ ). With these features, the optimal features are determined by the grid search method. Moreover, the model has an average classification accuracy of 90.67% and an average AUC of 92.24%. Compared with other methods, our model has better classification performance. (Refer to attached table 1)

### Conclusions:

The abnormal pupillary response of autistic children is mainly characterized by greater dilation and smaller contraction. These abnormal features may provide good help for the early diagnosis of autism in the future.

**518.110 (Virtual Poster)** The 16 Early Signs Checklist: A Brief Observational Screener to Improve Detection of Early Signs of Autism in Very Young Children

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**Background:** The median age of diagnosis of autism (ASD) has not changed in over a decade (Maenner et al., 2020). The availability of accurate, validated screening instruments continues to contribute to delayed identification of ASD (see Carbone et al., 2020 and Guthrie et al., 2019). Behavioral observations are a critical component of an evaluation for determining eligibility for ASD-specific services; yet they often require significant time and training to complete. There is limited research examining community-viable observational screeners for ASD in children under three.

**Objectives:** The purpose of this study is to explore the preliminary performance of the 16 Early Signs Checklist as an observational screener in distinguishing toddlers with ASD from those who are non-spectrum.

**Methods:** Participants include 211 children recruited from the community-based FIRST WORDS® Project (see Delehanty & Wetherby, 2021; Wetherby et al., 2008). Children received a best-estimate diagnosis of ASD (n=121), DD (n=46), or TD (n=44) near 36 months of age.

**Measures.** The Systematic Observation of Red Flags (SORF; Dow et al. 2016, 2020;) was used to code a video-recorded home observation of parent-child interaction collected at 20.25 months (SD=1.99; see Delehanty & Wetherby, 2021). The 16 Early Signs Checklist (Figure 1) comprises 16 early signs of ASD based on DSM-5 diagnostic criteria. Items are scored dichotomously as present/absent. The Checklist will be coded and compared across two methods: 1) from item-level scoring of the SORF, and 2) directly from the home observation. Research assistants coding the Checklist received no training on the SORF or ADOS and have limited knowledge of ASD. Coder training uses the *16 Early Signs by 16 Months Lookbook* and two short videos—*Can you spare 2 Minutes?* and *Another Minute?*

**Results:** Preliminary results of the Checklist scored from the SORF indicated high agreement between SORF subscales and the total number of early signs present ( $rs=0.54-0.98$ ). Child age at the observation was not significantly associated with the number of early signs ( $r=-.02$ ). Results of oneway ANOVA indicated a significant main effect of group on the total number of signs on the Checklist,  $F(2,208)=29.94, p<.001$ . Children with ASD had significantly more total signs compared to children in the DD ( $M_{diff}=1.09, p<.05$ ) and TD groups ( $M_{diff}=3.15, p<.001$ ). On average, children with ASD showed 6.25 signs during the home observation (SD=2.57). Coding of the Checklist scored directly from the video home observation is underway and will be completed and analyzed prior to the conference. Agreement between all three measures will be examined as well as differences in the number of identified early signs between diagnostic groups.

**Conclusions:** Results provide preliminary support for the simplified scoring scheme of the 16 Early Signs Checklist derived from the SORF scoring. The brevity of the required training will demonstrate the feasibility for use by community providers. The potential of the Checklist as a brief observational screener of ASD signs in the home environment, along with the companion parent-report version, is promising in accelerating the path to earlier detection and ASD-specific services.

**518.111** (*Virtual Poster*) Unpicking the Drivers of Neuropsychiatric Risk in Children with Autism Spectrum Disorders That Are Associated with Intellectual Disability

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**Background:**

IMAGINE-ID is a national UK study of children with Intellectual Disabilities (IDs) of known genetic origin that aims to identify genotype-phenotype risk. IDs are characterised by significant limitations in cognitive and adaptive skills and a substantially increased risk of ASD. Children with an ID with or without an associated ASD are at increased risk of internalising and externalising difficulties and their parents are reported to have elevated rates of psychological distress.

**Objectives:**

We aimed to identify the range and severity of co-occurring psychopathology in children with pathogenic CNVs or SNVs that were associated with both ASD and ID and to compare those comorbidities with children whose ID was not associated with ASD. We also tested the hypothesis that parents of children who had an ASD in addition to ID would experience significantly greater psychological distress than those whose child had ID alone, irrespective of the severity of their child's intellectual disability.

**Methods:**

3,031 children and young people (5-19 years) were recruited via UK National Health Services and patient support groups. The Development and Wellbeing Assessment (DAWBA), Strengths and Difficulties Questionnaire (SDQ) and the Everyday Feelings Questionnaire (EFQ) were administered to caregivers. The DAWBA is a comprehensive online interview used in national UK surveys of child mental health. An Index of Multiple Deprivation (IMD) was obtained from postcode data. Logistic regression models tested the association between ID (with and without ASD), co-occurring mental health, and parental psychological distress, controlling for children's sex, developmental level, physical health and IMD.

**Results:**

Of 1,904 participants (M=9.15, SD=3.75). 36.8% (n=701) had co-occurring ASD. Male-female ratio in those with ASD was 1.8 to 1 (1:1 in non-ASD group). Children whose ID was associated with ASD were at increased risk of ADHD (OR 2.18, 95% CI 1.75-2.72, p<.0001), emotional disorders (OR 2.1, 95% CI 1.56-2.83, p<.0001), and conduct disorders (OR 2.31, 95% CI 1.78-3.01, p<.0001) in univariable models, after adjustment for child sex, developmental level, physical health and IMD score.

Parents of children whose ID was associated with ASD reported significantly greater psychological distress (EFQ scores) than parents of children with IDD alone (p=.001). The statistical significance of this association remained after adjustment for child characteristics (sex, developmental level, physical health) and socio-economic deprivation, but not after adjustment for co-occurring child behavioural difficulties (p=.24).

**Conclusions:**

Children whose ID was associated with ASD had more severe, and a wider range of, behaviour difficulties compared to those with ID alone. This difference persisted after controlling for child characteristics and socio-economic deprivation. Parental distress was greater in families whose children had co-occurring IDD and ASD, compared to those with IDD alone. This difference also persisted after controlling for child characteristics and socio-economic deprivation. ASD (as a diagnostic category) was no longer significantly associated with parental psychological distress when co-existing behavioural problems were controlled, implying stress in families whose child has both ASD and ID is magnified by the behavioural problems specifically associated with ASD.

## Early Development (< 48 months)

### PANEL — EARLY DEVELOPMENT (< 48 MONTHS)

#### 222 - Functional Brain Development during Neonatal and Infancy Periods in Neurodiverse Populations

**Panel Chair: Katarzyna Chawarska,** Child Study Center, Yale University School of Medicine, New Haven, CT

**222.001** (*Panel*) Establishing a Platform for Early Childhood Development: MRI Studies of the Structure and Function of the Neonatal Brain

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**Background:** To understand the origins of brain diversity including neurodevelopmental conditions such as autism, we need to look early in development. In these studies, we are using MRI to examine the neonatal brain and address the following questions.

**Objectives:** 1) What architecture in the young human brain supports subsequent development? 2) How does individual variation arise? 3) Are there any early brain signatures which are linked to early childhood differences in general development and/or social cognition?

**Methods:** All neonates were recruited and scanned as part of the developing Human Connectome Project (dHCP) and AIMS-2-TRIALS Brain Imaging and Development in Babies programmes as approved by the national Research Ethics Committee in the U.K. This dataset permitted analyses of multiple modalities of brain macro (sMRI) and microstructure (DTI) and function (resting-state fMRI). Where possible, participants attended for a follow-up developmental assessment at 18 months which included the Bayley Scales of Infant and Toddler Development and the Q-CHAT (Quantitative Checklist for Autism in Toddlers). Data acquired from up to  $n = 241$  neonates (including  $n = 63$  children scanned twice in the first few months of life) contributed to a range of analyses. Our initial analyses examined the development across whole brain networks. Our subsequent analyses focused on the development of networks of interest - namely cerebellar networks, because the cerebellum has been so closely linked to autism in older individuals.

**Results:** In our whole brain analyses: We observed dynamic changes in the structure of cortical networks over an 8-week period after birth across a large group of neonates. When examining maps of neural connections (connectomes) at the level of the individual we found that structural connectivity is already relatively stable by birth and indeed, may act like a 'fingerprint' of the individual. In contrast, the functional connectome is much more changeable. In our cerebellar network-of-interest analyses: We found that functional connectivity from Crus I/II to somatosensory-motor and frontal cortices, as well as from vermis to somatosensory-motor and frontal cortices at birth was significantly associated with social cognition assessed using the Q-CHAT at 18 months, but not with general cognitive and motor abilities. However, there were sex-differences. Lower functional connectivity between vermis and cortex in the neonatal period was associated with higher Q-CHAT scores at 18 months in males, but the opposite was true for females. Structural connectivity of cerebellar networks at birth was not predictive of 18 month outcomes.

**Conclusions:** Thus, around birth, brain structure is already highly organised and is relatively stable. However, the brain's functional networks are changing more rapidly, most likely because the young brain is exposed to the external world for the first time, and infants are rapidly learning new skills. Our data suggests that the functional maturation status of cerebellar networks at birth may be especially important for the emergence of social behaviours linked to autism.

#### **222.002 (Panel) Salience Network Functional Connectivity in Neonates with High Likelihood of Autism**

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**Background:** Converging evidence from children, adolescents, and adults implicates alterations of the salience network—a large-scale brain network responsible for detecting and filtering salient stimuli of one's internal and external environment—in autism. Similarly, early behavioral markers of autism in later infancy and toddlerhood (e.g., reduced attention to social stimuli) are consistent with atypical patterns in salience network connectivity. However, functional connectivity of the salience network has not been examined in the context of neonates with differential likelihood of autism. Overall, salience network disruptions during the neonatal period could underlie later behavioral markers of autism during infancy and toddlerhood.

**Objectives:** To examine salience network connectivity in a neurodiverse group of neonates with and without familial history of autism (high likelihood, HL, and low likelihood, LL, respectively) and the developmental trajectories on these connections from the third trimester through the neonatal period.

**Methods:** 41 neonates (13 HL and 28 LL, 60% male) were scanned during natural sleep on a Siemens Prisma 3T scanner. The mean age was 3.89 weeks (SD=1.52). Standard functional connectivity preprocessing was performed. Functional connectivity was assessed using regions of interest (or seeds) placed in the left and right insula—key nodes of the salience network. Multiple comparisons correction was performed using cluster-based inference. In a subset of these participants, the First Year Inventory (FYI) was collected at 18 months in 10 HL and 15 LL toddlers. To assess developmental trajectories of these connections, low likelihood fetuses were scanned longitudinally at 30-32 weeks gestation ( $n=19$ ) and 34-36 weeks gestation ( $n=18$ ) as well as during the neonatal period. Analogous connectivity methods were used to assess connectivity in the fetuses.

**Results:** HL neonates exhibited greater connectivity between the left insula and angular gyrus edge when compared to LL neonates ( $p<0.05$ , corrected). In both groups combined, this connection correlated with social-communication scale of the FYI ( $r=0.589$ ,  $p=.002$ ,  $df=23$ ). In both fetal

time points, the insula exhibited only local (i.e., ipsilateral) connections. In contrast, after birth, the insula exhibited connectivity to the contralateral hemisphere.

**Conclusions:** Examining functional networks in the perinatal period can inform the associations between likelihood of autism and later phenotypes by identifying intermediary brain correlates that may ultimately underlie these behaviors. We show that atypical patterns of connectivity in the salience network are observable in neonates with high likelihood of autism, and these patterns predict behaviors a year later. Based on longitudinal fetal-neonatal connectivity, connections altered in neonates with high likelihood of autism develop across the perinatal period, particularly between the last month of the third trimester and the first postnatal month. Identifying patterns of functional connectivity in the fetal and neonatal periods as well as their associations to later behavior will pave the way for a better understanding of the developmental timing of putative alterations in brain and behaviors associated with autism.

**222.003 (Panel) Predictive Links between Salience Network Connectivity and Attention to Social Partners in Neonates with Familial History of Autism**

**A. Vernetti<sup>1</sup>, R. Ray<sup>2</sup>, D. Scheinost<sup>3</sup>, L. R. Ment<sup>4</sup>, S. Macari<sup>1</sup>, H. Neiderman<sup>5</sup>, C. Nutor<sup>1</sup>, C. D. Gershman<sup>1</sup>, H. Feiner<sup>1</sup>, R. Foster<sup>6</sup>, R. T. Constable<sup>7</sup>, J. Chang<sup>2</sup> and K. Chawarska<sup>1</sup>,** (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Statistics and Data Science, Yale University, New Haven, CT, (3)Radiology & Biomedical Imaging, Yale School of Medicine, New Haven, CT, (4)Pediatrics, Yale School of Medicine, New Haven, CT, (5)Psychology, University of Washington, Seattle, WA, (6)Child Study Center, Yale School of Medicine, New Haven, CT, (7)Yale University, New Haven, CT

**Background:** Selective attention to faces, known to be reduced in infants and toddlers with autism (Chawarska et al.,2013, Elsabbagh et al.,2013), is supported by several large-scale cortical networks including the salience network (SN), and the default mode network (DMN). The salience network has been shown to regulate attention to behaviorally meaningful stimuli and has been heavily implicated in autism (Menon & Uddin 2010). Functional connectivity studies have also shown atypical and age-varying connections between DMN regions in autism (Assaf et al.,2010; Burrows, Laird, & Uddin,2016). Although signs of altered social attention to dynamic faces in infants later diagnosed with autism have been reported in infants as young as 6 months of age (Chawarska et al.,2013; Shic et al.,2014; Macari et al.,2021), the early brain mechanisms that contribute to the emergence of this vulnerability have not been identified.

**Objectives:** To examine the predictive links between SN within-network and SN-DMN between-network intrinsic functional connectivity (iFC) at birth and attention to faces measured using eye tracking at 4, 6, 8, and 12 months in infants with (high-likelihood, HL) and without (low-likelihood, LL) familial history of autism.

**Methods:** 45 neonates (13 HL) were scanned during natural sleep on a Siemens Prisma 3T scanner at the mean age of 3.89weeks (SD=1.52). iFC was assessed using seeds placed in the left and right anterior insula (aInsula) and the anterior cingulate cortex (ACC), the key nodes of the SN, and SN-DMN iFC was assessed between left aInsula and angular gyrus node in the DMN. 24 of the neonates (9 HL, 54% male) completed a social selective attention eye-tracking task (SSA4.0) at 4, 6, 8, and 12 months involving watching a video of a person where gaze (direct/down) and speech (child-directed speech/silence) were manipulated. Linear mixed models (LMM) were used to evaluate the contribution of iFC at birth and age at the time of the eye-tracking task to percent looking to the face region during SSA4.0 and included main and interaction effects of iFC and age, main and interaction effects of speech and gaze conditions (all fixed effects), random intercepts for subject, and random slopes for age.

**Results:** The LMM models assessing contribution of the SN iFC and the SN-DMN iFC to attention to the face region during the first year of life indicate that, at 4 months of age, while higher iFC between the SN and DMN network nodes was associated with lower attention to faces ( $p<0.001$ , Fig1, left panel), higher iFC between the SN nodes was associated with higher attention to faces ( $p=0.018$ , Fig1, right panel).

**Conclusions:** Both lower between-network connectivity and higher within-network connectivity at birth, thought to respectively indicate better network segregation and synchronization in typical development, predicted higher attention to faces at 4 months, a highly formative age when infants begin to develop sophisticated face processing skills and engage in reciprocal interactions. This is the first demonstration of complex patterns of brain functional connectivity at birth associated with social attention that may be impacted in neonates who later develop autism.

**222.004 (Panel) Altered Theta-Beta Ratios in Infants at Elevated Likelihood of Neurodevelopmental Disorders**

**J. Begum Ali<sup>1</sup>, A. Goodwin<sup>2</sup>, L. Mason<sup>3</sup>, G. Pasco<sup>3</sup>, T. Charman<sup>2</sup>, M. H. Johnson<sup>1</sup> and E. J. Jones<sup>3</sup>,** (1)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (2)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom

**Background:** Neurodevelopmental disorders such as Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) are typically diagnosed in early/middle childhood through a combination of clinical interviews and observer-reports. The genetic factors that predispose an individual towards these highly heritable conditions likely act predominately prenatally, affecting brain development for years before the consolidation of the full clinical phenotype (Faraone & Larsson, 2019). Identifying the brain changes that precede the onset of behavioural symptoms could help with earlier identification of individuals who require additional support, and could provide useful outcome measures for early interventions. One such neural change is the balance of theta and higher frequency oscillations (typically theta-beta ratio; TBR). Previous research has shown that a subset of children with ADHD show differences in TBR and its use as a prognostic indicator has been suggested (Arns et al., 2013).

**Objectives:** We endeavoured to examine TBR using a prospective longitudinal infant sibling design (e.g., in infants with an elevated likelihood of developing ASD, ADHD, ASD+ADHD or neither). Examining both ASD and ADHD allows us to investigate specificity of TBR alterations to either condition, or indeed whether atypicalities in TBR are more broadly related to neurodevelopmental disorders.

**Methods:** We used high density EEG (128-channels) to investigate the theta/low beta ratio in 10-month-old infants; with theta defined as 2-5Hz and low beta defined as 9-14Hz.

**Results:** Infants with an elevated likelihood of ADHD showed a lower TBR-Low than those with a lower likelihood of ADHD [ $F(1, 136) = 4.21, p = .042, \eta^2 = .03$ ; Figure 1]. There was no significant effect of an elevated likelihood of ASD [ $F(1, 136) = .93, p = .335, \eta^2 = .007$ ] or an interaction of ASD\*ADHD elevated likelihood [ $F(1, 136) = .006, p = .939, \eta^2 = 0$ ]. Lower TBR-Low in our elevated likelihood of ADHD group was driven by lower theta [ $F(1,136) = 5.25, p = .023, \eta^2 = .04$ ] and higher beta [ $F(1,143) = 4.32, p = .04, \eta^2 = .03$ ] in this cohort. Further, we found relationships between TBR-Low in infancy and ADHD-related temperamental traits at 2 years, specifically lower TBR associated with greater Surgency [ $r(25) = -.43, p = .03$ ], greater Impulsivity [ $r(24) = -.5, p = .01$ ] and greater Sociability [ $r(23) = -.53, p = .01$ ; Figure 2]. We will discuss possible explanations for these associations.

**Conclusions:** This is the first demonstration that alterations in TBR are present prior to behavioural symptoms of ADHD. However, these alterations manifest differently than those sometimes observed in older children with an ADHD diagnosis. Importantly, altered TBR was not seen in infants at elevated likelihood of developing ASD, suggesting a degree of specificity to ADHD. Taken together, these findings demonstrate that there are brain changes associated with a family history of ADHD observable in the first year of life.

## PANEL — EARLY DEVELOPMENT (< 48 MONTHS)

### 230 - The Neurodevelopment of Language in Infants at High Risk for Autism

**Panel Chair:** Lisa Yankowitz, *Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA*

**Discussant:** Meghan Swanson, *University of North Carolina, Chapel Hill, NC*

#### 230.001 (Panel) Brain Morphometry in Infants Later Diagnosed with Autism Is Related to Later Language Skills

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**Background:** Infants with autism show deficits in language as early as 12 months of age (Swanson et al., 2017) and 29% of school-age children with autism are nonverbal or minimally verbal (Tager-Flusberg & Kasari, 2013). Recent studies have indicated that atypical brain development may precede the emergence of the associated features of autism, like language (Emerson et al., 2017). The neurobiological basis for these impairments has yet to be fully explored during the pre-symptomatic period for autism. Such studies would contribute to our understanding of the development of early autism.

**Objectives:** The objective of the study was to explore the relationships between two sets of variables: 1) measures of regional brain morphometry (surface area and cortical thickness) at 6 and 12 months of age and 2) receptive language and expressive language subscales on the Mullen Scales of Early Learning (MSEL) at 24 months of age.

**Methods:** Surface area and cortical thickness measurements were obtained for 78 brain regions using the AAL atlas from a structural MRI scan at 6 and 12 months. At 24 months, infants completed the MSEL and were included if they had receptive language and expressive language t-scores. Covariates included: sex, mother's education, data collection site, age at data collection, total surface area (for surface area regions), and cube root of intracranial volume (for cortical thickness regions). We used partial least squares correlation (PLSC) to analyze associations between the two sets of variables. Separate PLSC analyses were run for three groups of infants: those with low probability of autism who were typically developing (LP-Neg,  $n = 80$ ), those with high probability of autism who did not receive an autism diagnosis (HP-Neg,  $n = 128$ ), and those with high probability of autism who received an autism diagnosis (HP-ASD,  $n = 31$ ).

**Results:** Results revealed significant patterns of association between the brain morphometry measures and language for all groups (Table 1 and Figure 1 for an example of data from 6 months). No regions were found to be consistently significant across all three groups. Some regions associated with classic language models were found to be significant. For example, in the HP-ASD group cortical thickness at 6 months in the left inferior frontal gyrus was significantly associated with language. However, there were also regions outside the classic language models that were significant. For example, in the HP-ASD group there was a significant association between surface area at 6 and 12 months in the left middle occipital gyrus and later language. All reported relationships were stable across bootstrap resampling.

**Conclusions:** While results indicated significant relationships between regional surface area and cortical thickness at 6 and 12 months and language skills at 24-months of age, the three groups did not show the same patterns of relationships. Significant regions were found in all lobes of the brain.



These results suggest that future research on the neurobiology of language in infants with autism take a more comprehensive approach when selecting regions of interest.

**230.002 (Panel) Vocalization Behavior and Intrinsic Functional Connectivity between Language Regions in Infants at High and Low Risk for Autism**

**L. D. Yankowitz<sup>1</sup>, R. T. Schultz<sup>2</sup>, S. Petersen<sup>2</sup>, B. Tunc<sup>1</sup>, V. Petrulla<sup>3</sup>, S. Plate<sup>1</sup>, J. Pandey<sup>4</sup>, M. Swanson<sup>4</sup>, W. Guthrie<sup>1</sup>, N. Marrus<sup>5</sup>, S. S. Meera<sup>6</sup>, M. Styner<sup>7</sup>, H. Hazlett<sup>8</sup>, K. Botteron<sup>9</sup>, S. R. Dager<sup>9</sup>, A. M. Estes<sup>10</sup>, L. Zwaigenbaum<sup>11</sup>, J. Parish-Morris<sup>12</sup> and J. R. Pruett<sup>13</sup>,** (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Washington University, St. Louis, MO, (3)Florida International University, Miami, FL, (4)University of North Carolina, Chapel Hill, NC, (5)Washington University School of Medicine, St. Louis, MO, (6)National Institute of Mental Health and Neurosciences, Bangalore, India, (7)Psychiatry and Computer Science, University of North Carolina, Chapel Hill, NC, (8)\*co-senior author, University of North Carolina, Chapel Hill, NC, (9)Radiology, University of Washington, Seattle, WA, (10)Speech and Hearing Sciences, University of Washington, Seattle, WA, (11)University of Alberta, Edmonton, AB, Canada, (12)\*Co-Senior Author, Children's Hospital of Philadelphia, Philadelphia, PA, (13)\*Co-senior author, \*\*For the IBIS Network, Washington University School of Medicine, St. Louis, MO

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**Background:** The first two years of life are characterized by incredibly rapid growth in expressive communication ability, with infants progressing from babbles and coos to words and phrases. Little is known about the relationship between expressive communication and intrinsic functional connectivity in the infant brain, particularly with regard to individual vocalization behaviors. There is evidence that regions within the language network are weakly connected when infants are born, and develop increasingly adult-like connectivity over the first two years of life. A small number of studies suggest that increased connectivity between language regions in infancy and toddlerhood is associated with higher scores on standardized language measures (Bruchhage et al. 2020, Emerson et al., 2016). No studies have yet examined the relationship between fine-grained measures of vocalization behavior and language network connectivity.

**Objectives:** Test the hypothesis that infant vocalizations are positively associated with intrinsic functional connectivity between key regions in the adult language network (Broca's and Wernicke's areas) in a longitudinal sample of infants at high and low risk for autism spectrum disorder (ASD).

**Methods:** Functional connectivity was assessed using MRI (fcMRI) during natural sleep in infants aged 6m (n=107), 12m (n=131), and 24m (n=141) at high and low familial risk for ASD, drawn from the multisite Infant Brain Imaging Study. Vocalization variables were derived from video-recorded clinical interactions: speechlike rate (the number of speechlike vocalizations per minute of recording time), speechlike ratio (the proportion of vocalizations that are speechlike), canonical babbling ratio (the proportion of syllables that have a consonant, a vowel, and smooth transition between them, at 6 and 12 months only), and socially-directed proportion (the proportion of all vocalizations that are directed toward another person, at 6 and 12 months only). Regions of interest representing Broca's and Wernicke's areas were placed following a large meta-analysis (Tomasi & Volkow, 2012). Generalized linear models assessed relationships with each of the four vocalization variables, with z-transformed time-series correlations between Broca and Wernicke ROIs as predictors after controlling for site, sex, and maternal education (FDR-corrected within each age (q<0.05)).

**Results:** At 6 months, Broca-Wernicke connectivity was positively associated with canonical babbling ratio and the proportion of vocalizations that were socially directed (Figure, Table). At 12 months, canonical babbling ratio, speechlike rate, and proportion of vocalizations that were speechlike were all *negatively* associated with Broca-Wernicke connectivity. At 24 months, speechlike rate and proportion speechlike continued to be negatively associated with Broca-Wernicke connectivity.

**Conclusions:** Hypothesized relationships between infant vocalizations and connectivity among classic adult language areas were generally not supported, and diminished connectivity between Broca's and Wernicke's areas in the second year of life was associated with more mature vocalization types. These findings, which may be influenced by the exact selection of Broca's and Wernicke's regions of interest, represent a first attempt to relate infant vocalizations to functional connectivity.

**230.003 (Panel) Longitudinal White Matter Microstructure and Language Development in High-Risk Infants at 6-, 12-, and 24-Months**

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**Background:** Autism spectrum disorder (ASD) is a highly heritable disorder. Approximately 20% of infants who have an older sibling with ASD go on to later develop ASD and an additional 28% display other developmental concerns including language delays. Language atypicalities are some of the earliest phenotypic indicators of ASD, detectable by 12 months of age and commonly persist throughout the lifespan. Previous research has linked white matter microstructure to cognitive development in non-clinical samples and to social development outcomes in ASD. However, the unique contributions of white matter microstructure to language development in ASD remains unexplored.

**Objectives:** This study sought to examine the longitudinal relationships between white matter microstructure and expressive and receptive language development in high-risk infant siblings and controls at 6, 12, and 24 months.

**Methods:** Participants were recruited from the Infant Brain Imaging Study and included 140 controls (low familial ASD risk; LR-Neg), 62 high-familial risk infants later diagnosed with ASD (HR-ASD), and 227 high-familial risk infants who were negative for ASD (HR-Neg). Infants contributed behavioral and imaging data at 6, 12, and 24 months. Measures of language development included the receptive and expressive age-equivalent scores from the Mullen Scales of Early Learning (MSEL). Diffusion weighted images were used to perform fiber tractography and compute fractional anisotropy (FA) at each age. Tracts of interest included the bilateral arcuate, uncinate, and inferior longitudinal fasciculus as well as the genu, splenium, and body of the corpus callosum. Preliminary correlations were conducted to evaluate the relationships between white matter FA and language variables at 6, 12, and 24 months.

**Results:** Significant relationships between white matter microstructure and language emerged uniquely in the bilateral arcuate fasciculus. At 6 and 12 months, the right arcuate (but not the left arcuate) was significantly related to expressive language (but not receptive language) in the HR-ASD group at both time points,  $r = .38$  and  $.37$  respectively,  $ps < .017$  (Fig. 1 and 2). The HR-Neg group also demonstrated significant correlations between expressive, receptive language and left and right arcuate microstructure at 6 months (but not the LR-Neg group); however, these relationships did not hold at 12 and 24 months. At 24 months, both the left and right arcuate were significantly associated with both receptive and expressive language age equivalent scores for the HR-ASD groups,  $rs > .43$ ,  $ps < .0023$ ; these relationships were not present in the LR-Neg and HR-Neg groups.

**Conclusions:** These findings emphasize the developmental role of the bilateral arcuate fasciculus in language development in early autism and suggest potential neurodevelopmental risk trajectories.

**230.004 (Panel) Quantitative Autistic Traits in Parents and the Development of Language and Language Circuitry in Infants**  
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**Background:** Atypical language development is present in children with autism spectrum disorder (ASD) as early as the first year of life (Estes et al., 2015, Swanson et al., 2017). Recent research has demonstrated that receptive language is an endophenotype of ASD, where at 24 months, high-risk (HR) siblings of children with autism exhibit a greater likelihood of lower language abilities (Marrus et al., 2018; Girault et al., 2020), regardless of an ASD diagnosis. Given the familial nature of language phenotypes, parental traits may serve as informative predictors of HR sibling development. Quantifying markers of elevated risk allows for earlier detection and establishes targets for early intervention.

**Objectives:** In this study, we examine the ability of parental quantitative autistic traits (QATs) to inform infant receptive language (RL) and expressive language (EL) development, as well as language-related white matter (WM) fiber tract integrity at 24 months of age.

**Methods:** Ninety-seven (97) high-risk infant siblings of children with ASD and 49 low-risk controls were included in this study. Clinical best estimate diagnosis was made at 24 months using DSM-IV-TR criteria; 20 HR children developed ASD (HR-ASD). Parent QATs were measured using the total score from the Social Responsiveness Scale, Second Edition (SRS-2). Parents were scored using the Informant Report form when completed and available, but if no Informant Report was available, Self-Report forms were used. Infant language was measured using the Mullen Scales of Early Learning (Mullen) RL and EL domains. Infant WM measurements were captured using diffusion tensor imaging; fractional anisotropy (FA) of the arcuate fasciculus was the primary WM measure of interest. The relationship between parental QATs and infant language and WM development was investigated using linear mixed models adjusted for age, sex, and study site.

**Results:** Among the HR-ASD group, maternal QATs were significantly associated with lower infant RL ( $\beta = -0.522$ ,  $p = 0.002$ ) and reduced right arcuate FA development ( $\beta = -0.699$ ,  $p = 0.037$ ) (Figure 1). This effect was not significant in the infant siblings that do not develop ASD (HR-NEG) or the typically developing controls (LR-NEG). Paternal SRS scores were not significantly related to infant language or white matter in any group.

**Conclusions:** This study suggests that maternal autistic traits correlate with both infant sibling language and white matter development at 24 months of age. These findings will help further characterize the familial nature of differential language development and neurodevelopment in ASD, ultimately identifying markers of ASD risk in the first two years of life.

## ORAL SESSION - 2A — EARLY DEVELOPMENT (< 48 MONTHS)

### 302 - Early biomarkers

**302.001** (Oral) Executive Attention Moderates the Association between Infant Excitation/Inhibition Balance and Autistic Traits in Toddlerhood  
**V. Carter Leno<sup>1</sup>, J. Begum-Ali<sup>2</sup>, L. Mason<sup>3</sup>, G. Pasco<sup>4</sup>, A. Pickles<sup>5</sup>, T. Gliga<sup>6</sup>, S. Garg<sup>7</sup>, J. Green<sup>8</sup>, T. Charman<sup>4</sup>, M. Johnson<sup>9</sup> and E. J. Jones<sup>3</sup>,**  
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**Background:** Alterations in excitation/inhibition (E/I) balance are implicated in the aetiology of autism and other neurodevelopmental conditions. As most existing research has examined E/I balance in older individuals, it is unknown whether alterations in E/I balance precede autism symptom emergence. Additionally, recent frameworks hypothesise that emerging infant executive functioning-type abilities (e.g., executive attention) may moderate the impact of early neural alterations.

**Objectives:** To test whether 1) infants enriched for increased likelihood of autism outcomes are characterized by alterations in E/I balance, 2) alterations in infant E/I balance predict autism and attention-deficit hyperactivity disorder (ADHD) traits in toddlerhood, and 3) emerging executive functioning abilities moderate the association between infant E/I balance and neurodevelopmental traits in toddlerhood.

**Methods:** At-rest electroencephalography (EEG) recordings was collected from 10-month-old infants (N=155), who were at typical likelihood for autism and/or ADHD (N=24), or at elevated likelihood (EL) for neurodevelopmental outcomes, either by virtue of having a first-degree relative with autism (EL-autism; N=67), ADHD (EL-ADHD; N=24), or both (EL-autism+ADHD; N=19), or having a diagnosis of Neurofibromatosis 1 (NF1) (N=21).

A subgroup of infants (n=94) also completed assessments of executive attention at 24 months (using the Early Childhood Behavioral Questionnaire), and autism (using the Preschool Social Responsiveness Scale-2) and ADHD (using the Preschool Child Behavior Checklist) traits at 36 months.

Measurement of E/I balance was extracted from EEG data by estimating the aperiodic slope of the power spectrum (e.g., 1/f) using the fitting oscillations & one over f (FOOOF) pipeline. To test group differences in aperiodic slope, two mixed-effect models were run with region (frontal, central, posterior) as a within-subjects factor. The first compared NF1 against typical likelihood infants. The second compared typical and elevated likelihood groups, testing the effect of EL-autism and EL-ADHD status, and their interaction. Region, age at 10-month visit, number of EEG trials and sex were included as covariates.

Next, the average aperiodic slope across regions was calculated and two linear regressions were run, predicting 36-month autistic and ADHD traits respectively. We tested a direct effect of 10-month aperiodic slope and an aperiodic slope\*24-month executive attention interaction. We included age at 10-month visit, number of EEG trials, sex and group (EL-autism, EL-ADHD, and their interaction) as covariates.

**Results:** Mixed-effect models found infants with NF1 displayed steeper aperiodic EEG slopes than typical likelihood infants ( $b=.07$ ,  $p=.01$ ; Figure 1, left panel), indicative of enhanced inhibition. Infants at familial elevated likelihood for autism and/or ADHD did not display any alterations in E/I balance. Longitudinal analyses found a significant aperiodic slope\* executive attention interaction ( $b=-4.08$ ,  $p=.03$ ), such that steeper 10-month aperiodic slopes predicted greater 36-month autism traits, but only in infants who had lower executive attention (Figure 1, right panel). No associations were found with ADHD traits.

**Conclusions:** Results suggest increased cortical inhibition may be one feature on the developmental pathway to autism outcomes. However, early alterations in E/I balance did not predict autism traits in those with strong early executive function, highlighting the importance of considering interacting risk and resilience factors when seeking to understand neurodevelopmental outcomes.

**302.002** (Oral) Neonatal Neurobehavior in Infants with Autism Spectrum Disorder  
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**Background:** Neonatal neurobehavioral functioning is a critical component of the overall health and adaptability of the newborn. From birth, newborns engage a neurological and behavioral system designed to achieve and maintain a calm and alert state that supports successful caregiver–infant interaction. These neurobehavioral competencies include the ability to regulate body temperature and involuntary muscle movements, enact appropriate reflexes, and sustain attention during social exchanges. Neonatal neurobehavior in medically high-risk populations (e.g., preterm infants) is predictive of later developmental outcome, but neurobehavioral profiles for infants at elevated familial risk for ASD and who subsequently develop ASD is largely unexplored.

**Objectives:** This study used a longitudinal prospective design of infants at elevated and low familial likelihood of developing ASD to investigate neurological and behavioral maturation; that is, the neurobehavioral phenotype of newborns who later develop ASD. From 1 to 3 months of age, we evaluated neurological integrity and behavioral responsivity of the neonate using the NICU Network Neurobehavioral Scale (NNS).

**Methods:** Neonatal neurobehavior was examined monthly in 1- to 3-month-old infants at elevated and low familial likelihood of ASD ( $n=60$ ). At 2 years, infants were seen for a clinical best-estimate evaluation, resulting in 18 infants with ASD and 36 typically developing infants. Repeated-measures analysis of variance models were conducted to examine the effects of age, diagnostic groups, and their interactions.

**Results:** Statistical models revealed significant effects of time across both groups on the following NNNS variables: attention, regulation, excitability, quality of movement, non-optimal reflexes, and stress. There was a significant main effect of diagnostic group only for the attention scale ( $F_{1,42}=4.59$ ,  $p=0.038$ ), with typically developing infants scoring higher than infants with ASD. This model also revealed a significant interaction effect between diagnostic groups and time ( $F_{2,59}=3.31$ ,  $p=0.043$ ) where the difference increased with time. Upon further examination of the attention items, a significant effect of diagnosis was observed for visual (but not auditory) attention ( $F_{1,43}=6.68$ ,  $p=0.01$ ; TD > ASD) and a significant interaction between diagnosis and time was present for inanimate (object) attention ( $F_{2,60}=5.08$ ,  $p=0.01$ ), but not animate (face and voice) attention.

**Conclusions:** Overall, neurobehavioral functioning for infants with ASD was largely similar to that of typically developing infants. Both groups exhibited similar initial levels and subsequent change in arousal and excitability, self-regulation, and signs of stress. The only neurobehavioral function to differentiate infants with ASD from typically developing infants was the development of attention. Our findings suggest that a trajectory of diminished visual orienting and tracking in the first months of life is a distinct, quantifiable feature in infants who later develop ASD. Attention to objects was different for infants with ASD compared to typically developing infants as early as 2 to 3 months and predicted social-communication skills at 2 years. These findings are consistent with many studies identifying differences in attention for older infants with ASD. In a critical extension of these studies, we identified attention to objects, not faces, as a key indicator of ASD in the first 3 months of life.

### **302.003 (Oral) Dyadic Vocal Contingency in Infants Later Diagnosed with Autism Spectrum Disorder**

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**Background:** Identifying the earliest emerging signs of autism spectrum disorder (ASD) is a priority for understanding how the disorder unfolds and for facilitating the provision of early intervention services. Further, there is a gap in our understanding of mechanisms underlying prodromal differences in socio-communicative behaviors. Dyadic contingency – or, the extent to which one's social and communicative behaviors are temporally related to and dependent upon those of an interactional partner – may be one such mechanism (e.g., Pruett & Povinelli, 2016; Wan, Green, & Scott, 2018), as early contingent interactions scaffold key aspects of development (e.g., Warlaumont, Richards, Gilkerson, & Oller, 2014). The present study used a novel approach to analyze the timing and probability of infant vocal responsiveness to adult social partners.

**Objectives:** Analyze the relationship between contingent vocalization and later language abilities and symptom presentation in infants at low familial likelihood of ASD (LL) and infants at high familial likelihood of ASD with (HL-ASD) and without (HL-Neg) later ASD diagnoses.

**Methods:** A total of 42 infants participated (14 LL, 14 HL-ASD, 14 LL-Neg). Data at 12- and 24-month timepoints were contributed as part of a larger, ongoing longitudinal study – the Infant Brain Imaging Study. Using ELAN (2016), two coders blind to diagnostic outcome coded infant and adult vocalizations during the 12-month Communication and Symbolic Behavior Scales; contingent response probability was calculated using study-specific data extraction in R. Outcome data included language t-scores at 12 and 24 months on the Mullen Scales of Early Learning and diagnostic outcome and autism symptom severity scores (SS) on the Autism Diagnostic Observation Schedule (ADOS-2) at 24 months.

**Results:** At 12 months, the HL-ASD group demonstrated lower probability of vocalizing in response to adult vocalization as compared to the HL-Neg and LL groups ( $F(2,39)=4.30$ ,  $p=.02$ ,  $\eta^2=.18$ ). Across all infants, 12-month contingent vocalization probability was significantly related to 24-month language abilities ( $b=.31$ ,  $t=2.80$ ,  $p=.008$ ), such that infants with greater probability of contingent response at 12 months demonstrated higher combined expressive and receptive language t-scores 1 year later. Contingent vocalization probability was also significantly related to 24-month ADOS-2 SS ( $b=-.45$ ,  $t=-.70$ ,  $p=.001$ ) across all infants, such that lower contingent vocalization probability was significantly related to higher ADOS-2 SS 1 year later. Further, 12-month contingent vocalization probability was significantly related to diagnostic outcome at 24 months ( $\chi^2(2) = 22.63$ ,  $p < .001$ ), wherein every percentage increase in contingent vocalization probability was associated with a 20% decrease in likelihood of autism diagnosis ( $OR = 0.80$ ,  $b = -0.22$ ,  $SE = 0.09$ ,  $p = .009$ ).

**Conclusions:** Given that contingent probability was associated with later language and ASD outcomes, these findings suggest that targeting vocal responsiveness may offer a key opportunity for pre-diagnostic intervention, particularly for infants at heightened likelihood of ASD. This research also identifies a potential mechanism through which early symptoms of ASD are exacerbated, leading to cascading socio-communicative challenges. Continued research identifying patterns of contingent response has important implications for understanding prodromal behavioral markers of ASD, guiding early intervention, and supporting more positive socio-communicative outcomes.

### **302.004 (Oral) The P1 Event-Related Potential Response Is Associated with Sensory Responsivity in Infants with Fragile X Syndrome and High Familial Risk for Autism**

**M. W. Guy<sup>1</sup>, S. Conte<sup>2</sup>, A. L. Hogan<sup>3</sup>, A. Bursalioglu<sup>1</sup>, J. E. Richards<sup>1</sup> and J. Roberts<sup>3</sup>, (1)Loyola University Chicago, Chicago, IL, (2)University of South Carolina, Columbia, SC, (3)Department of Psychology, University of South Carolina, Columbia, SC**

**Background:** Atypical sensory processing and sensory responsivity is widely reported in research on autism spectrum disorder (ASD) and fragile X syndrome (FXS) and may result from atypical neural processing, signal integration, or gating. Examination of sensory processing in infancy could provide insight into the development of atypical sensory responsivity within these disorders. Event-related potentials (ERPs) are valuable for investigating relations between neural correlates of sensory processing and emerging behavioral sensory responsivity. In particular, the infant P1 ERP component is associated with visual sensory orienting, providing a sensitive index to examine early occurring neural responses in relation to observed behavioral sensory responsivity.

**Objectives:** To investigate neural correlates of sensory processing in 12-month-old infants at high-risk for ASD in relation to clinical measures of sensory responsivity concurrently and as a predictor of sensory responsivity in early childhood.

**Methods:** Twelve-month-old infants with FXS ( $n=15$ ), siblings of children with ASD (i.e., ASIBs;  $n=21$ ), and low-risk control (LRC) infants ( $n=21$ ) participated in an ERP study including presentations of familiar and novel faces and toys (Guy et al., 2018). Group differences in P1 amplitude were investigated. The Sensory Experiences Questionnaire (SEQ) total score was used to assess sensory responsivity in participants at 12 months and early childhood ( $M = 43.15$  months). SEQ scores were analyzed in relation to P1 responses.

**Results:** The groups differed on P1 amplitude,  $F(2, 972) = 55.97, p < .001, \eta^2 = .10$ . Amplitude was greater among participants with FXS,  $M = 18.39\mu V$ , than ASIBs,  $M = 10.71\mu V$ , or LRC participants,  $M = 11.01\mu V$ . At 12 months of age, there was an interaction of SEQ score and participant group on P1 amplitude,  $F(2, 864) = 5.16, p = .006, \eta^2 = .01$ . Higher SEQ scores at 12 months were associated with greater concurrent P1 amplitude responses for ASIBs, however, the opposite pattern was observed in LRC infants, and no relation was seen for infants with FXS. In predicting SEQ scores during early childhood from 12-month-olds' ERPs, there was an interaction of SEQ score, group, and stimulus type,  $F(4, 882) = 2.45, p = .045, \eta^2 = .01$ . Among participants with FXS, greater amplitude P1 was associated with higher SEQ scores across stimulus type, while LRC participants showed relations between P1 amplitude and SEQ varied based on stimulus type. There were no significant effects of SEQ scores in early childhood for ASIBs.

**Conclusions:** High-risk infant groups demonstrated unique patterns of P1 activation, which were uniquely associated with sensory responsivity concurrently during infancy and as a predictor during early childhood. Although infants with FXS demonstrated greater P1 amplitude responses than ASIBs or LRC infants, greater SEQ scores were observed only as a predictor of elevated sensory responsivity in early childhood. In contrast, elevated sensory responsivity was associated with greater P1 amplitude during infancy for ASIBs, despite not displaying elevated atypical P1 responses. Results indicate that P1 amplitude is associated with sensory responsivity, but that the nature and developmental timing at which these relations are observed varies based on risk group.

## ORAL SESSION - 12A — EARLY DEVELOPMENT (< 48 MONTHS)

### 318 - Early Communication and Cognition

**318.001 (Oral)** Links between Exposure to More Than One Language in the Home and Neuroanatomical Development in Language Regions in Young Children with Autism Spectrum Disorders

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**Background:** Exposure to more than one language in early childhood is positively associated with language and brain development (e.g., Kuhl, 2011; Costa & Sebastian-Galles, 2014). Children exposed to more than one language in the home have distinct neurodevelopmental trajectories of brain morphology compared to monolingual children (Pilatsikas et al., 2020). For example, bi/multilingual children have increased gray matter density and white matter integrity compared to monolingual peers (Pilatsikas et al., 2020; Li et al., 2014). It is unknown to what extent associations between early exposure to more than one language and structural brain adaptations are present in young children with ASD, given the particular vulnerability of language emergence and development in autism.

**Objectives:** To examine associations between language exposure in the home (1 language vs. > 1 language) and indices of brain morphology in language regions in toddlers and preschool children with ASD, in comparison to typically developing (TD) peers.

**Methods:** T1-weighted anatomical MRI data were acquired in 70 young children during natural sleep (ASD:  $n=39$ , mean age:  $38.7 \pm 13$ mo, bi/multilingual<sub>ASD</sub>  $n=25$ ; TD:  $n=31$ , mean age:  $37.6 \pm 14$ mo, bi/multilingual<sub>TD</sub>  $n=13$ ). ASD diagnoses (or clinical best estimates for younger children) were established according to DSM-5 criteria, supported by the Autism Diagnostic Observation Schedule (ADOS-2), Autism Diagnostic Interview, Revised (ADI-R), and expert judgment. Language skills were assessed with the Mullen Scales of Early Learning. FreeSurfer v.5.3.0 was used for cortical surface reconstruction and to calculate local gyrification index (LGI, a measure of brain folding), cortical thickness (CT), and surface area (SA). Multiple linear regression models were employed, with language exposure (1 language vs. > 1 language), diagnosis, and diagnosis by language exposure interaction terms as explanatory variables and neuroanatomical measures in canonical language regions (derived from the Desikan-Killiany atlas) as outcome variables. Total brain volume, sex, age, and socioeconomic status (SES) variables (e.g., income-to-needs ratio) were used as covariates.

**Results:** Children exposed to more than one language in the home did not differ from monolingual children in receptive or expressive language skills, after controlling for diagnosis (ASD vs. TD) and SES variables. There were no significant main effects of diagnosis or diagnosis by language exposure interaction effects on any neural measures tested. Compared to monolingual peers, regardless of diagnosis, children exposed to more than

one language showed (a) higher local gyrification in the right inferior frontal gyrus, pars triangularis ( $t = 2.83, p = 0.006$ ) and pars opercularis ( $t = 3.6, p = 0.001$ ), and the right transverse temporal gyrus ( $t = 3.2, p = 0.002$ ), controlling for income-to-needs ratio and age, and (b) lower cortical thickness in the left middle temporal gyrus, controlling for age and gender ( $t = -3.0, p = 0.003$ ).

**Conclusions:** Findings suggest that early exposure to more than one language is linked with a more mature neuroanatomical profile in language-related regions in both autism and typical development. These results suggest that hearing more than one language in the home may confer a neural advantage for language development in both children with ASD and TD children.

**318.002 (Oral)** Developmental Milestone Attainment in 17,000 Individuals with Autism Spectrum Disorder and 4,000 Unaffected Siblings: Relationships with Comorbid Intellectual Disability, Genetic Etiology, and Cohort

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**Background:** Individuals with autism spectrum disorder (ASD) show diverse patterns of behavioral development starting from early childhood. Characterizing developmental milestone norms can provide individuals with ASD, caregivers, and clinicians with a clearer understanding of early developmental progress in ASD.

**Objectives:** We aimed to characterize the ages which individuals with ASD attain developmental milestones and evaluate differences based on whether they had comorbid intellectual disability (ID), carried a rare disruptive genetic variant associated with ASD or neurodevelopmental disorders, and were ascertained in an earlier or later cohort.

**Methods:** We harmonized four cohorts including Autism Genetic Resource Exchange (AGRE), The Autism Simplex Collection (TASC), Simons Simplex Collection (SSC), and Simons Foundation Powering Autism Research for Knowledge (SPARK), for a total sample of 21,243 participants comprising 17,098 participants with ASD (mean age 9.15 years, 80% male) and 4,145 siblings without ASD or ID (mean age 10.2 years, 50% male). Caregivers reported ages at which participants attained milestones across four domains, including gross motor skills (sitting upright, crawling, and walking), fine motor skills (spoon-feeding self), expressive language skills (speaking word and speaking phrase), and physiological regulation skills (acquiring bladder control and acquiring bowel control). 5,270 ASD participants and all siblings were genotyped. We conducted survival analysis to evaluate time to milestone attainment across the ASD subgroups and the sibling sample.

**Results:** Compared to siblings without ASD or ID, delays in milestone attainment for ASD were on average less than 1 year for gross and fine motor skills, 1 to 2 years for expressive language skills, and more than 2 years for physiological regulation skills. Individuals with comorbid ID showed more severe and variable delays than individuals without comorbid ID, with some being up to 7 years delayed in attaining milestones. Approximately 5% of individuals with ASD who were genotyped had a rare disruptive genetic variant, which substantially increased delays across all milestones except for smiling. Furthermore, individuals with ASD in this sample were ascertained from as early on as 1997 in the AGRE cohort, 2008 in the TASC and SSC cohorts, and 2016 in the SPARK cohort. Compared to ASD participants who were ascertained more recently, ASD participants who were ascertained in earlier cohorts showed generally similar delays for gross motor skills but showed greater delays for later milestones in expressive language and physiological regulation.

**Conclusions:** In the largest study to date of developmental milestone attainment in ASD, more severe and more variable delays were associated with having comorbid ID, carrying a rare disruptive genetic variant, and being ascertained in earlier cohorts. We extended prior work demonstrating that individuals with ASD who have comorbid ID or carry a rare disruptive genetic risk variant show substantial delays in attaining gross motor milestones and expressive language milestones and also show greater delays for fine motor and physiological regulation skills. Furthermore, the cohort differences suggest that though these widely used cohorts measured the same behaviors, they ascertained different groups of individuals with ASD in part based on shifting diagnostic criteria over the past two decades.

**318.003 (Oral)** Early Predictors of Language Outcomes at 36-Months in Infants Who Have an Older Sibling with Autism Spectrum Disorder: A Baby Siblings Research Consortium Study

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**Background:** Several studies have investigated the early predictors of language outcomes in infants who have an older sibling with ASD (i.e., “infant siblings”). Most studies have identified behavioral predictors of language outcomes in infant siblings, such as gesture use (Choi et al., 2020), fine motor (LeBarton & Iverson, 2013), and visual reception abilities (Thurm et al., 2007), while fewer have focused on distal environmental predictors, such as maternal education level (Swanson et al., 2019). It is currently unknown whether these early predictors of language outcomes in infant siblings differ depending on diagnostic outcome (ASD or no ASD).

**Objectives:** (1) Identify the early behavioral and environmental predictors of 36-month language outcomes in infant siblings. (2) Determine whether these predictors vary across three diagnostic outcome groups – infant siblings diagnosed with ASD at 36-months (“Sibs-ASD”), infant siblings not diagnosed with ASD at 36-months (“Sibs-No ASD”), and typically-developing infants without a family history of ASD (“TD”).

**Methods:** Our sample included  $N=796$  infants ( $N=114$  Sibs-ASD,  $N=434$  Sibs-No ASD,  $N=248$  TD) from the Baby Sibling Research Consortium (BSRC). Maternal education level was collected via parent-report at time of enrollment (~12-months). The MacArthur-Bates Communicative Development Inventory–Words and Gestures (MCDI; Fenson et al., 1992) assessed infant gesture use at 12-months. The Mullen Scales of Early Learning (MSEL; Mullen, 1995) assessed infant fine motor, visual reception, and expressive and receptive language abilities at 12-months. The MSEL was re-administered at 36-months to assess language outcomes. Analyses involved two multivariate regression models. The baseline model included MSEL language subscale, sex, and diagnostic outcome group as predictor variables. The stepwise model included 12-month maternal education level, MSEL visual reception and fine motor age equivalent (AE) scores, and MCDI early gestures and late gestures scores as additional predictor variables. Backward elimination procedure was used in the stepwise model. Outcome variables for both models were 36-month MSEL language AE scores.

**Results:** For the baseline model, main effects of MSEL language subscale ( $X^2(1)=26.01, p<.001$ ), sex ( $X^2(1)=22.88, p<.001$ ), and diagnostic outcome group ( $X^2(2)=169.27, p<.001$ ), were significant. For the stepwise model, main effects of maternal education level ( $F(1,442.68)=19.28, p<.001$ ) and 12-month MCDI late gestures scores ( $F(1,448.68)=5.68, p<.05$ ) were significant. Interactions between 12-month MCDI late gestures scores and diagnostic outcome group ( $F(431.96)=4.47, p<.05$ ; Figure1) and maternal education level and diagnostic outcome group ( $F(432.06)=7.71, p<.001$ ; Figure2) were also significant.

**Conclusions:** Findings suggest that early predictors of language outcomes in infant siblings differ depending on diagnostic outcome. Gesture use predicted language outcomes in infant siblings, although the direction of this relation differed between diagnostic outcome groups (negative in Sibs-ASD, positive in Sibs-No ASD). Maternal education level positively predicted language outcomes in Sibs-ASD, but not in Sibs-No ASD. Findings suggest that both behavioral and environmental predictors play a role in language development for Sibs-ASD. Variability in these early predictors may explain why language outcomes are heterogeneous across the autism spectrum. Further research focus on both environmental variables, such as maternal education level, and behavioral variables, such as infant gesture use, could strengthen our understanding of language development in infant siblings.

#### **318.004 (Oral) Does EEG Spectral Power Predict Language Development in the Early Years?**

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**Background:** Younger siblings of children with autism spectrum disorder (ASD) diagnoses are more likely to experience developmental concerns, including language impairment. Better early language development is often associated with more positive long-term outcomes, however early language development in ASD is highly heterogeneous, and there is increasing interest in understanding the neural processes that are associated with it. Measures of neuronal synchrony, such as EEG spectral power, have previously been found to be associated with language ability in both typical and atypical development. However, few studies to date have tested whether early brain measures are indicative of the developmental trajectory of language in infants at familial risk for ASD.

**Objectives:** The aim of this study was to examine the association between EEG spectral power within the first year of life and the developmental trajectories of expressive and receptive language.

**Methods:** We used 410 EEG recordings from 191 unique infants from two longitudinal studies of typically developing infants and infants at familial risk for ASD, which were standardized and accessible as part of the International Infant EEG Data Integration Platform (EEG-IP). Using a linear growth curve model, we assessed trajectories of expressive and receptive language across 6, 12, 18, 24, and 36 months, as measured by the mullen scales of early learning. We tested whether absolute power in the delta, theta, alpha, beta, and gamma frequency bands at 6 months predicted trajectories of expressive and receptive language ability, while controlling for non-verbal cognitive ability, biological sex, and familial risk-status.

**Results:** 6-month alpha-band power was concurrently associated with expressive language in both typically developing and at-risk infants ( $b=1.119, p=0.018$ ). An alpha-power by risk-status interaction term was included to test whether this association was moderated by risk-status, but it was non-significant ( $p > .05$ ). Spectral power did not predict later trajectories of language development in any of the specified frequency bands (all  $p$  values  $> .05$ ).

**Conclusions:** While infants at-risk for ASD have been reported to differ in spectral power from typical-risk controls, the observed association between 6-month alpha-band spectral power and 6-month expressive language scores was not moderated by risk-status. This suggests that there is some continuity between autism and typical development in the underlying neural processes of language, which could help to identify infants that would benefit most from developmental supports. Measures of spectral power that are sensitive to temporal properties have also been linked to language processes, and future studies should assess whether they may be stronger indicators of later language development.

## POSTER SESSION — EARLY DEVELOPMENT (< 48 MONTHS)

### 423 - Early Development (< 48 months)

#### **423.013** (Poster) Differential Cognitive and Behavioral Development from 6 to 24 Months in Autism and Fragile x Syndrome

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**Background:** Fragile X syndrome (FXS) is a heritable genetic condition caused by a mutation in the *FMR1* gene on the X chromosome. FXS is associated with intellectual disability and autistic features, and approximately one third of boys with FXS will meet diagnostic criteria for autism spectrum disorder (ASD). Previous research has unveiled markedly lower language, motor, and visual reception abilities in infants with FXS compared to infants with an older sibling with ASD, who are also at an increased likelihood of later diagnosis of ASD. However, these studies do not distinguish within the family history group, infants who receive an ASD diagnosis from those who do not, and do not examine differences between groups in a longitudinal manner. Examining longitudinal developmental differences in key cognitive and behavioral domains between these groups allows for an understanding of the etiologically distinct developmental profiles and intervention needs of children with FXS, and has important implications for parsing heterogeneity among children diagnosed with ASD.

**Objectives:** Compare skill trajectories among infants with FXS, infants with a family history of ASD who are diagnosed with ASD (FH+), infants with family history but are not diagnosed with ASD (FH-), and infants with no family history of ASD (NFH) in a longitudinal manner from 6 to 24 months of age in the domains of language, motor, visual reception, and nonverbal developmental quotient (NVDQ).

**Methods:** Infants were assessed with the *Mullen Scales of Early Learning* by trained researchers at approximately 6, 12, and 24 months of age as part of larger longitudinal brain and behavior studies. A total of 20 FXS infants, 61 FH+ infants, 228 FH- infants, and 143 NFH infants were included in the analyses. To compare longitudinal skill trajectories between groups, regression analyses with the FXS group and the 6-month timepoint as reference categories were executed for each skill domain. Bonferroni correction for multiple comparisons was applied and significant results are reported after correction.

**Results:** Analyses revealed that FXS infant performance is significantly lower than performance of FH+ infants on NVDQ at 6 months of age, on all domains except receptive language at 12 months, and on all domains at 24 months. FXS infants also underperformed compared to FH- and NFH infants on gross motor and NVDQ at 6 months and on all domains at 12 and 24 months.

**Conclusions:** Results reveal longitudinal trajectories of skill in expressive language, fine and gross motor, and visual reception in which infants with FXS differ from FH+ infants by 12 months and in NVDQ by 6 months. Identifying lower performance for FXS infants than FH+ infants in multiple domains in the first year of life highlights opportunities for early, specialized intervention for infants with FXS, especially since FXS can be diagnosed at birth.

#### **423.014** (Poster) Imagine It in Movement: Motor Development in Children with and without Autism Spectrum Disorder in New Zealand

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**Background:** Although motor impairments are not a critical diagnostic feature in Autism Spectrum Disorder (ASD), increased clumsiness is typically expected. A gross motor skill (like walking or throwing) is also essential for development. It can evolve into more complex movements that allow the child to engage in other aspects of physical activity and, indeed, to learn by engaging in the world around them. Research has shown that deficits in motor impairments are associated with lower cognitive processing. Motor skills have also been shown to impact social interaction and one's ability to move around their environment, which may influence the child's ability to learn from others and the environment. Furthermore, object exploration supports learning their properties and participating in games with their caregivers. This link facilitates and enriches the experiences of linguistic and social knowledge.

**Objectives:** Increased participation in physical activity has been related to a positive influence on the occurrence of stereotypic behaviour in ASD, social functioning, and health-related outcomes. However, gross motor skills are often necessary to participate in physical activity. Given that people with ASD may be prone to motor deficits, they may also be intensifying their other behavioural excesses and deficiencies. This study aimed to understand how motor development trajectory is similar or different in children with and without Autism Spectrum Disorder in New Zealand.

**Methods:** Sample with and without ASD included 150 participants from the Growing Up in New Zealand project (ASD diagnosis was obtained by parent-report and formal diagnosis at four and a half and eight years), and developmental outcomes were obtained from Data Collection Wave data sets at six weeks, nine months, two years, four and a half years and eight years. Information of prevalence and trajectories was obtained by mother and child questionnaires, child observation and observation instruments to assess motor outcomes of child development. Mediating factors such as ethnicity, maternal education, and socioeconomic status were considered, plus gestational age at birth, body mass index, nutrition, and physical disability. Ethics approval from the Growing Up in New Zealand Data Access Committee (N° IA 21\1014).



Results: A decrease in body mass index, nutrition and motor alterations were observed in Maori group in children with and without ASD.

Conclusions: The lower decrease of motor development in Maori children with and without ASD could be due to protective factors of New Zealand's heritage. Further studies are required in a larger population.

**423.015 (Poster)** A Demonstration of Limited Attention to Parent Faces during a Live Eye-Tracking Task in Toddlers with Elevated Autism Symptoms

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**Background:** Reduced attention to dynamic faces in autism has been documented during screen-based studies under specific conditions, particularly those involving social engagement cues such as child-directed speech and eye contact (Chawarska et al., 2013; Shic et al., 2014; Shic et al., 2020). However, many important aspects of genuine social encounters are absent from screen-based studies such as social presence, familiarity, and motivation to engage in reciprocal interactions. Social difficulties in children with autism may be more acute during live interaction (Drysdale et al., 2018; Cañigueral & Hamilton, 2019) but may be less pronounced with familiar social partners (Gillespie-Smith et al., 2014). The influence of social cues such as speech and gaze on attention to faces during interactions with parents in real-world contexts remains to be investigated.

**Objectives:** To examine 1) attention to the face of a familiar person (parent) in a neurodiverse group of toddlers in a live interaction context during which the presence of speech and gaze was manipulated; and 2) the association between attention to face and autism severity.

**Methods:** The gaze patterns of 11 toddlers with and without autism ( $M_{age}=23.1mo$ , 55% male, ASD:n=5) were recorded by a stand-alone Tobii Eye-Tracker as they sat facing their parent who was: 1) naturally speaking (SP+) and looking at them (EC+), or, 2) silent (SP-) and looking down (EC-). Each condition lasted 15 seconds and was repeated twice. Areas of interest comprised the overall scene and face regions. Social impairments were quantified using the ADOS. Eye-tracking calibration accuracy ( $M=0.08^\circ$ ,  $SD=0.05$ ) was excellent compared to field standards. The percent valid looking time (%Valid: looking time at overall scene/duration of condition) and percent looking time to the face (%Face: looking time at face/valid looking time) between the speech and gaze conditions were compared using t-tests. Correlational analyses were computed between %Face during each condition and ADOS calibrated social affect scores.

**Results:** T-tests revealed reduced %Valid ( $p=0.039$ ) and %Face ( $p<0.001$ ) during the (SP-EC-) compared to the (SP+EC+) condition such that all toddlers looked longer at the scene ( $M=46\%$ ,  $SD=18$ ) and at the face ( $M=82\%$ ,  $SD=17$ ) during (SP+EC+) compared to (SP-EC-) (Scene: $M=35\%$ ,  $SD=15$ ; Face: $M=50\%$ ,  $SD=23$ ) (Figure 1, top panel). %Face in the (SP+EC+) condition was negatively correlated with social affect scores ( $r(9)=-0.70$ ,  $p=0.033$ ), unlike in the (SP-EC-) condition ( $r(9)=-0.12$ ,  $p=0.774$ ) suggesting that lower attention to the parent's face during a face-to-face interaction is associated with higher autism severity scores (Figure 1, bottom panel).

**Conclusions:** All toddlers attended to the scene and the parent's face but the duration of looking depended on social engagement cues. Namely, they looked more when the parent spoke and looked at them. Consistent with screen-based eye-tracking studies, (Shic et al., 2020) speech and direct gaze constitute powerful attentional cues in neurodiverse samples of toddlers. However, toddlers with higher autism symptom severity were less sensitive to the contingencies and attended less to their parents' speaking face. This preliminary study demonstrates the feasibility of studying attention to a parent during a naturalistic setting in young children with and without autism and prompts the need to further investigate social attention to familiar partners during live interaction to understand looking behavior closely resembling everyday experiences of toddlers with autism.

**423.016 (Poster)** A Prospective Study of Anxiety and Perceptual Sensitivity As Early Markers for Restricted and Repetitive Behaviours in Infants with Typical and Elevated Likelihood of Autism and ADHD: Replication and Extension in an Independent Cohort.

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**Background:** Earlier models link anxiety to Restrictive Repetitive Behaviours (RRB); however, prospective studies are needed to test this further. A previous study on the elevated likelihood group indicated that infant anxiety and perceptual sensitivity traits were not specific to later RRB alone but were also related to Social Communication Interaction (SCI). Hence, we examine whether we could replicate this model and whether a more refined measure of sensory processing would show greater specificity.

**Objectives:** The study aims to; 1) replicate results in an independent sample. 2) extend findings by using a more specific measure of sensory processing. 3) explore specificity of effects to autism traits as compared to ADHD traits.

**Methods:** As part of the Studying Autism and ADHD Risks (STAARS), 161 infant-siblings participated in a longitudinal study. All participants had at least one older-sibling with a diagnosis of ASD (elevated-likelihood-Autism (EL-ASD;  $N=80$ )), or first degree relative with ADHD (elevated-likelihood-ADHD (EL-ADHD;  $N=31$ )) or both (elevated-likelihood-ASD&ADHD (EL-ASD/ADHD;  $N=21$ )). All typical-likelihood (TL) participants ( $N=29$ ) had no known immediate family members with a diagnosis of ASD or ADHD. Parents rated infant's traits of early anxiety and perceptual sensitivity using the Infant Behavior Questionnaire (IBQ; Fear and Perceptual Sensitivity subscales) at 10 and 14-months, and the Early Childhood Behavioral Questionnaire (ECBQ; Shyness and Perceptual Sensitivity subscales) at 24-months, RRB and SCI were assessed using subscales of the parent-rated Social Responsiveness Scale (SRS-2) at 36-months; along with Infant Toddler Sensory Profile (ITSP), which was

administered at all timepoints. Longitudinal cross-lag structural equation models tested 1) predictive pathways from fear/shyness and perceptual sensitivity at 10-24-months and RRB and SCI at 36-months, 2) bidirectional pathways between fear/shyness and hypo and hyper sensitivity quadrants of ITSP between 10-24-months.

Results: We found significant auto-regressive pathways (e.g., within-domain continuity) for both fear/shyness and perceptual sensitivity between 10-14 and 14-24-months (Figure 1). The cross-lagged auto-regressive model provided a good fit to the data ( $\chi^2(2) = 0.78, p = 0.68$ ; CFI = 1.000, RMSEA < .001). Interestingly, perceptual sensitivity at 8-months predicted RRB symptoms at 36-months. Higher levels of shyness at 24-months were significantly associated with heightened levels of RRB at 36-months. The cross lagged model with ITSP (Figure 2a and 2b) indicated within domain continuity to next timepoint in both hypo and hyper sensitivity. Cross-lagged paths indicated that higher levels of shyness at 24-months were associated with higher levels of hyper sensitivity at 14-months but not with hypo sensitivity.

Conclusions: Consistent with previous findings, relative stability was found over time in fear/shyness and perceptual sensitivity. At a trait level, early infant manifestations of anxiety (e.g., fear/shyness) was specifically related to later RRB and not SCI, this was inconsistent with previous finding. The novel model with the ITSP found that developmental continuity of traits and association of fear was specific to hyper sensitivity compare to hypo sensitivity. Future planned analyses will test whether a similar pattern of results is found with later ADHD symptoms.

#### **423.017 (Poster) ASD Assessment and Timing of Diagnosis: The Impact of Sex and IQ**

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#### **Background:**

Identifying individuals with autism spectrum disorder (ASD) is complex due to the continuum of behavioral topographies and symptom severity differences. This study describes how sex and IQ impact timing of diagnosis and diagnostic classifications on the ADOS/ADOS-2.

Males are diagnosed with ASD approximately three to four times as often as females. The state of the literature is mixed regarding sex differences in ASD. Some studies suggest that sex and IQ may impact core symptom expression on the ADOS/ADOS-2 as well as timing of ASD diagnosis with males and individuals with lower IQ scores potentially diagnosed earlier.

#### **Objectives:**

Do males and females with ASD have similar rates of ASD classification on the ADOS?

Is there a significant difference between males and females on the timing of initial ASD diagnosis?

Is there a significant difference between males and females on the timing of ASD diagnosis by IQ score?

#### **Methods:**

Secondary analysis of population-based data from multiple sites collected by the CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network. The study sample included eight-year-old, confirmed ASD cases for surveillance years 2000-2016 [N = 33,324; n = 27,265 (81.82%) males; n = 6,059 (18.18%) females]

Descriptive and inferential statistics were conducted using SPSS & R software. Specifically, multilevel logistic regression (MLR) analyzing sex differences on the ADOS/ADOS-2, and survival analysis using Kaplan-Meier estimates for analyzing sex differences on timing of diagnosis. Survival curves were compared using the Tarone-Ware  $\chi^2$  test

#### **Results:**

In a MLR model controlling for ascertainment site, year, and assessment's practitioner credential, males were = .56 (95% CI .45, .71) times more likely to have an autism classification with the ADOS. Individuals with IQ below 70 were = 3.14 (95% CI 2.46, 4.02) times more likely to have an autism classification with the ADOS. There were no significant sex differences in the timing of ASD diagnosis (Tarone-Ware  $\chi^2(1) = 0.026, p = 0.871$ ).

When IQ was considered, there were significant sex differences. The survival analysis resulted in mean Kaplan-Meier estimates of 60.37 months for males with IQ scores above 70, 59.62 for females with IQs above 70, 51.0656 for males with IQs at or below 70, and 53.02 for females with IQs at or below 70. The survival distributions comparing timing of ASD diagnosis by sex when considering IQ using the Tarone-Ware  $\chi^2$  test were statistically different ( $\chi^2(3) = 736.217, p < 0.0001$ ).

#### **Conclusions:**

This study found that there were sex differences in ADOS/ADOS-2 ASD classifications, particularly for individuals with IQ scores above 70. It is recommended that clinicians utilize data from multiple sources in combination with the ADOS/ADOS 2 to inform diagnosis. In contrast, these results suggest there were significant sex differences in timing of diagnosis when IQ was considered. This suggests that IQ may impact timing of ASD diagnosis more than sex as both males and females with IQs above 70 were diagnosed approximately one year later than those with IQs at or below 70.

**423.018 (Poster)** Age of First Screen-Positive Status in Children Diagnosed with Autism Spectrum Disorder: A Comparison across Multiple Measures

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**Background:** Symptoms of ASD may be present as early as 9-12 months, but are rarely identified at this age, in part because there are few screeners validated for use in the first year of life. Our team developed the Video-referenced Infant Rating System for Autism (VIRSA), a parent-report screener that utilizes video rather than written descriptions of behavior and is appropriate for infants 6-24 months of age (Young et al., 2020). In this study, we compared the VIRSA to two widely used screening measures, the Modified Checklist for Autism in Toddlers-Revised (M-CHAT-R; Robins et al., 2014) and the Infant Toddler Checklist (ITC; Wetherby et al., 2008).

**Objectives:** To examine the age of first-screen positive status across three different measures (VIRSA, M-CHAT-R, and ITC) in children screened within a community-based sample who were later diagnosed with ASD.

**Methods:** 1,781 parents of infants without a known family history of ASD completed the VIRSA and the ITC online at 6, 9, 12, 18, and 24 months and the M-CHAT-R at 18, 24, and 36 months. Any child screening positive on the M-CHAT-R (score of 3 or above), VIRSA (score of 3 or below), or the ITC (composite score below the 10<sup>th</sup> percentile) at any age were seen for a diagnostic evaluation at 24 and/or 36 months (n = 114). Additionally, 77 children who screened negative on all screeners at every age were randomly selected for a diagnostic evaluation at 24 and/or 36 months. The current analysis focuses on the 18 children diagnosed with ASD so far after the diagnostic evaluation.

**Results:** All 18 children diagnosed with ASD screened positive on at least one of the three measures (e.g., no randomized screen-negatives were diagnosed). 58% of the children screened positive first on the VIRSA, 26% first on the ITC, and 16% first on the M-CHAT-R (see Table 1). One participant screened positive first simultaneously on the VIRSA and the ITC. The mean age of first screen-positive status on the different screening instruments was 12 months on the VIRSA, 16 months on the ITC, and 24 months on the M-CHAT-R (see Table 1).

**Conclusions:** Results demonstrate the potential value of screening for ASD earlier in life. Over half of the children later diagnosed with ASD in this sample screened positive on the VIRSA and/or the ITC in the first year of life, earlier than when screeners are typically first administered in primary care (i.e., 18 months). The majority of the sample screened positive first on the VIRSA, suggesting that its use of video depictions of social-communication behaviors in infancy were helpful for identifying a child's delays in families with no prior knowledge and/or history of ASD. As part of an ongoing investigation, when the full sample of n = 2000 reaches 36 months, we will calculate the VIRSA's psychometric properties (i.e., sensitivity, specificity, positive and negative predictive values) to determine its early screening utility relative to current standard screening measures.

**423.019 (Poster)** Altered Locus Coeruleus-Norepinephrine Activity As Underlying Mechanism of Attenuated Social Attention in Preschoolers with ASD

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**Background:** Recent evidence suggested altered activity of the Locus Coeruleus-norepinephrine (LC-NE) system in ASD as a promising biomarker. Pupil dilation (PD) indexes LC-NE activity and has been shown to be attenuated in ASD in response to static social stimuli, which may indicate an implication of LC-NE activity in attenuated social attention. So far, it remained unclear whether aberrant PD patterns can also be elicited by dynamic video stimuli that more closely represent naturalistic visual exploration. A reliable measure to show altered social attention in ASD is a paradigm assessing the preference for competing social vs. geometric motion. In various studies, children with ASD showed an attenuated social motion preference compared to typically developing children (TD), which has also been applied as a prognostic risk assessment for a later diagnosis. LC-NE activity remains to be explored as underlying mechanism of altered social preferences in ASD.

**Objectives:** The aim of the current study was to examine 1) whether aberrant PD can be found in reaction to dynamic stimuli, 2) whether PD as measure of LC-NE activity can explain altered social preference and 3) whether combining social preference with PD measures can enhance the prediction of an ASD diagnosis.

**Methods:** 57 ASD and 39 TD children (age: 18-65 months) matched for developmental age were included. Participants watched simultaneously presented videos of social motion (grimacing actors) versus geometric motion (moving geometric objects) while an eye-tracker assessed their social preference and PD. Group differences and the prediction of social motion preference by PD were analyzed with Linear Mixed Models. Post-hoc comparisons for PD measures were done with Tukey-HSD, the prediction of the diagnosis with logistic regression models.

**Results:** PD analyses revealed a significant interaction effect between group (ASD vs. TD) and stimulus type (social vs. geometric;  $\beta = -0.577$ ,  $p < .0001$ ). Post-hoc comparisons showed that ASD participants had an attenuated PD in response to social motion ( $\beta = -0.282$ ,  $p = .026$ ), but a larger PD

to geometric motion ( $\beta=0.295$ ,  $p=0.016$ ). This was accompanied by an attenuated social motion preference ( $\beta=1.042$ ,  $p<.0001$ ). Higher social motion preference was associated with higher PD to social ( $r=.718$ ,  $p<.0001$ ) but lower PD to geometric motion ( $r=-.468$ ,  $p<.0001$ ). Social motion preference was explained by the combination of PD to geometric ( $\beta=-0.262$ ,  $p<.0001$ ) and to social motion ( $\beta=0.394$ ,  $p<.0001$ ; marginal pseudo  $R^2=0.358$ ). The ASD diagnosis was predicted by social motion preference ( $\beta=1.71$ ,  $p<.0001$ ), while this effect was mediated by inclusion of the significant effects of PD to geometric ( $\beta=-2.319$ ,  $p=.009$ ) and to social motion ( $\beta=1.851$ ,  $p=.044$ ; adjusted Pseudo  $R^2=0.626$ ).

**Conclusions:** This is the first empirical evidence of altered LC-NE functioning as underlying mechanism of altered social preference in ASD. In preschoolers with ASD, PD is altered in response to dynamic stimuli. In contrast to previous studies, we found increased PD to non-social geometric motion, which might indicate aberrant reactivity to sensory salience. PD to dynamic stimuli might be a predictive phenotype of ASD that explains altered social preferences. Underlying LC-NE activity seems worthwhile to consider in future etiological models as well as the investigation of diagnostic biomarkers.

#### **423.020 (Poster)** Association between Ultrasonography Fetal Anomalies and Autism Spectrum Disorder

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#### **Background:**

Today, autism spectrum disorder (ASD) diagnosis is based on behavioral symptoms, which are typically manifested in the second year of life. Nevertheless, a growing body of evidence suggests the prenatal onset of abnormal neurodevelopment and abnormal embryonic organogenesis of different body parts in some children with ASD. Accordingly, there is emerging interest in examining the prenatal development of fetuses later developing into children diagnosed with ASD. Prenatal ultrasound, a commonly used pregnancy monitoring tool, is an excellent framework for this purpose as it allows physicians to survey fetal growth and organ development throughout different pregnancy stages. A primary prenatal ultrasound screening is the fetal anatomy survey, which is designed to detect various fetal structural anomalies and “soft markers” that may develop into congenital anomalies and diseases. Here, we present results from the the most comprehensive exploration to date of ultrasonography fetal anomalies (UFAs) associated with ASD, as reflected in the prenatal fetal anatomy survey.

#### **Objectives:**

To investigate the association between UFAs and ASD.

#### **Methods:**

A retrospective case-sibling-control study comprised of children diagnosed with ASD (cases); their own typically developing, closest-in-age siblings (TDS); and typically developing children from the [general] population (TDP), who were matched to cases by year of birth, sex (male/female) and ethnicity (Jewish/Bedouin). This case-sibling-control design allows accounting for familial and environmental exposures known to affect ASD risk. The case group was drawn from all children diagnosed with ASD at the National Autism Research Center of Israel (NARCI). Fetal ultrasound data from the fetal anatomy survey, which is conducted during gestational weeks 20-24 in Israel, were obtained from all the prenatal ultrasound clinics of Clalit Health Services (CHS), Israel's largest health maintenance organization (HMO), serving ~75% of the families enrolled at the NARCI.

#### **Results:**

The study comprised 659 children: 229 ASD, 201 TDS, and 229 TDP; 471 (71.5%) males. Differences in UFA rates between cases and controls are presented in **Figure 1**. UFAs were found in 29.3% of ASD cases vs. only 15.9% and 9.6% in the TDS and TDP groups (aOR=2.23, 95%CI=1.32-3.78, and OR=3.50, 95%CI=2.07- 5.91, respectively). Also, multiple co-occurring UFAs were significantly more prevalent among ASD cases. UFAs in the urinary system, heart, and head&brain were the most significantly associated with ASD diagnosis (aOR<sub>Urinary</sub> =2.08, 95%CI=0.96-4.50 and aOR<sub>Urinary</sub>=2.90, 95%CI=1.41-5.95; aOR<sub>Heart</sub>=3.72, 95%CI=1.50-9.24 and aOR<sub>Heart</sub>=8.67, 95%CI=2.62-28.63; and aOR<sub>Head&Brain</sub>=1.96, 95%CI=0.72-5.30 and aOR<sub>Head&Brain</sub>=4.67, 95%CI=1.34-16.24; vs. TDS and TDP, respectively). ASD females had significantly more UFAs than ASD males (43.1% vs. 25.3%,  $p=0.013$ ) and a higher prevalence of multiple co-occurring UFAs (15.7% vs. 4.5%,  $p=0.011$ ). No sex differences were seen among TDS and TDP controls. ASD fetuses were characterized by a narrower head and a relatively wider ocular-distance vs. TDP fetuses (OR<sub>BPD</sub>=0.81, 95%CI=0.70-0.94, and aOR<sub>Ocular-Distance</sub>=1.29, 95%CI=1.06-1.57). Finally, UFAs were associated with more severe ASD symptoms.

#### **Conclusions:**

Our findings shed important light on the abnormal multiorgan embryonic development of ASD and suggest fetal ultrasonography biomarkers for ASD.

#### **423.021 (Poster)** Associations Among Motor Speech, Arm and Hand Control, Social Communication, and Language Skills in Toddlers with and without Autism Spectrum Disorder

**Background:** Motor impairments are prevalent in children with autism spectrum disorder (ASD); yet often go undiagnosed (Bhat et al., 2021; Licari et al., 2019). Additionally, motor speech impairments commonly co-occur in children with ASD (Chenau et al., 2019; Velleman et al., 2010). Early motor skills and language development are significantly related in children with and without ASD and developmental delays (DD), and motor differences in the first two years of life provide important indicators of ASD- and DD-risk (Lim et al., 2021). However, few clinical observation measures of early motor control are available (McCauley & Strand, 2008).

**Objectives:** 1) To examine and compare measures of motor speech, arm, and hand control in toddlers with and without ASD; 2) to examine concurrent associations between motor and social communication skills, and 3) to examine prospective associations between motor and verbal and nonverbal developmental level.

**Methods:** Participants were 249 toddlers identified with ASD ( $n=48$ ), DD ( $n=33$ ), and typical development (TD,  $n=168$ ) recruited through screening in primary care by the FIRST WORDS® Project. Children completed a Communication and Symbolic Behavior Scales (CSBS) Behavior Sample at 20.0 months ( $SD=3.1$ ). The Early Motor Control Scales (EMCS; Hayden et al., 2006), a standardized tool that uses the observation of communication and play to evaluate motor control of arm, hand, oral, and vocal mechanisms was scored during the CSBS. The EMCS is based on the theoretical model and developmental framework tested in the Verbal Motor Production Assessment for Children (VMPAC; Hayden & Square, 1999). Children completed a follow-up evaluation at 37.2 months ( $SD=6.9$ ) that included the ADOS and Mullen Scales of Early Learning (MSEL).

## Results:

**EMCS.** Children with ASD and DD had significantly lower Motor Speech Composite and Total Scores than TD,  $F(2,247)=36.15$ ,  $p<.001$  and  $F(2,247)=52.52$ ,  $p<.001$ , respectively. Effect sizes for group differences (ASD-TD: Cohen's  $d=1.26$ , and DD-TD:  $d=0.86$ ) were observed to be large. All three groups differed significantly on the Arm and Hand Composite, with TD scoring highest, followed by DD and ASD,  $F(2,247)=39.27$ ,  $p<.001$ . The ASD-DD and DD-TD group differences were medium in effect size ( $d=0.50$  and  $0.79$ , respectively), while the ASD-TD  $d=1.35$  was large.

**Concurrent relationships: CSBS.** Medium and large correlations were observed between the EMCS Motor Speech Composite and the CSBS Social ( $r=.54$ ), Speech ( $r=.79$ ), and Symbolic ( $r=.54$ ) Composites, as well as between the Arm and Hand Composite and CSBS Social ( $r=.51$ ), Speech ( $r=.44$ ), and Symbolic ( $r=.54$ ) Composites.

**Prospective relationships: MSEL.** Medium and large correlations were observed between the Motor Speech and Arm and Hand Composites and MSEL Visual Reception, Fine Motor, Expressive Language, and Receptive Language T scores (range  $r = .42-.52$ ).

**Conclusions:** Findings provide evidence that 1) delays in early motor control may be identified in toddlers with ASD and DD during a clinical assessment of communication and play, and 2) these skills were observed to be related to social communication and language skills. Observational measures of early motor control may contribute to earlier detection and provide toddlers at risk of developmental delays and ASD with the opportunity to access targeted interventions.

## 423.022 (Poster) Associations between Autistic Traits and Behavioral/Emotional Problems in Toddlers with Autism

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## Background:

The Social Responsiveness Scale (SRS) is a quantitative parent report of autistic traits in children aged 4-18 years old (SRS; Constantino & Gruber, 2005). The scale measures impairment in social reciprocity, a key developmental domain which is often diminished in children with ASD. Scores on the SRS are continuous and normally distributed in a general population study (see Bolte, Poustka, & Constantino, 2008 for review). Further, twin studies have demonstrated a high degree of heritability on the scale. Higher scores on the SRS are indicative of a higher risk for an ASD diagnosis and a higher risk for emotional/behavioral issues, as measured by the Child Behavior Checklist (CBCL; Achenbach, & Rescorla, 2001).

The Video-referenced Rating of Reciprocal Social Behavior (VrRSB) is an extension of the SRS, aiming to measure autistic traits in social reciprocity in children between 18-30 months (Marrus et al., 2015). In the general population, the scale demonstrates continuously distributed scores and appears to be highly heritable based on twin study designs.

## Objectives:

To investigate concurrent associations between parent ratings of autistic traits and parent-reported behavioral or emotional problems in young children with ASD.

## Methods:

Parents who sought enrollment at a university-based, inclusive preschool for children with and without autism were invited to complete a battery of surveys. Parents were included in the current study if (1) children were < 30 months, and (2) children presented significant concerns about ASD. The sample included 24 children (20 male; age: 20 to 30 months;  $M = 25.38$ ,  $SD = 2.9$ ).

Parents of 17 children reported a prior diagnosis of ASD ( $N=17$ ). In addition, clinical review of parent surveys (CDI, M-CHAT, parent concerns) identified seven additional children who were classified as 'likely ASD'. For the current analysis, parents completed the VrRSB and the CBCL.

The VrRSB Scale video referenced score, repetitive and restrictive behavior subscale, and social communication subscale were calculated for each family. The Child Behavior Checklist is a 99-item parent questionnaire used to capture standardized scores on behavioral and emotional issues. The CBCL 1.5-5 is a 99-item continuous and normally distribute rating scale used for children aged 1.5 to 5 years (Achenbach, & Rescorala., 2001). Additional calculations were made for the CBCL standardized total problem score, externalizing problems T score, and the internalizing problems T score.

#### Results:

Preliminary results revealed that neither measure (CBCL, VrRSB) was significantly correlated with age. Pearson correlations demonstrated a significant correlation between the total score on the VrRSB ( $M = 56.5$ ,  $SD = 13.54$ ) and the CBCL Total Problems T-score ( $M = 48.54$ ,  $SD = 9.44$ ) ( $r(24) = .77$ ,  $p < 0.001$ ). A scatter plot illustrating the association between the VrRSB Total Score and the CBCL Total Problems T-score is displayed in Figure 1. Correlations between all subscales are reported in Table 1.

#### Conclusions:

The current study found significant positive correlations between continuous, quantitative measures of autistic traits (VrRSB) and emotional/behavioral problems (CBCL) in toddlers with diagnosed or likely ASD. Similar relations have been identified in older children with and without ASD.

#### **423.023 (Poster)** Asymmetries in the Development of Infant-Caregiver Social Contingency in Typical Development and ASD

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**Background:** Increasing evidence suggests that prodromal symptoms of autism may emerge over time within the first year of life, suggesting that early developmental trajectories may form the basis for biomarkers of autism risk and resilience. In previous studies, we found evidence for a developmental cascade in vocal development discriminating high-risk and low-risk siblings, beginning by 12 months, with deficits in vocal contingency leading to later deficits in adult then infant volubility, all of which were predictive of speech and language outcome at 24 months. Existing studies of conversational turn-taking in infancy suggest that vocal contingency between infant and caregiver is asymmetric and changes over time, as each learns to initiate and then respond to vocal signals from the other. This was not captured in our previous measures of vocal interaction, which tested for statistical dependence but not mutual causality. Accordingly, we revisit our analysis to examine the directionality of infant-caregiver signaling and response, in typical development and ASD.

**Objectives:** The goal of this research is to examine developmental progressions in infant-caregiver vocal interaction, to determine whether there are asymmetries in the emergence of vocal contingency between infant and caregiver, and differences between autism and typical development.

**Methods:** As part of an NIH Autism Center of Excellence (NIH P50 MH100029), we tracked vocal development among 45 high-risk infant siblings and 35 low-risk controls. Each child wore a LENA recorder one day every month from 0-24 months to provide audio recordings of their vocal environment. Using multitaper harmonic analysis, we identified the onset and offset of each infant and caregiver vocalization. From the mean rate of event markers, we determined the number of vocalizations per hour for infant and caregiver, as an index of volubility. Following our previous research, we used the mutual information between event marker sequences to calculate an index of vocal contingency. In the present study, we further used the transfer entropy, an information-theoretic metric of statistical causality between the past history of one stochastic process and the future of another, to derive a new index of directional vocal contingency between infant and caregiver, and caregiver and infant. Using Functional Data Analysis, we then determined developmental trajectories for these measures for each infant-caregiver dyad, and mean trajectories for each risk group. Permutation tests were used to identify significant ( $P < .05$ ) differences between risk groups.

**Results:** Previous results provided evidence for a developmental cascade, beginning with differences in overall vocal contingency between low-risk and high-risk infants over the first 12 months of life. Results from the present study revealed developmental asymmetries in vocal contingency between caregiver and infant. Infant contingency upon caregiver was weaker than caregiver contingency on infant near birth, but rose from 4-6 months. The change was significantly weaker in high-risk relative to low-risk infants.

**Conclusions:** These results suggest that early deficits in social contingency that later characterize autism may originate in deficits in infant contingent responding to caregiver within the first 6 months of life, whereas caregiver responding to infant appears to remain intact.

#### **423.024 (Poster)** Autism Spectrum Disorder (ASD) Screening Project: How to Increase Community ASD Screening and Improve Linkage to Care in an Underserved Region?

**Background:** The American Academy of Pediatrics (AAP) recommends all children be screened for Autism Spectrum Disorder (ASD) at 18 and 24 months-of-age. However, there is a persistent gap between the time of parental concern for ASD and the time of first professional evaluation, particularly in underserved communities. The delay in ASD detection may be related to lack of an effective screener and inadequate follow up with children who screen at-risk for ASD.

**Objectives:** This study will test whether implementing an ASD Screening Program, with the inclusion of peer support for mothers, will increase ASD screening and referral to services through a Newark-based pediatric practice. Additionally, this study examined information from practitioners to identify barriers and challenges to screening.

**Methods:** The ASD Screening Project is an ongoing study initiated in 2020 at the Rutgers-New Jersey Medical School (NJMS) Pediatric Continuity Care Center (PCCC). Cooperating with practice physicians, we enhanced routine ASD screening using a novel, brief, and reliable ASD screener, the Psychological Development Questionnaire for Toddlers (PDQ-1), for children between 18 and 36-months. Children who screened positive (i.e., at-risk for ASD) were contacted by a liaison and connected with Mom2Mom, a peer support group for mothers of children with special needs. In conjunction with this project, a 12-question survey regarding in-office developmental and ASD screening was sent via email to New Jersey AAP members.

**Results:** The ASD screening project led to a 15% increase (36.5% to 51.3%) in developmental screening from 2019 to June 2021. The percentage of young children (PCCC patients) referred to the local Early Intervention Program (EIP) and developmental specialists increased from 68.7% to 88.0% and from 43.7% to 76.0%, respectively.

Out of 53 physicians who responded to the AAP survey, 77.4% used a general development screener and 90.6% used an ASD screener. Less than 10% of respondents used the Center for Disease Control and Prevention's (CDC) "Learn the Signs, Act Early" program materials, but nearly 80% were interested in learning more about and receiving further information regarding early childhood development.

**Conclusions:** The ASD Screening Project was overall successful in improving linkage to care for children in an underserved community. These results emphasize that applying a similar model elsewhere may lead to similar improvements. Based on the AAP survey, there is a strong desire by clinicians to learn more about this type of intervention, which may lead to expansion of the project and further improvement in ASD screening and early referrals across the state.

While the ASD Screening Project showed positive results, screening at the PCCC is still less than perfect with only 1 in 2 children being screened for ASD. The AAP survey results suggest that barriers to screening may be avoided with the implementation of continued education, specifically regarding the general understanding of development and the use of general development screeners.

#### **423.025 (Poster) Differences in Object Manipulation in Infants at Low and Elevated Likelihood for Autism Spectrum Disorder**

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#### **Background:**

Deficits in motor skills have been identified in the first year of life for infants who later develop autism spectrum disorder (ASD). These infants show atypical fine and gross motor skills and object manipulation behaviors, including differences in mouthing, visual exploration, and grasping (Kaur et al., 2015). Generally, studies have used broad definitions for object exploration. To better understand object exploration differences in infants at a genetic likelihood for ASD (EL infants), the current study examines differential patterns of exploration between EL infants and infants at a low likelihood for ASD (LL).

#### **Objectives:**

This study aims to investigate differences in proportion of time 6 and 9 month old infants at LL and EL for ASD spent exploring an object during a brief interaction with an age-appropriate toy, and identify associations between object exploration and cognitive and motor skills.

#### **Methods:**

Participants (LL=24, EL=11) were enrolled in a study of infant development. At 6 and 9 months of age, participants completed a brief interaction with an age-appropriate object and the Bayley Scales of Infant Development. Videos of infant interactions with the object were coded for the amount of time spent exploring (i.e., holding/touching/moving fingers across the object).

By March 2022, 5 more unique participants will have participated in this study and all participants will have undergone 12-month assessments, which will allow for the evaluation of change in object exploration over time and longitudinal predictive relationships between object exploration and motor and cognitive skills.

## Results:

Results revealed significant differences in the proportion of time that EL and LL 6-month-old infants explored objects. EL infants spent a significantly higher proportion of time exploring objects ( $M=92.05\%$ ) than LL infants ( $M=77.30\%$ ;  $t(29.04)=2.97$ ,  $p=0.01$ ). Surprisingly, there were no differences in the proportion of time that 9-month-old EL and LL infants explored objects ( $EL=46.56\%$ ,  $LL=50.89\%$ ,  $t(8.28)=-0.28$ ,  $p=0.79$ )

Multiple regressions were used to examine the relationship between proportion of time spent exploring the object and concurrent cognitive and motor skills across all participants. Model results showed that at 6 months, exploration of objects were associated with cognitive ( $F(31)=4.52$ ,  $p=0.04$ ) and gross motor skills ( $F(31)=4.05$ ,  $p=0.05$ ), but not fine motor skills ( $F(31)=0.56$ ,  $p=0.46$ ). At 9 months, cognitive ( $F(16)=0.12$ ,  $p=0.74$ ), gross motor ( $F(16)=0.00$ ,  $p=0.94$ ), and fine motor ( $F(16)=1.15$ ,  $p=0.30$ ) skills were nonsignificant.

## Conclusions:

This study documents that EL infants spend a higher proportion of time exploring the object compared to LL infants at 6 months of age, but no differences emerged at 9 months of age. Positive associations between object exploration and cognitive skills, and negative associations between object exploration and gross motor skills were also observed at 6 months of age, but not 9 months of age. Evidence has been provided for the idea that EL infants engage in more repetitive play than LL infants (Thomas & Smith, 2004). Thus, EL infants may spend time repetitively exploring the object, whereas LL infants may explore and engage in other, more complex actions. Further investigation is needed to parse out the differences in object exploration across the first year of life.

### 423.026 (Poster) Examining Clinical Phenotype Sex Differences Among ASD Toddlers

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#### Background:

With a 4:1 male-to-female ratio (Maenner et al. 2020) Autism Spectrum Disorder (ASD) has been classically regarded as a male condition. However, epidemiological, and population-based studies challenge these numbers and report much more balanced ratios (Kim et al. 2011; Mattila et al. 2011), suggesting that females with ASD are underdiagnosed. A proposed explanation for the difficulties identifying females on the spectrum is that they often “mask” symptoms with superior social and language abilities (for a review see Hull et al. 2020). Yet, studies on sex differences in ASD are scarce and have small sample sizes.

#### Objectives:

The present study aimed at elucidating the presence of fundamental sex differences in the behavioral presentation of ASD within social, communicative, cognitive, motor, and adaptive skills in a large sample of toddlers with and without ASD.

#### Methods:

A total of 1373 toddlers diagnosed with ASD ( $F=294$ ,  $M=1079$ ; mean age  $F=24.9$  months,  $M=25.8$  months) and 694 typically developing toddlers ( $F=277$ ,  $M=417$ ; mean age  $F=20.3$  months,  $M=19.1$  months) participated. Scores of the Autism Diagnostic Observation Schedule (ADOS-2), the Communication and Symbolic Behavior Scales Developmental Profile (CSBS-DP), the Mullen Scales of Early Learning (MSEL) and the Vineland Adaptive Behavior Scales (VABS-3) were selected as measures of social, communicative, cognitive, motor, and adaptive skills. Sex differences were examined using T-tests, and the Benjamini-Hochberg (B-H) procedure was applied to correct for multiple comparisons.

#### Results:

While no statistically significant sex differences were found in the ASD group, boys and girls in the typically developing (TD) group displayed significantly different profiles in all the domains of the ADOS-2 [Communication & Social interaction ( $t = -3.196$ ,  $p = 0.002$ ), Restricted & Repetitive Behavior ( $t = -3.669$ ,  $p = 0.002$ ), Overall Total ( $t = -3.925$ ,  $p = 0.002$ )], the MSEL [Visual Reception ( $t = 2.255$ ,  $p = 0.029$ ), Fine Motor ( $t = 2.156$ ,  $p = 0.032$ ), Receptive Language ( $t = 3.858$ ,  $p = 0.002$ ), Expressive Language ( $t = 2.751$ ,  $p = 0.009$ ), Early Learning Composite ( $t = 3.577$ ,  $p = 0.002$ )] and the CSBS-DP [Social ( $t = 2.605$ ,  $p = 0.011$ ), Expressive ( $t = 2.770$ ,  $p = 0.009$ ), Symbolic ( $t = 2.159$ ,  $p = 0.032$ ), Total Score ( $t = 2.817$ ,  $p = 0.009$ )] and the VABS-3 [Communication ( $t = 3.744$ ,  $p = 0.002$ ), Daily Living Skills ( $t = 3.413$ ,  $p = 0.002$ ), Socialization ( $t = 2.688$ ,  $p = 0.009$ ), Adaptive Behavior Composite ( $t = 3.347$ ,  $p = 0.002$ )] except for Motor Skills domain. Girls outperformed boys in all measures except for Restricted & Repetitive Behavior in the ADOS-2, and the Social and Total Score in the CSBS-DP. All reported p-values were corrected with B-H. See figures for example.

#### Conclusions:



Our results show that in TD toddlers, sex differences in social, language, and cognitive skills are common, with females generally scoring higher than males during this young age period. Yet, boys and girls with autism perform similarly, even in the ADOS-2. These findings challenge the prevailing theory of fundamental sex differences in ASD at this young age.

**423.027 (Poster)** Expanding Social Attention and Communication Surveillance into Preschool (SACS-PR): An Additional Checklist of the SACS-Revised for Early Autism Detection

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**Background:** A universal, developmental surveillance tool for autism, Social Attention and Communication Surveillance-Revised (SACS-R), was developed for use in 11-30-month-old children, with very strong psychometric properties (83% positive predictive value, PPV; 99% negative predictive value, NPV; 72% sensitivity, 99.5% specificity; Barbaro et al., under review). Although the SACS-R's sensitivity was sufficient, we wanted to investigate whether we could improve its sensitivity whilst maintaining sufficient accuracy.

**Objectives:** The objective of this study was to improve the SACS-R's sensitivity by adding a preschool checklist (SACS-PR) at 42-months of age at children's free, routine, community-based health-checks.

**Methods:** The SACS-R and SACS-PR comprise brief checklists to monitor developmentally appropriate social-attention and communication behaviours at 12-, 18-, 24-, and 42-months-of-age. A total of 126 Maternal and Child Health (MCH) nurses were trained to utilise these checklists during routine child health-checks, with 13,511 children monitored with the SACS-R between 11- and 30-months, and 8,233 with the SACS-PR at 42-months. All children identified at 'high likelihood' for autism were referred for a University developmental assessment. Furthermore, children identified at 'low likelihood' on SACS-PR who had *any* developmental concerns, or had a community-based diagnosis of autism, were also referred for a University assessment to determine false negatives. Gold-standard assessment tools were utilised (ADOS, ADI-R, Mullen Scales of Early Learning) at each age.

**Results:** A total of 270 children on the spectrum were identified by the SACS-R between 11- and 30-months of age. The MCH nurses identified an additional 168 children at 'high likelihood' for autism using the SACS-PR at 42 months who had not previously been identified by the SACS-R. An additional 11 children on the spectrum were identified that were 'low likelihood' on both tools (i.e., false negatives). The psychometrics of the SACS-PR as a stand-alone tool was 89.6% sensitivity, 99.1% specificity, 56.5% PPV, and 99.9% NPV. However, when used as intended – as a developmental surveillance tool combined with the SACS-R, the PPV increased significantly to 73.7%, with 97.7% sensitivity, 99% specificity, and 99.9% NPV.

As with the SACS-R, no "true" false positives (typically developing children) were identified using the SACS-PR, with all children identified as either on the spectrum or having developmental/language delays. Autism prevalence was 1.99% (1 in 50) between 11- and 30-months and rose to 2.78% (1 in 36) when the children identified at 42-months were included.

**Conclusions:** The addition of the SACS-PR as a 42-month follow-up checklist to the SACS-R significantly increased sensitivity from 72% to 97%, stressing the importance of a developmental surveillance model where children are repeatedly monitored across time for autism. Had a preschool checklist not been utilised, >160 children on the spectrum would have missed the opportunity to be identified, diagnosed, and enrolled into early intervention services prior to school entry. Thus, it is imperative that early screening/developmental surveillance tools include a preschool check to identify a significant proportion of children who will not be identified very early in life. Used together, the SACS-R/PR continues to be the most robust early developmental surveillance tool for autism.

**423.028 (Poster)** Explaining the Gap: Executive Functioning Predicts the Discrepancy between Cognitive and Adaptive Functioning in Toddlers with ASD

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**Background:** Autism spectrum disorder (ASD) is associated with poor adaptive functioning (AF), even in the absence of cognitive delays. For school age autistic children, the gap between IQ and age-expected AF increases with age, such that AF lags behind IQ (Pugliese et al., 2015). Executive functioning (EF) and AF are correlated in ASD (Pugliese et al., 2016), although results are mixed regarding which aspects of EF and AF are linked. No study has examined the association between EF and the gap between cognitive ability and AF in autistic toddlers and young children.

**Objectives:** We evaluated whether: (a) toddlers' AF decreases with age relative to age norms; (b) the gap between cognition and AF increases with age; (c) EF is associated with AF; and, (d) EF predicts the cognition-AF gap.

**Methods:** Parents of children with ASD without cognitive delays (i.e., nonverbal developmental quotient  $\geq 70$ ) ages 25-36 and 48-60 months (N=61, 66% boys, 69% white) completed the Vineland Adaptive Behavior Scales (VABS-III) and the Behavior Rating Inventory of Executive Functioning, Preschool Edition (BRIEF-P). Multiple regressions examined whether: age (months) predicted (a) VABS domain scores beyond cognition, (b) the gap between cognition and VABS; and BRIEF-P Global Executive Composite (GEC) predicted (c) VABS domain scores beyond age and cognition and (d) the gap between cognition and VABS domains beyond age. Caregiver income and education were not significant predictors of AF or EF and were removed from final models.

Results: For 2- and 4-year-olds, age was not related to VABS Composite, Communication, Daily Living Skills, or Socialization domains ( $-.15 < \beta s < .10$ ,  $.22 < ps < .71$ ). Similarly, age did not predict the gap between cognition and AF ( $.04 < \beta s < .19$ ,  $.31 < ps < .78$ ). While cognition-AF gaps exist, ANCOVAs yielded no effect of age or domain. For 2-year-olds, EF skills predicted adaptive Composite ( $\beta = -.46$ ,  $p = .02$ ) and Socialization ( $\beta = -.59$ ,  $p < .001$ ) domains. For 4-year-olds, EF skills predicted VABS Composite ( $\beta = -.43$ ,  $p < .01$ ), Socialization ( $\beta = -.56$ ,  $p < .001$ ), and Daily Living ( $\beta = -.43$ ,  $p < .01$ ) domains. Overall, as EF problems increased, AF decreased. EF was not associated with Communication domain scores ( $-.28 < \beta s < .07$ ,  $.17 < ps < .68$ ). For 2-year-olds, EF problems predicted the gap between cognition and Socialization only ( $\beta = .51$ ,  $p < .01$ ), whereas for 4-year-olds, EF problems predicted the gap between cognition and Composite ( $\beta = .35$ ,  $p = .03$ ), Socialization ( $\beta = .48$ ,  $p = .002$ ) and Daily Living skills ( $\beta = .32$ ,  $p = .047$ ). Overall, as EF problems increased, the degree to which AF lagged cognition increased.

Conclusions: For autistic 2- and 4-year-olds without cognitive delays, no decline in adaptive functioning (AF) relative to same-aged peers or increase in the gap between cognition and AF was observed. Plateauing of AF likely begins later in development (Pugliese et al., 2015; Braverman et al., in prep). However, as early as 2 years, children's executive functioning (EF) skills predict both concurrent socialization skills and the gap between cognition and socialization skills. By 4 years, EF also predicts daily living skills and the gap between cognition and daily living skills. Everyday communication skills may track more closely with factors other than EF (e.g., cognition) in preschool. These findings demonstrate the potential importance of EF interventions in toddlerhood to support adaptive development.

**423.029 (Poster)** Eye-Tracking and NIRS Measures of Familiar Face Processing in Infants with and without an Older Sibling with Autism  
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Background: Differences in attentional and neural responses to faces have been found between individuals with and without autism (e.g., Pelphrey et al., 2002; Webb et al. 2006). These differences have also been examined in first-degree relatives, including infants who have an older sibling diagnosed with autism (Sibs-ASD; e.g., Lloyd-Fox et al., 2013; Wagner et al., 2018), but little work has explored attentional and neural responses within the same sample and asked how these responses might be associated.

Objectives: In the current study, we examined attentional and neural responses to faces in Sibs-ASD and a comparison group with no family history of autism (Sibs-Comp).

Methods: Sibs-ASD ( $n = 14$ ) and Sibs-Comp ( $n = 35$ ) were tested at 12 months with a Tobii T-120 eye-tracker and a 24-channel Hitachi ETG-4000 NIRS system simultaneously recording responses to 16s videos of the infant's mother or a stranger talking with a neutral expression (sound removed). Analysis of attention focused on the proportion of time on eyes and mouth (divided by time on face). NIRS recordings were collected from frontal and right lateral regions. Oxyhemoglobin concentration (oxyHb) was averaged from 6s to 16s after stimulus onset. Infants who contributed  $\geq 2$  trials for both mother and stranger for eye-tracking and/or NIRS were included in the current analyses.

Results: For eye-tracking, a 2 (Identity: Mother, Stranger)  $\times$  2 (Group: Sibs-ASD, Sibs-Comp)  $\times$  2 (Region: Eyes, Mouth) mixed model ANOVA analyzed visual attention, and a Group  $\times$  Region interaction was found ( $p = .014$ ). Post hoc tests revealed that Sibs-Comp showed a greater proportion of time on the mouth than the eyes ( $p = .004$ ), but Sibs-ASD showed no difference in attention to these two regions ( $p = .29$ ; Figure 1). For NIRS, a 2 (Identity: Mother, Stranger)  $\times$  2 (Group: Sibs-ASD, Sibs-Comp)  $\times$  2 (Region: Frontal, Right Lateral) mixed model ANOVA analyzed mean oxyHb responses, and a Group  $\times$  Identity interaction was found ( $p = .013$ ), with Sibs-ASD responding significantly more to mother than stranger ( $p = .026$ ) and Sibs-Comp showing no difference ( $p = .38$ ). An exploratory analysis looked at correlations between eye-tracking and NIRS responses and found that decreased attention to the mouth was associated with increased frontal neural responses ( $r = -.38$ ,  $p = .026$ ; Figure 2), and this was driven by the Sibs-Comp group ( $r = -.51$ ,  $p = .008$ ). Sibs-Comp also showed a trend towards increased attention to the eyes relating to increased frontal neural responses ( $r = .39$ ,  $p = .05$ ).

Conclusions: The current study found interactions with group for both eye-tracking and NIRS measures and relations between attentional and neural responses. For eye-tracking, Sibs-Comp showed increased attention to the mouth relative to the eyes, while Sibs-ASD looked similarly to the two face regions. Across frontal and right lateral brain regions, Sibs-ASD showed greater neural responses to mother than stranger, but Sibs-Comp showed no difference based on identity. Together, this work suggests that differential patterns of attentional and neural responses could underlie face processing in Sibs-ASD and Sibs-Comp in the first year.

**423.030 (Poster)** Impact of Co-Occurring Gestures on Social Visual Engagement to Caregivers in Infants with and without Autism Spectrum Disorder  
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**Background:** Communication to infants occurs multimodally through speech, gesture, and facial expressions. Parents' use of co-occurring gestures with speech facilitates language development, including in children at risk for autism spectrum disorder (ASD). Children with ASD have impairments in both gesture and language development. Using gestures and teaching gesture imitation skills through natural play opportunities may be important for supporting social interaction and may have downstream impacts on child language/communication skills. However, little is known

about how the use of gesture during interactions impacts how infants allocate their visual engagement and if this relates to their later development. We investigated visual engagement in infants with and without ASD within two common contexts that frequently involve co-occurring gestures: infant-directed speech and song.

**Objectives:** Explore the impact of co-occurring gestures on patterns of social visual engagement (SVE) in naturalistic social scenes of infant-directed speech and song in both typically-developing (TD) infants and infants that later develop ASD.

**Methods:** Eye-tracking measures of SVE were collected from infants while they watched videos of a caregiver engaging them naturalistically, using either infant-directed speech (with and without gestures) or song (with and without gestures). Infants were eye-tracked at 12 months (Speech:  $n_{TD}=72$ ,  $n_{ASD}=19$ ; Song:  $n_{TD}=137$ ,  $n_{ASD}=33$ ) and 24 months (Speech:  $n_{TD}=118$ ,  $n_{ASD}=22$ ; Song:  $n_{TD}=159$ ,  $n_{ASD}=41$ ). Data were quantified as the percentage of time infants spent fixated on regions of interest within videos (i.e. eyes, mouth, body, and object). Infants were evaluated for ASD at 24 months by expert clinicians using gold-standard assessments.

**Results:** Patterns of SVE were significantly different between clips with and without gestures in both the speech and song conditions, at both 12 and 24 months, in infants with and without ASD (all  $p$ -values $<0.01$ ). At both 12 and 24 months of age, infants with and without ASD fixated more on the caregiver's body when she used co-occurring gestures in speech or song ( $p$ 's $<0.001$ ). In addition to the main effect of gestures on body-looking, at 24 months, there was a significant interaction with diagnosis in both the speech ( $p<0.001$ ) and song ( $p<0.01$ ) conditions. At 24 months of age, ASD infants fixated more on bodies during videos where the caregiver engaged them with gestures than TD infants, but not in videos without gestures.

**Conclusions:** Co-occurring gestures modulate social visual engagement to caregivers in infants with and without ASD, during both infant-directed speech and song. By 24 months, infants with and without ASD also diverge in their patterns of visual engagement to speech and song with and without gestures. This may reflect differences in children's symbolic development and the communicative value of different components of multimodal, social-communicative signals by this age. Future analyses will explore the adaptive value of SVE to gestures in speech and song contexts for clinical outcomes. This work has implications for interaction strategies that incorporate using animated and exaggerate gestures to modulate SVE in children with ASD.

#### **423.031 (Poster)** Implementing the Get SET Early Model in a Community Setting to Lower the Age of ASD Diagnosis

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#### **Background:**

Despite research indicating that symptoms of autism are present as early as 12-months in many cases (Miller et al., 2017; Ozonoff et al., 2010; Pierce et al., 2011, 2019; Wan et al., 2013; Zwaigenbaum et al., 2015), and that autism can be diagnosed soon thereafter (Lord, et al., 2006; Pierce et al., 2019), the current median age of diagnosis is 51 months (Maenner et al., 2020) and in many states, it is even older. Various reasons exist for late diagnosis, including limited understanding of early warning signs among healthcare professionals and parents, and limited access to diagnostic evaluations (Crais et al., 2014; Daniels & Mandell, 2014). Since diagnosis enables access to early intensive intervention, which improves long-term outcomes (Anderson, Oti, Lord, & Welch, 2009; Dawson, 2008; Dawson et al., 2012; Reichow, 2018), effective screening practices are critical.

**Objectives:** The goal of the present study was to implement a validated early detection program, *Get SET Early*, which results in a mean age of diagnosis of 19 months when mediated through a university research program, in a community clinic setting.

**Methods:** Following *Get SET Early* guidelines, licensed psychologists were trained to provide diagnostic evaluations to toddlers as young as 12 months. Next, 109 primary healthcare providers (PHP) joined the screening network and completed a survey at both baseline and 2 years into the program. PHPs administered the CSBS-IT Checklist at 12-, 18- and 24-month well-baby visits and referred toddlers whose scores fell into the range of concern for a developmental evaluation. For comparison, 18 providers that were not part of the screening network completed a blinded survey to document the use of a screening tool at the same well-baby visit schedule. Mean age of diagnosis was compared to current population rates.

**Results:** PHP screening improved after *Get SET Early* program implementation. Across a 4-year period, 45,504 screens were administered at well-baby visits and 648 children were evaluated at least one time. The median age for ASD diagnosis overall was 22 months, significantly lower than the median age reported by the CDC (57 months). For children screened at 12 months, the age of first diagnosis was significantly lower at 15 months. Of the 350 children who completed at least one follow up evaluation, 323 were diagnosed with ASD or another delay, and 239 (74%) were enrolled in a treatment program.

**Conclusions:** Overall, the *Get SET Early* model was successfully implemented in a community-based center and led to positive changes in pediatrician attitudes and behavior regarding early developmental screening. Toddlers with ASD were diagnosed nearly 3 years earlier than the most recent CDC report for a similar region, which allowed most children to start a treatment program by 36 months. Overall, the *Get SET Early* model was an effective strategy for improving the current approach to screening, evaluation, and treatment referral for toddlers with ASD. Efforts to demonstrate sustainability and scalability are underway.

#### **423.032 (Poster)** Increased Feminine Gender Markers in Toddler Girls with and without Autism Spectrum Disorder

#### Background:

Autism Spectrum Disorders (ASD) has traditionally been considered a predominantly male disorder with a 4:1 ratio. Until recently the majority of research recruited male-skewed samples, leading to a potential self-reinforcing male-biased understanding of the syndrome. Underrepresentation of females and lack of knowledge about female presentation may contribute to delayed or misdiagnosis of girls, despite similarities in symptoms, timing and type of parental concerns. As long as ASD remains a behaviorally-defined disorder it is necessary to address clinicians' sex/gender biases and raise awareness about female phenotypes and women's experiences with ASD. This study aimed to explore the particular phenomenon of Gender-Appearance-Rigidity (GAR; i.e., gender-specific marking) as a potential factor for clinicians' biased expectations and diagnoses. Following research showing that child's sex/gender (e.g., clothing, hair) influences teachers' appraisals of children's behavior and performance, we investigated whether girls with ASD referred for neurodevelopmental assessment exhibit enhanced feminine appearance compared to girls without ASD.

#### Objectives:

(1) Develop and validate a video coding scheme to quantify gender markers in toddler girls; (2) Use the scoring to compare feminine genderness between toddler girls with and without ASD.

#### Methods:

Participants included two age-matched groups of girls, 41 with ASD (mean age: 45.3 months) and 21 without ASD (mean age: 45.2 months). Girls with ASD were recruited from a neurodevelopmental clinic and received a formal diagnosis. Girls without ASD included those who did not receive the diagnosis, as well as 10 typically developing (TD) girls recruited from a mainstream nursery school in the same area. We developed and validated ( $\kappa = 0.82, p < 0.001$ ) a modified coding scheme for GAR by Halim et al. (2018). Four coders, blinded to diagnosis, scored GAR from full-body images extracted from videos. The GAR scoring included markers of gender appearance rigidity in choices of color, texture, and style (i.e., pink/purple, sequins/sparkles, ruffles/frills, dresses/skirts). One point was given for each gender-rigid characteristic.

#### Results:

Differences in GAR scores between girls with and without formal ASD diagnosis were analyzed using the nonparametric Wilcoxon rank-sum test. Total GAR scores did not differ, however compared to girls without ASD, girls with ASD scored higher in stereotypically feminine items. Specifically, they wore more dresses or skirts ( $W = 581.5, p < 0.01$ ) with more gender-rigid accents such as ruffles, frills, or lace ( $W = 537.5, p < 0.05$ ).

#### Conclusions:

This study examines GAR in toddler girls with and without ASD. Based on our modified scoring system (Halim et al., 2018), we found more gender-specific items (i.e., pink, dresses/skirts, ruffles/frills) in girls who received a formal diagnosis of ASD, compared to age-matched girls without ASD and the sample of TD girls. These results suggest that in addition to IQ and behavioral symptoms, increased genderness may contribute to clinicians' best-estimate ASD diagnoses. Furthermore, since toddler girls' clothing is likely based on parents' cultural and socioeconomic background, future studies will determine the importance of social impairment in girls as the basis for parents from diverse backgrounds to use hyperfeminine markers at the time of the diagnostic evaluation.

#### **423.033 (Poster) Infant Sibling's Temperament Associate with Proband Traits of ASD and ADHD**

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#### Background:

Autism spectrum disorder (ASD) and attention deficit/hyperactivity disorder (ADHD) are both highly heritable neurodevelopmental conditions. Having an older sibling (proband) with ASD increases the likelihood of developing ASD symptoms. Dimensional variation of proband symptomology has been shown to predict likelihood of familial ASD recurrence. Likewise, having a family member with ADHD increases the likelihood of developing ADHD. Previous prospective studies have shown associations between fear/shyness to later development of ASD traits, while activity level and attentional measures show similar pattern for later ADHD trait development. However, few previous studies have investigated how proband traits of ASD and ADHD associate with early infant temperament traits in their younger siblings.

#### Objectives:

To investigate how elevated likelihood of developmental disorders and older siblings' ASD and ADHD traits associate with early childhood predictors of ASD and ADHD in infant siblings.

#### Methods:

The study included 411 infant participants (male=213, female=198) and their older siblings with ASD (n=250), ADHD (n=31), both (n=21) or neither (n=106) from the British Autism Study of Infant Siblings (BASIS) and Studying Autism and ADHD Risks (STAARS) studies. A combined group variable was made combining all elevated likelihood children into one category (n=302). For infant temperament, parents completed the Infant Behavior Questionnaire (IBQ) at 8-months and 14-months and the Early Childhood Behavior Questionnaire (ECBQ) at 24-months. Fear/shyness was used as possible early predictors of ASD, while activity level, duration of orientation and attentional shifting/focus were used for ADHD. For proband ASD traits, parents completed Social Communication Questionnaire (SCQ) Lifetime version (n=329). Conners 3 parent questionnaire was used for ADHD traits from which a mean variable was derived using the subscales for inattention and hyperactivity/impulsivity. Latent growth curve models with maximum likelihood method were used for statistical analysis.

#### Results:

Infants with older siblings with more ASD symptoms had higher levels of initial fear/shyness with the effect carrying over all timepoints (figure 1). Neither group nor ADHD traits were significantly associated with fear/shyness. Infants whose siblings had more ADHD traits had higher scores in initial attention and lesser change over time (figure 2). On the other hand, being in an elevated likelihood group was associated with lower initial attention and higher level of change over time. Proband ASD traits were not associated with attention. Higher ADHD traits in older sibling was also associated with increased initial level of activity in infant siblings ( $\beta=.21$ ,  $p=.038$ ) with the effect carrying across all timepoints, while group and ASD traits showed no significant association. There were no associations between the change in activity level over time and proband traits or group.

#### Conclusions:

This is one of few studies investigating how older siblings' traits associate with the development of temperament in their infant siblings. The results show that older siblings' ADHD and ASD traits associate with the temperament trajectories of their infant sibling in a distinctive manner, differentiating across different constructs. Future studies should explore possible connection with later emergence of ASD and ADHD, as temperament traits might be early predictors of later neurodevelopmental disorders.

**423.034 (Poster)** Infant's Visual Attention to Faces and Temporal Frequency: A Prospective Longitudinal Autism and ADHD Study  
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#### Background:

Neurodevelopmental conditions like autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) are diagnosed in early childhood and frequently co-occur. It is important to understand the early mechanisms that could contribute to later difficulties in these neurodevelopmental conditions through prospective studies. Throughout infancy, there are developmental changes in infant's face-scanning patterns, which shapes and reflects their processing of social information like language. Another important component in early learning is how temporal structure of events influences attention. Syllabic speech occurs at 6Hz frequency, but it is unclear how mouths moving at different frequencies affects visual attention. Here we explore looking patterns to faces at various temporal frequencies, in infants with and without autistic and/or ADHD first-degree relatives.

#### Objectives:

To investigate attention to eyes, mouth and temporal structure (i.e. information presented at different frequencies), in infants at typical-likelihood (TL) and elevated-likelihood (EL) of ASD and/or ADHD.

#### Methods:

This prospective study included 161 infants (70 females) from the Studying Autism and ADHD Risks Study (STAARS; [www.staars.org](http://www.staars.org)). At 5- 10- and 14-month timepoints, 29 TL controls, 80 EL-ASD, 31 EL-ADHD and 21 EL-ASD+ADHD infants completed an eye-tracking paradigm ('Frequency Task'). Three 10-second videos of face pairs were presented to the infants (Figure 1A). Each stimulus in the pair displayed the mouth opening and closing at low, mid or high frequencies. An eye-mouth index (EMI; see Figure 1B) was calculated as: upper-face-looking time/(upper-face-looking time + lower-face-looking time).

#### Results:

A Linear Mixed Model was used to investigate the main effects and interactions of likelihood groups, frequency, and age (in months) on EMI. Side of stimulus presentation was a significant predictor, and therefore included as a covariate. Meanwhile, age and participant-ID were included as

random effects. There were no TL or EL group differences in EMI ( $ps > .47$ ), and no effect of frequency ( $ps > .06$ ). However, the main effect of age was significant;  $t(1910) = -5.38$ ,  $p < .001$ ,  $d = 0.69$ ), showing that EMI decreased with age; see Figure 2. Interactions did not reach significance.

## Conclusions:

Typical-likelihood and elevated-likelihood for ASD and/or ADHD infants showed similar patterns of looking to the eyes and mouth. Temporal frequency did not modulate infant's visual attention, suggesting no preference for stimuli presented at the rate of human syllabic speech. As they got older, infants across groups looked more at the mouth than the eyes. This provides support for the primary developmental shift from looking at the eyes towards looking at the mouth, consistent with the age of language emergence. The present study contributes to the developmental literature of infant's face scanning patterns by investigating EMI in EL-ADHD and EL-ASD+ADHD populations. Future work will explore the relation between EMI, later language abilities and ASD outcomes in these infants.

### 423.035 (Poster) Internalizing and Externalizing Symptoms Are Elevated in 3-Year-Olds with ASD and Are Predicted By Temperamental Features at Age 2.

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#### Background:

Internalizing symptoms (e.g., anxiety, depression) and externalizing symptoms (e.g., aggression, oppositional behavior) occur in children with ASD at rates several times higher than in the general population (Salazar et al., 2015), resulting in greater functional impairments and additional challenging behaviors (Brookman-Frazee et al., 2018). Preschoolers with ASD experience more internalizing and externalizing (I/E) symptoms compared to typically-developing (TD) peers (Li et al., 2019) with a subgroup exhibiting high levels of I/E symptoms during preschool- and school-age (Vaillancourt et al., 2017). Models of the emergence of I/E symptoms stress the role of early temperament, particularly Negative Affectivity (NA) and Surgency (SU) (Behrendt et al., 2020; Colder et al., 2002; Putnam & Stifter, 2005; Rothbart, Posner & Hershey, 1995) but little is known about these predictors in children with ASD.

#### Objectives:

Determine 1) if 3-year-old toddlers with ASD differ from non-ASD toddlers on I/E symptoms, and 2) if parent-reported temperament (NA, SU) at age 2 predicts I/E symptoms at age 3.

#### Methods:

Participants included age-matched toddlers with ASD ( $n=67$ ; 81% male) and without ASD ( $n=81$ ; 58% male; with atypical development, TD, and unaffected siblings of children with ASD) during their first visit (Time1;  $M_{age}=21.35m$ ,  $SD=3.38$ ), at which time parents completed the Early Childhood Behavior Questionnaire (ECBQ; Putnam et al., 2006). Negative Affectivity (NA) and Surgency (SU) scores were computed. Approximately one year later (Time2;  $M_{age}=39.16m$ ,  $SD=3.67$ ), parents completed the Early Childhood Inventory-5 (ECI-5; Sprafkin & Gadow, 2014); Internalizing and Externalizing (I/E) composites were derived. Group differences in I/E scores were assessed using group (2) by sex (2) general linear models. Multiple regressions evaluated contributions of Time1 temperament (NA, SU), severity of autism symptoms (ADOS), and cognitive abilities (Mullen Scales: VerbalDQ, NonverbalDQ) to Time2 I/E symptoms.

#### Results:

GLM analyses resulted in significant main effects of group for both ECI-5 Internalizing ( $p<.001$ ) and Externalizing ( $p<.05$ ) but, in both analyses, no effect of sex ( $ps>.694$ ) or group by sex interaction ( $ps>.107$ ). Contributions of NonverbalDQ were not significant in either model ( $ps>=.413$ ) nor was VerbalDQ for Internalizing ( $p=.266$ ), although marginally significant for Externalizing ( $p=.060$ ). Planned contrasts indicated that toddlers with ASD had significantly more severe Internalizing symptoms ( $p<.001$ ,  $d=.996$ ) and Externalizing symptoms ( $p<.05$ ,  $d=.682$ ) than non-ASD toddlers. In the ASD group, multiple regression indicated that among all T1 predictors, ECBQ NA alone was significant and explained 23.4% of the variance ( $R^2=.234$ ,  $p<.001$ ) in age 3 Internalizing symptoms ( $\beta=.483$ ,  $p<.001$ ). Similarly, multiple regression indicated that ECBQ NA explained 18.9% of the variance ( $R^2=.189$ ,  $p<.001$ ) in later Externalizing symptoms ( $\beta=.434$ ,  $p<.001$ ).

#### Conclusions:

By 3 years of age, significant vulnerabilities in internalizing and externalizing symptoms occur in children with ASD compared to peers. As in the general population, both classes of symptoms are predicted by negative temperament assessed a year earlier. Given the relationships between NA and I/E symptoms by late toddlerhood, high negative affectivity in toddlers with ASD should be identified as a potential risk factor for later emotional/behavior problems, which are likely to affect quality of life for children as well as their families.

### 423.036 (Poster) Investigating Discrepancies between Eye-Tracking Measures and Expert Clinician Evaluation of ASD: Discrepancies Reflect Less Diagnostically-Clear Cases

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**Background:** To increase access to timely expert clinical assessment for autism spectrum disorder (ASD), eye-tracking technologies show promise for objectively quantifying biomarkers of atypical social visual engagement (SVE)—a core feature of ASD—and may serve as an effective tool to aid early identification and diagnosis. To that end, an in-depth examination comparing discrepant and concordant cases between eye-tracking and reference-standard clinician best estimate (CBE) diagnosis can help inform that development.

**Objectives:** To examine quantitative differences in profiles of clinically-referred children between 16-45 months for whom eye-tracking and reference-standard CBE of ASD were concordant versus discrepant.

**Methods:** Eye-tracking and clinician assessments were completed concurrently in a large sample of patients referred to a specialty center for evaluation ( $N=243$ ,  $M_{\text{age(months)}}=28.7$ ). Expert clinicians blind to eye-tracking results completed standard-of-care diagnostic evaluations using the *Mullen Scales of Early Learning (MSEL)* and the *Autism Diagnostic Observation Schedule (ADOS-2)* to obtain a CBE diagnosis. Clinicians also rated their level of diagnostic certainty. True Positive (TP) and True Negative (TN) status was assigned based on concordant eye-tracking to CBE. False Positive (FP) and False Negative (FN) status was assigned when eye-tracking was discrepant with CBE. Data were analyzed according to two distinct pairings: FP versus TN (i.e., non-ASD) cases and FN versus TP (i.e., ASD) cases.

**Results:** Paired groups did not differ on age or sex. TN versus FP: Compared to TN ( $n=47$ ) cases, FP ( $n=20$ ) cases had higher ADOS-2 Restricted and Repetitive Behavior (RRB) scores ( $p=0.03$ ,  $d=0.59$ ), but no differences in Total ( $p=0.06$ ,  $d=0.52$ ), Social Affect (SA) ( $p=0.28$ ,  $d=0.29$ ) or MSEL scores ( $ps>0.05$ ). There were no significant differences in diagnostic certainty ( $p=0.99$ ). Notably, 80% of FP and 64% of TN were diagnosed with non-ASD developmental delays or subthreshold ASD traits. TP versus FN: Compared to TP ( $n=148$ ) cases, FN ( $n=28$ ) cases had lower ADOS-2 Total ( $p<0.001$ ,  $d=1.11$ ), SA ( $p<0.001$ ,  $d=1.10$ ), and RRB scores ( $p=0.02$ ,  $d=0.48$ ). The FN group also had higher MSEL verbal ( $p<0.001$ ,  $d=0.74$ ) and nonverbal ( $p=0.02$ ,  $d=0.47$ ) age equivalent scores than the TP group. Clinicians indicated greater diagnostic certainty ( $>80\%$ ) for children in the TP versus FN group ( $p=0.03$ ).

**Conclusions:** Overall, our findings reveal quantitative differences in profiles of children classified concordantly and discrepantly between eye-tracking measures of atypical SVE and a reference-standard CBE diagnosis of ASD. The majority of children for whom eye-tracking indicated ASD but the clinician did not (i.e., FP) received other diagnoses and had higher RRB scores than the TN cases, but otherwise demonstrated comparable developmental and social abilities. This suggests that eye-tracking identified children with more atypical behavioral symptoms. Children for whom eye-tracking did not indicate ASD while the clinician did (i.e., FN) had greater developmental and social abilities than TP cases, suggesting that these children demonstrated fewer or more subtle observable symptoms. Clinicians were less diagnostically certain of children classified as FN. As such, findings provide preliminary evidence that eye-tracking may detect children who display potentially more complex or less diagnostically clear symptom presentations, and who may benefit from additional monitoring and follow-up.

#### **423.037 (Poster)** Multimodal Investigation of Brain Morphology and Local Activity and Connectivity in Young Children with ASD

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**Background:** Previous studies have examined early brain structural abnormalities and functional connectivity in young children with ASD (Wolff et al., 2017). However, little is known about regional brain activity and connectivity in the first years of life in autism. In particular, it is unknown if regions with aberrant neuroanatomy (e.g., morphometric features such as cortical thickness or surface area) also show atypical brain function in young children with ASD. A multimodal investigation examining both structural and functional brain patterns can provide clues about the underlying neurobiology and neurodevelopment in ASD.

**Objectives:** (i) To identify regions with atypical brain morphometry, by investigating the effects of ASD diagnosis, age, and their interactions on surface area (SA) and cortical thickness (CT), and (ii) to examine local activity and functional connectivity in the same regions in young children with ASD, as compared to typically developing (TD) peers.

**Methods:** Participants were young children with ASD (mean age:  $45\pm15$  months) and TD children (mean age:  $44\pm14$  months) enrolled in a longitudinal study of early brain markers of autism. Data from 69 participants (38 ASD, 31 TD) for whom both T1-weighted structural and functional MRI (fMRI) scans were successfully acquired during natural sleep were included. SA and CT measures were extracted from 34 regions of interest (ROIs) per hemisphere using the Desikan-Killiany atlas. To reduce the number of comparisons, Principal Component Analysis (PCA) was carried out, separately for SA and CT, and PCA loadings guided the selection of ROIs for subsequent analyses. The fractional amplitude of low frequency fluctuation (fALFF) and the local correlation index (LCOR) as indices of local activity and connectivity were extracted from the fMRI data, in the ROIs identified through PCA of the neuroanatomical data. Linear regression models were employed with SA, CT, fALFF, and LCOR as outcome variables, and age, diagnostic group, and age by group interaction as predictors (with gray/white contrast-to-noise ratio and head motion indexed by root mean square of displacement as covariates in structural and functional analyses, respectively).

**Results:** PCA revealed an SA component encompassing the pars triangularis subdivision of the inferior frontal gyrus (IFG<sub>p.tri</sub>) and a CT component encompassing the medial and lateral orbitofrontal cortex (OFC). Linear regression analyses revealed no effect of diagnosis, but a main effect of age on IFG<sub>p.tri</sub> SA (positive; Fig. 1a), OFC CT (negative; Fig. 1b,c), and OFC fALFF (negative; see Fig. 2c). An age by diagnostic group interaction effect on IFG<sub>p.tri</sub> fALFF and LCOR was identified ( $p = 0.01$  and  $0.005$ , respectively), with fALFF and LCOR increasing with age in TD children but not in the ASD group (Fig. 2a,b).

Conclusions: Although we found no main effect of diagnosis on brain morphometry in the brain regions showing age-related SA expansion and cortical thinning (cross-sectionally), a lack of neurotypical age-related increase in local activity and connectivity was identified in IFG, pars triangularis among children with ASD. These results suggest that multi-modal investigations of structural and functional brain indices may reveal complementary information on early neurodevelopment in ASD.

**423.038 (Poster)** Pre-Emptive Interventions for Infants and Toddlers at Risk for Autism: A Systematic Review and Meta-Analysis

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Background: Caregivers may observe early indications of delays related to autism before a child reaches one year old; however, deficits become apparent when the child reaches school-aged (American Psychiatric Association, 2013). Risk factors should be evaluated to reduce the severity of autism, and earlier identification should be prioritized (Fulsberg, 2016). A key indicator of development is language; however, development is tough to assess in children at risk for autism. The receptive language performance of a child at an early age predicts long-term development. Nevertheless, researchers rely heavily on linguistic and phonetic milestones as the primary makers of development (Moharir et al., 2014). Emphasis on the receptive domain is critical as all parts of language a child is exposed to play a role in how significant the receptive-expressive language gap is later (Gibson et al., 2014). One option is to evaluate parent-mediated interventions on receptive language. Hampton et al. (2017) observed that young children with receptive and expressive language delays profited from parent-mediated early intervention. Children with expressive language only delay indicated skill increase despite the group they were assigned. This proposal evaluates the receptive domain and provides recommendations for future research to improve the expressive-receptive gap in toddlers at risk for autism.

Objectives: This systematic review and meta-analysis observed the impact of preemptive autism interventions on siblings' receptive language outcomes.

Methods: Criteria for this study included toddlers under 36 months who were "at-risk" for autism, a behavior intervention, child development outcomes, an intervention, and a non-intervention group. The studies had to be completed in English and published after 2009. PsychInfo, PsycArticles, Academic Search Complete, ERIC, and PubMed databases were reviewed. Dissertations, peer-reviewed publications, and conferences were also examined for content. In the end, 16 records representative of 13 studies were reviewed.

Results: Receptive assessments included the Mullen Scale for Early Learning, Vineland Adaptive Behavior Scale, and Clinical Assessment of Speech Perception for Infants and Toddlers. Additional assessments included MacArthur-Bates Communication Development Inventories. Event-related potentials (ERPs) measurement (ERPs) receptive language were compared to test perception. Results showed little effect on receptive language ( $g = -.021$ ,  $se = .173$ ).

Conclusions: Research indicates that early childhood intervention before two can lead to higher gains in development while the brain is still developing (Whitehouse et al., 2021). This finding provides a foundation for future research into high-risk siblings as the severity of autism symptoms may decrease with intervention. Despite the small effect of receptive language outcomes in this study, it plays a vital role in long-term child outcomes. Large-scale diagnoses result in long-term societal and financial burdens on the early childhood education system; therefore, addressing the expressive-receptive language gap is an urgent public health issue. Future research should consider the validity of parent surveys as measures of child outcomes and instead contemplate integrating standardized measures of language for robustness—comparisons in future meta-analyses. Researchers should identify early language markers of both the child and their autistic sibling as potential risk factors.

**423.039 (Poster)** Qualitative and Quantitative Analyses of Early Vocal Productions of 6 Months Old Infants with High-Likelihood of ASD

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Background: The estimates of recurrence of autism within siblings ranges from 10 to 25% and the probability that they have a history of language delays is three to four times higher than siblings of non-autistic children, viz. with a low likelihood of autism; LL-ASD. Beyond investigations into early markers of ASD, conducting observations of HL-ASD infants could also help delineate early signs of atypical language development. Canonical babbling, emerging around 6-months old represent the first typical pre-speech-language milestones. At that young age, this mix of early vocalizations and canonical babbling can be regarded as the pre-linguistic output made available for researchers.

Objectives: The present study, exploratory in nature, tested if at 6 months, significant differences already emerging between infants with higher likelihood of ASD and infants with lower risk of autism in term of volubility (amount total of productions) and of representation of type of productions, consonant inventory and vocalic inventory. We are wondering if infants with HL-ASD will demonstrate significantly more restricted and less diversified consonant repertoire compared to LL-ASD infants and if type and diversity of vocalizations will be correlated with the VABS-II score.

Methods: This corpus is part of the sample of a longitudinal study following infants between 6 and 36-months with HL and LL of ASD. The sample of the present study is composed of 8 males and 9 females HL-ASD and 12 males and 5 females LL-ASD. Manual transcription of infants' productions were made on a daylong recording at 6-months, at home. The entire coding procedure is included in a OSF project co-authored [https://osf.io/y2jxm/?view\\_only=998df871579f445283cb54b89e91ff75](https://osf.io/y2jxm/?view_only=998df871579f445283cb54b89e91ff75). General Logistic Models (Poisson family) were used to investigate both group differences on total amount of productions and on amount of each type of productions (non-vocalic preverbal productions, vocalic preverbal production, proto-word and word).



Results: Results showed a significant effect of group on total production counts ( $\chi^2(1) = 10.82, p = .001$ ) with HL-ASD producing more than LL-ASD ( $\beta = -0.07, z = -3.29, p < .001$ ). Additionally, result also showed a significant group x type interaction on production counts ( $\chi^2(4) = 69.3, p < .001$ ). Further analyses showed that groups did not differ in the production of proto-words and words (both  $p > .97$ ). However, HL-ASD produced more non-vocalics ( $\beta = 0.31, z = 4.37, p < .001$ ) and vocalic ( $\beta = 0.12, z = 5.2, p < .001$ ) pre-verbal productions than LL-ASD. On the other hand, LL-ASD used more syllabic productions than HL-ASD ( $\beta = -0.24, z = -5.2, p < .001$ ).

Conclusions: Preliminary results shown that quantitative and qualitative differences of infant's productions are already measurable at 6-months old between infants with higher likelihood of ASD and infants with lower risk of autism. Further analyses will focus on qualitative differences in term of consonant and vocalic inventories and the relation between early vocal and verbal productions and VABS-II scores.

**423.040 (Poster)** Racial/Ethnic and Socioeconomic Disparities in Identification and Diagnosis of Autism Spectrum Disorder

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Background: Multiple studies have documented disparities in the identification and treatment of Autism Spectrum Disorder (ASD) by race/ethnicity and socioeconomic status (SES). Previous studies have shown that the median age at diagnosis among children with ASD was still higher in Black than White children (48 months vs. 42 months) [1]. Potential barriers to identification of ASD include: lack of healthcare services due to non-citizenship or low-income, a non-English primary language, lack of awareness about ASD, and stigma. A delay in diagnosis can have significant consequences in delaying access to early intensive behavioral interventions such as Early Intervention Programs that have been shown to improve clinical outcomes in children with ASD [1]. Recent studies have begun to show equalizing prevalence among non-Hispanic White, non-Hispanic Black and Hispanic children indicating improvement in identification among minorities and in underserved regions.

Objectives: In this study, we estimated the proportion of children identified with ASD between 2000 and 2016 in New Jersey that received their first professional evaluation by age 36 months of age. Data was further stratified by sociodemographic factors (sex, race/ethnicity, SES) to assess if disparities exist in identification of ASD.

Methods: Data from seven surveillance cycles of active ASD surveillance from New Jersey (NJ ADDM) were utilized. Data collected by the surveillance includes demographic and clinical information obtained from professional evaluations. Age of first evaluation was based on first evaluation abstracted for each ASD case.

Results: Between 2000 and 2016, across seven ASD surveillance cycles, 4,661 children were identified with ASD. Prevalence estimates increased from 1% in the initial 2020 surveillance cycle to 3.1% in the 2016 surveillance cycle. The analysis was restricted to children identified with ASD and born in NJ,  $n = 3,807$  (82%). Overall, 42% ( $n = 1612$ ) of children with ASD received their first evaluation by age 36 months. While there was no difference by sex, bivariate analysis identified differences by race/ethnicity, SES, and intellectual ability. Multivariate analysis showed that no significant differences by race/ethnicity remained when we controlled for SES. Overall, children from high SES areas were twice as likely to receive an evaluation by age 36 months when controlling for sex, race/ethnicity, intellectual ability and birth cohort. We did not identify any improvement or increase in the number of children receiving their first evaluation by 36 months over a 16-year period of ASD surveillance.

Conclusions: Consistent with previous findings, our analysis showed disparities in the first age of identification of ASD. While race/ethnicity is a well-documented factor in receipt of services, our findings indicate that SES is a stronger predictor of receipt of services. Our findings highlight that in a 16-year period the proportion of children with ASD identified early has remained static, highlighting the need for new strategies for early identification of ASD, especially of children from low SES communities.

Acknowledgement: CDC, GCA

**423.041 (Poster)** Relationship between Caregiver-Reported Autism Symptoms and Age, Cognitive Level, and Language Abilities.

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Background: Autism is a neurodevelopmental disorder that emerges in the first few years of life, a dynamic period in which significant growth across a range of domains occurs. Over this time period, children with autism or other developmental delays gradually demonstrate skills that diverge from those of their typically developing peers. Accurate assessment of autism therefore requires careful consideration of the impacts of emerging language and cognitive abilities. The Toddler Autism Symptom Inventory (TASI) is a novel caregiver interview for use in diagnostic evaluations of children 12-36 months of age. While the validity and reliability of the TASI has been demonstrated (Coulter et al., 2021), the contributions of cognitive abilities, age, and language level to the total TASI score have not yet been determined. Given the dynamic development that occurs between 12 and 36 months, investigation of the contributions of these factors is necessary.

Objectives: To examine the impact of age, cognitive skills, and language level on the total score of the TASI.

Methods: Data were obtained during diagnostic evaluations of young children identified as having concerns for autism by screener or provider concern. Diagnostic evaluations included the Autism Diagnostic Observation Schedule (ADOS-2), TASI, Mullen Scales of Early Learning (MSEL),

and developmental history, and clinical best-estimate diagnoses (CBE) were assigned. Children were diagnosed with autism (ASD;  $n=72$ ), another developmental delay (DD;  $n=131$ ), or typical development (TD;  $n=91$ ).

Multiple linear regression was conducted in order to examine the relationship of these factors with TASI total score, above and beyond diagnosis (dummy coded). Child age in months and MSEL expressive language, receptive language, and visual reception age equivalents (MSEL EL ae, RL ae, and VR ae) were included in the model.

Results: Diagnosis, age, and receptive and expressive language abilities were significant predictors of total TASI score. Older age and lower language abilities were associated with higher TASI scores. Nonverbal cognition (MSEL VR ae) was not significantly related to TASI total score. Overall, the model predicted 51% of the variance in TASI total score ( $R^2=.52$ ). Even when accounting for the effect of age and visual reception, expressive language, and receptive language age equivalents, diagnosis remains the most influential contributor to TASI total score.

Conclusions: Results suggest that total TASI score is associated with a child's diagnostic status, as well as their age and receptive and expressive language skills. Total TASI score was not found to be related to visual reception skills. Overall, a child's diagnosis has the strongest relationship with TASI total score. However, the significant contributions of a child's age and language level to the model suggest that these are factors that clinicians must consider carefully when conducting diagnostic evaluations of young children.

#### **423.042 (Poster)** Sleep Challenges and Temperament Among Infants with Autistic Siblings

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##### **Background:**

Subtle indicators of atypical neurodevelopment exist among children with ASD before hallmark symptoms emerge. For example, autistic infants have been observed to experience difficulties with falling asleep in addition to difficult temperament, such as reduced surgency, increased negative affect, and lower regulatory capacity (MacDuffie et al., 2020; Macari et al., 2017). Among neurotypical infants, researchers have found associations between shorter sleep duration and frequent nighttime awakenings with high negative affectivity and reduced regulatory capacity (Mindell et al., 2017). The link between surgency and sleep difficulties is less apparent as some suggest that higher surgency is related to better sleep while others found the opposite (Jian & Teti, 2016). It remains unclear how these two developmental indicators interact and reflect neurological mechanisms underlying ASD.

##### **Objectives:**

The current study uses parent report in a prospective longitudinal design to examine the relationship between early sleep difficulties and temperament among infants with an older sibling diagnosed with ASD (elevated likelihood, EL) and those with no familial history of ASD (low likelihood, LL).

##### **Methods:**

Participants ( $n = 39$ ; EL,  $n = 10$ ; LL,  $n = 29$ ) were enrolled in a prospective longitudinal study on early autism symptoms. At 6 and 12 months, caregivers completed the Short Form of the Infant Behavior Questionnaire-Revised (IBQ-R) (Putnam et al., 2014). To understand how sleep difficulties are related to temperament, a new scale of Sleep Challenges was created with items related to falling and staying asleep as had previously been done with the Very Short Form (Macduffie et al., 2020). We investigated trajectories of sleep difficulties between EL and LL groups with linear mixed-effects models. In addition, associations between early sleep difficulties and IBQ-R scales were examined.

##### **Results:**

As expected, sleep difficulties were significantly higher in the EL group than in the LL group ( $F(1, 37) = 6.94, p = .01$ ), but sleep difficulties did not decrease over time for either group. Significant positive associations among Sleep Challenges and Smiling and Laughter ( $r = .68, p = .03$ ) were found in the EL group at 6 months. Within the LL group, Sleep Challenges were negatively correlated with Perceptual Sensitivity ( $r = -.43, p = .02$ ) at 6 months and positively associated with Approach ( $r = .59, p = .01$ ) and High Pleasure at 12 months ( $r = .51, p = .02$ ).

##### **Conclusions:**

The results of this preliminary study suggest that sleep difficulties are significantly higher among children with autistic siblings and this trend remains stable between 6 months to 12 months of life. Sleep difficulties were not significantly associated with regulation/orientation as previously considered, but instead with various aspects of surgency in both groups. Findings of this study point to the possibility that early predictors of sociability are related to temperamental challenges of falling and staying asleep. Additional research is needed to examine objective measures of sleep alongside temperamental measures and its relationship to clinical outcomes.

#### **423.043 (Poster)** Symptoms of Executive Dysfunction and ADHD Are Linked with Poorer Adaptive Functioning in 3-Year-Olds with ASD

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**Background:** Executive functioning (EF) deficits and attentional problems co-occur frequently with autism spectrum disorder (ASD) and have a long-term detrimental impact on the quality of life for affected children and their families (Rosenthal et al., 2013; Simonoff et al., 2008). Elevated symptoms of EF impairments and attention deficit-hyperactivity disorder (ADHD) are already present in preschool-aged children with ASD, although it is not clear when they first begin to manifest at clinically relevant levels (Smithson et al., 2013; McLean et al., 2014). Timely identification of regulatory and attentional problems may hasten access to early intervention and alleviate their long-term consequences.

**Objectives:** Determine (1) if EF deficits and ADHD symptoms are elevated in 3-year-olds with ASD compared to siblings of children with ASD, typically developing (TD) toddlers, and toddlers with atypical development; and (2) if the co-occurring symptoms have negative effects on adaptive functioning in ASD.

**Methods:** Participants included 73 toddlers with ASD, 34 unaffected siblings of children with ASD (SIB), 36 toddlers with atypical developmental features (ATP), and 30 TD toddlers (TYP) matched on age ( $M = 38.97$  months,  $SD = 3.09$ ). EF deficits and ADHD symptoms were measured using parent report on the Behavior Rating Inventory of Executive Function – Preschool Version (BRIEF-P; Gioia et al., 2003) and Early Childhood Inventory-5 (ECI-5; Sprafkin & Gadow, 2014), respectively. Adaptive skills were measured using the Vineland Adaptive Behavior Scales-II (VABS-II; Sparrow et al., 2005). Group differences in EF and ADHD scores were assessed using group (4) x sex (2) general linear models (GLM). Multiple regression was used to assess relationships between EF deficits, ADHD symptoms, and adaptive skills in the ASD group. Whenever appropriate, analyses controlled for developmental level using the Mullen Scales of Early Learning (MSEL, 1995), autism severity using the Autism Diagnostic Observation Schedule-2 (ADOS2; Lord et al., 2012), and sex.

**Results:** GLM analysis indicated main effects of group in both BRIEF-P Global Executive Composite (GEC) and ECI-5 ADHD-Combined (ADHD-C) scores. Planned comparisons revealed that the ASD group had significantly higher mean GEC and ADHD-C scores compared to each of the three comparison groups (all  $p < .002$ , Cohen's  $d$  0.68-1.34, **Figure 1**). Regression analysis revealed that higher GEC and ADHD-C scores were each associated with lower VABS-II scores across social, communication, and daily living skills domains. Importantly, neither severity of EF deficits nor ADHD scores correlated with autism symptom severity ( $r = .09$  and  $r = .15$ , respectively).

**Conclusions:** By the age of 3, children with ASD exhibit marked challenges in executive functioning and attention/hyperactivity compared to toddlers at increased likelihood for ASD due to familial factors, those with other developmental challenges, and TD peers. Further, greater severity of co-occurring conditions was associated with lower adaptive skills in ASD. These differences can be detected using parent-based questionnaires. Considering the links with adaptive skills, EF and attentional deficits should be targeted for intervention early on to ameliorate their cascading effects on long-term outcomes and quality of life of children and their families.

#### **423.044 (Poster)** Temperament in Infancy in Relation to Symptom Load of ASD and ADHD in Older Siblings

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#### **Background:**

ASD is a highly heterogeneous condition with many affected children showing co-occurring symptoms of ADHD. However, it remains unclear whether early emerging phenotypic markers for ASD and ADHD are shared or distinct. Infant sibling studies have several advantages in order to understand the early development of later diagnostic outcome (Johnsson et al., 2016). However, certain features or behaviors might not necessarily be predictive of later symptoms or outcome but still be important liabilities that contribute to elevated likelihood for ASD and ADHD (Constantino, 2018; 2021). We reason that by using a *between* sibling design we might be able to reduce factors that may modify or alter developmental trajectories. Thus, a valuable way to study the early expression of elevated likelihood independent of outcome is to explore associations to symptoms in the proband.

#### **Objectives:**

To explore early specific and/or common temperamental markers of co-occurring ASD and ADHD by examining phenotypic associations *between* sibling behaviors. We use proband symptoms of either ASD or ADHD as a proxy for familial likelihood for these conditions.

#### **Methods:**

The sample consisted of 214 infants at elevated likelihood of ASD between 7 to 12 months of age ( $M = 9.39$  months,  $SD = 1.03$ ), and a respective older sibling diagnosed with ASD ( $M = 7.06$  years,  $SD = 2.63$ ). We used the Infant Behavior Questionnaire Revised (IBQ-R; Gartstein & Rothbart, 2003) to assess infant temperament. In terms of symptoms of ASD and ADHD in the older sibling, we used the Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003) and the Conner's Rating Scale- 3 (CRS-3; Conners, 1989, 2008), respectively.

#### **Results:**

We found distinct as well as common relations between infant temperament and the sibling symptoms of ASD and ADHD. First, poor approach behavior and low cuddliness was specifically related to higher sibling symptoms of ASD. Second, high levels of infant activity were specifically related to higher levels of ADHD symptoms in the older sibling. Lower infant soothability was related to higher levels of ASD and ADHD symptoms in the older sibling.

#### Conclusions:

This explorative study shows distinct but also common phenotypic profiles of likelihood for ASD and ADHD which can be detected from 10 months of age by dimensional proband phenotyping. By furthering our understanding of how early developmental liabilities spread across family members we might improve our understanding of the heterogeneity of these disorders. Finally, we reason that these traits might constitute early liability that contribute to elevated likelihood for ASD and ADHD and might serve as part of early intervention strategies to alleviate later difficulties.

#### **423.045 (Poster)** The Role of Predictability in Social Rhythmic Entrainment in TD and ASD Toddlers

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#### Background:

Typically developing (TD) children are sensitive to the rhythm and timing of social engagement from infancy (Beebe et al., 2016). In contrast, children with Autism Spectrum Disorder (ASD) have impairments in social timing and coordination (Ozonoff et al., 2010). However, in our recent work using child-directed singing, a naturally-occurring, rhythmic, social interactive behavior, both TD and ASD toddlers rhythmically modulated their social visual engagement, as observed by increased looking to the eyes of a singing caregiver, time-locked to the song beats (Chawla et al., INSAR 2021). As rhythmically important moments, beats are temporally predictable and associated with meaningful social-communicative cues such as caregivers' wide-eyed, positive facial expressions, which may potentiate rhythmically entrained eye-looking in toddlers. Given the critical importance of eye-looking for understanding social information, we examined whether time-locked attention to eyes is modulated by the temporal predictability of the social information.

#### Objectives:

To examine the role of rhythmic predictability on entrainment of eye-looking during child-directed singing in TD and ASD toddlers.

#### Methods:

Thirty-two age- and sex-matched TD (n=16) and ASD (n=16) toddlers (18-37 months) watched videos of an actress engaging them with child-directed singing while eye-tracking data were collected. Stimuli videos included natural rhythmic versions of songs as well as experimentally-manipulated versions in which the rhythmic structure was disrupted by randomly jittering inter-beat intervals (duration of all intervals randomly expanded or contracted up to 50%). Eye-looking was quantified as the amount and timing of toddlers' fixations on actresses' eyes. We measured whether changes in looking to the eyes of actresses were time-locked to the beats using permutation testing of crosscorrelograms compared with chance rates of eye-looking.

#### Results:

Both TD and ASD toddlers demonstrated significant rhythmically-entrained eye-looking during the original singing ( $p < 0.05$ , by permutation testing), albeit with peak magnitudes of increase that were numerically reduced in ASD versus TD toddlers: 5.3% ASD versus 9.0% TD (non-significant difference in this initial sample). When experimentally-manipulated, reduced-predictability singing was presented, both TD and ASD groups showed less entrained eye-looking than for the original, rhythmically-predictable singing (6.5% TD,  $p < 0.05$ ; 4.4% ASD,  $p > 0.05$ ). Notably, during the reduced-predictability singing, change in ASD eye-looking was no longer significantly different from chance for the ASD toddlers (Figure 1), although in TD toddlers there remained a small increase over levels expected by chance alone.

#### Conclusions:

These findings suggest that rhythm is an important structuring mechanism for social behavior during early childhood. Rhythmic predictability may serve as a structuring mechanism to help children coordinate their behavior to important moments of social-communicative signaling. Decreased predictability may be particularly detrimental for toddlers with ASD, who may be less able to flexibly accommodate such unpredictable cueing. Future work will further analyze effects of rhythmic predictability in a larger sample and examine how different social cues combine to scaffold toddlers' looking behaviors. These results have implications for the use of rhythmic predictability during natural social interactions to scaffold social behavior.

#### **423.046 (Poster)** Trajectories of Language Development in Young Children with and without Autism Spectrum Disorder in Taiwan

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**Background:** Language development is an important issue and plays a critical role in outcomes in young children with developmental disabilities (DD), including autism spectrum disorder (ASD) and non-ASD delays (e.g., language delay, developmental delays). However, few studies have explored the trajectories of language development in young children with and without ASD.

**Objectives:** This study aimed to investigate the trajectories of receptive and expressive language development in young children DD, including ASD and non-ASD delays, across 3 years by a longitudinal study. Besides, further exploring the relations between trajectory class assignment and diagnostic outcomes 3 years later, and the characteristics of early abilities among trajectory classes to provide implications to early intervention.

**Methods:** One hundred and one young children with DD in a rural county in Taiwan were recruited at the mean age of 21.88 months old (Time 1). Receptive and expressive language abilities were assessed by the Mullen Scales of Early Learning (MSEL) and were followed up 1.5 (Time 2) and 3 years (Time 3) after the first assessment. Based on information at Time 3, participants were divided into ASD (n = 54) and non-ASD delays (n = 47) group. Growth mixture modeling analyses were respectively conducted to receptive language developmental quotients (RLDQ) and expressive language developmental quotients (ELDQ) assessed over three time points for investigating the trajectory classes.

**Results:** The results showed that receptive language development in young children with DD could be identified with three trajectory classes: age-expected, delay catch-up, and delayed trajectory class. While expressive language development could only be identified with two trajectory classes: delay catch-up and delayed trajectory class. The trajectory class assignments in receptive and expressive language development were respectively related to diagnostic outcomes three years later. A majority of young children with ASD were assigned in trajectory classes of receptive and expressive language development with worse outcomes. In addition, children with better ability levels in receptive or expressive language development showed better performances on their early nonverbal developmental quotients (NVDQ), developmental quotients (DQ), social-communication skills, and autistic symptom severity. However, early adaptive functioning did not show significant differences among those children assigned in the two trajectory classes of expressive language development.

**Conclusions:** Trajectories of receptive and expressive language development in young children with DD are heterogeneous. The trajectory class assignment in receptive and expressive language development were related to the diagnostic outcomes. Besides, children with better outcomes on language development showed better performances on most early abilities. Findings of the current study provides implications for clinicians to plan suitable early intervention to young children with DD based on individuals' developmental characteristics.

**423.047 (Poster)** Trajectories of Visual Attention to the Mouth during Infant-Directed Speech and Song in Infants with and without ASD over the First Year of Life

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**Background:** Infant directed speech (ID-speech) is a universal form of communication by which caregivers engage with their infants. In comparison to adult-directed speech, ID-speech is characterized by notable rhythmicity, increased pitch variability, and exaggerated and repetitive frequency contours (Fernald 1992). These characteristics increase the perceptual saliency of speech to capture and maintain infants' attention. Over the first year of life, when engaged with ID-speech, infants gradually shift their gaze from the eye region to the mouth region of the caregiver, as the mouth region provides synchronous visual cues to support language development (Tenenbaum et al. 2015). Another form of communication, infant-directed song (ID-song), exaggerates the characteristics of ID-speech through increased rhythmic predictability, repetition, and audiovisual synchrony. The multimodal cues of ID-song maintain infant attention longer than ID-speech (Tsang et al. 2017). Infants with ASD also attend to the faces of singers for longer durations, and for similar durations as typically developing infants, than to faces of speakers (Macari et al. 2020; Thompson & Abel 2018). However, how infants with and without ASD allocate visual attention to the face during ID-song, and whether this differs from ID-speech, is unknown.

**Objectives:** Examine visual fixations to the mouth over the first year of life (3-12 months of age), across ID-speech and ID-song conditions, in typically developing (TD) infants and those later diagnosed with autism spectrum disorder (ASD).

**Methods:** TD infants (N = 351) and those later diagnosed with ASD (N = 61) were eye-tracked at 3, 4, 5, 6, 9, and 12 months of age, while watching videos of caregivers singing a song (ID-song) or speaking (ID-speech). Eye-tracking data was quantified as the proportion of face-looking time (PFLT) spent on the caregivers' mouth (i.e. number of fixations to mouth region/number of fixations to face (mouth and eyes); PFLT-mouth). A linear mixed model assessed changes in mouth-looking (PFLT-mouth) by age, condition (ID-speech vs. ID-song), and diagnosis.

**Results:** Across diagnostic groups, a significant main effect of age indicated that PFLT-mouth significantly increased with age ( $\beta = .033$ ,  $p < .001$ ). Infants also exhibited greater PFLT-mouth in ID-song compared to ID-speech ( $\beta = -.052$ ,  $p = .005$ ). A significant interaction between age and condition indicated that PFLT-mouth increased at a faster rate for ID-song than ID-speech ( $\beta = -.009$ ,  $p < .001$ ; Figure 1).

**Conclusions:** Over the first year of life, infants with and without ASD allocate more facial visual attention to the mouth. This effect is greater during ID-song compared to ID-speech potentially due to the increased rhythmicity and audiovisual synchrony provided during song. Next steps will explore differential adaptive value of attention to the mouth during ID-speech vs. ID-song on language development in TD and ASD infants. These findings may have implications for early interventions aimed at improving language development in infants at risk for ASD, as well as processes that may underlie differential attention to ID-song and ID-speech.

**Figure 1:** Proportion of mouth fixation (mouth/face fixation) vs age in ASD and TD infants during ID-Song and ID-Speech.

#### **423.048** (Poster) Trends in Regressive Autism between 2000 and 2016

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##### **Background:**

Autism Spectrum Disorder (ASD) is a neuro-developmental disorder characterized by restricted, repetitive patterns of behavior and limited social and communication skills. ASD is often diagnosed in early childhood and may be classified as regressive or non-regressive. Published research suggests that regression in ASD occurs in 10-30% of children who are diagnosed with ASD and is characterized by initial attainment of developmental milestones in year one, followed by loss of language and social skills between the ages of 18 to 30 months. The definition and parameters of regressive autism are controversial. In the past, loss of language skills, which is often the factor most readily identified by parents, has been used as the sole factor in defining regression. To date, few studies have reported on the prevalence and expression of regressive ASD from population-based studies.

##### **Objectives:**

The objective of this study is to report on trends in the prevalence of regressive ASD across a 16-year-period, from 2000 to 2016.

##### **Methods:**

ASD cases were identified and characterized through the New Jersey Autism Study, a longstanding Autism and Developmental Disabilities Monitoring (ADDM) Network site. The ADDM surveillance method utilizes a two-phase process based on review, scoring and analysis of information contained in educational and health evaluations. Regressive ASD was defined as documented indication in professional evaluations, by either parent report and/or by a qualified professional, noting loss of skills in either language and/or social ability, before the age of 36 months. The definition and scoring of regressive ASD was maintained across all 7 surveillance cycles from 2000 to 2016 in the New Jersey surveillance region.

##### **Results:**

Across seven cycles of ASD surveillance, 4,661 8-year-old children with ASD were identified. Among those, 690 cases (15%) satisfied the case definition of regressive ASD. Regressive ASD prevalence ranged from 1.4 per 1,000 (95% CI:1.0-1.8) in 2000 to 4.6 per 1,000 (95% CI:3.9-5.4) in 2016, a 3.3-fold increase over the period. Overall, regressive ASD ranged from 6.1% in 2000 to 22.2% in 2016 of ASD cases across the surveillance cycles. Regressive ASD increased 4.2-fold among males and 2.2-fold among females. Among Hispanic children, regressive ASD increased from 0.64 per 1000 in 2000 to 5.3 per 1,000 in 2016, which was the highest rate of regressive ASD prevalence. The median age of the onset of regression was 20 months. Overall, children with regressive ASD were more likely to be categorized with severe impairment and to have higher rates of intellectual disability compared to children with non-regressive ASD. Children with regressive ASD were highly likely to have an ASD diagnosis before 8-years.

##### **Conclusions:**

This study indicates that 1 in 7 children with ASD experience developmental regression. Our findings also show that increases in ASD prevalence have occurred broadly, including for children with the regressive ASD subtype and that children with regressive ASD are more likely to have severe impairment.

#### **423.049** (Poster) Unique Pathway to Social Communication Intervention with or without an Autism Spectrum Disorders (ASD) Diagnosis

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##### **Background:**

Autism Spectrum Disorders (ASD) are among the most prevalent developmental disabilities among children with a current prevalence of one in 54 (Maenner et al., 2020). A number of factors contribute to increased ASD risk, including perinatal and other medical complications (Hyman et al., 2020). These risks can be considerable as preterm and early term births are associated with a three-fold increase in ASD risk (Crump et al., 2021).

The expansion of evidence linking preterm birth and medical complexities to ASD risk highlights the need for creative paths to timely and effective early intervention for high-risk populations who may or may not have a formal diagnosis of ASD. Empirically-validated treatments like Naturalistic Developmental Behavioral Interventions (NDBIs; Schreibman et al., 2015) serve to support social communication in this population by utilizing developmental principles and behavior strategies. Project ImPACT (Ingersoll & Dvortcsak, 2019), one NDBI example, has been found to be efficacious in supporting the imitation and language skills of toddlers at high-risk for ASD due to having an older sibling with ASD (Yoder et al., 2021). Despite its promising support for use with young children with and without a diagnosis of ASD, this model has yet to be examined within other high-risk groups.

##### **Objectives:**

This study sought to: 1) examine the profiles young children with or at heightened-risk for ASD due to medical complexities and/or significant prenatal or perinatal birth complications (including preterm birth and very low birth weight) who were referred to an outpatient clinical program; and 2) assess intervention outcomes following participation in a Project ImPACT parent-mediated treatment model.

#### Methods:

Ten participants (13 to 35 months) and their primary caregivers were referred to an outpatient clinical program targeting social communication deficits in children at or under the age of 36 months (Target: 20 toddlers by 05/2022). Referrals were placed from specialty clinics within a children's hospital in a major metropolitan area. Specialty clinics targeted medically complex children demonstrating neurodevelopmental delays and/or children with significant prenatal and perinatal risks. Five of ten received an ASD diagnosis prior to participating in Project ImPACT. Intervention was delivered once per week for 12 weeks. Outcomes included score change on the *Social Communication Checklist (SCC)* (Wainer et al., 2017) and *Infant Toddler Checklist (ITC)* (Wetherby & Prizant, 2002), progress towards treatment goals made in collaboration with parent, parent satisfaction, and changes in parent sense of competence.

#### Results:

Data collection is ongoing. Preliminary analyses for participants who completed admissions and not actively in treatment ( $n = 2$ ) suggest participants met 75-100% of goals set at week 1. Further, participants' scores on the SCC increased 5-17% over the course of 12 weeks, representing modest increases in social communication skills.

#### Conclusions:

Targeting social communication and play through Project ImPACT for a group of young children at elevated risk for ASD due to perinatal complications and/or medical complexities holds promise. We aim to examine change across a range of measures to describe the program's effectiveness, the differences made in each child's communication profile, and parent satisfaction.

#### **423.050 (Poster) What Are You Looking at? – Gaze Following with and without Target Objects in ASD and TD**

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Background: While children with Autism Spectrum Disorder (ASD) are often reported to follow gaze less than typically developing (TD) children in natural settings (e.g. Dawson et. al, 2004), several experimental studies have reported comparable performance across groups (e.g. Akechi et. al., 2011; Parsons et. al., 2019). Previous studies comparing infants at elevated likelihood (EL) of ASD versus TD infants have manipulated aspects relating to the gaze cue (e.g. compared performance in response to eye gaze only versus eye gaze and head movement in conjunction; Thorup et. al., 2016), but the role of the object being attended to by the other is not known.

Objectives: The aim of this study was to assess gaze following when target objects were either present or absent in the direction of an interaction partner's gaze. The study was conducted by the use of live eye tracking, and performance was compared between infants with later ASD and other infants.

Methods: The experiment was conducted at 10, 14 and 18 months. Infants were either at elevated likelihood of ASD (due to having an older sibling with the diagnosis) or TD control infants. All infants went through diagnostic assessment at age three, and were divided into the following groups: EL infants meeting diagnostic criteria for ASD (EL-ASD,  $N = 25$ ), EL infants not meeting diagnostic criteria (EL-no-ASD,  $N = 72$ ) and TD control infants ( $N = 29$ ). During the eye tracking experiment, the infants watched an experimenter gaze in the direction of an area where a target object (doll or stuffed animal) was either present or absent. Dependent measures were gaze following accuracy, looking durations at target and experimenter, and latency to look back at the experimenter after following gaze.

Results: No group differences in terms of gaze following accuracy or looking durations were found. In the latency measure, a group by condition interaction effect emerged,  $p = .030$ . After following gaze, EL-ASD infants looked back at the experimenter faster than TD infants when no target objects were present,  $p = .046$ . There was no difference between groups when target objects were present,  $p = .448$ .

Conclusions: The results add to a number of studies suggesting that gaze following in infants with later ASD is largely typical. However, they also suggest that subtle atypicalities may occur just *after* gaze following. Previous studies have indicated that children with or at elevated likelihood of ASD may be less influenced by others looking behaviors when processing objects in the common attentional focus (e.g. Falck-Ytter et.al., 2015). The current finding that infants with later ASD look back at the experimenter faster than TD infants after following gaze to areas without target objects may be in line with this hypothesis. Compared to many other studies of early gaze following, the current study has the advantage of being performed during live interaction, rather than by the use of pre-recorded stimuli.

#### **423.051 (Poster) Robotese and Mothers: Examining Patterns of Attention Preference in Infants and Toddlers in Eye-Tracking Paradigms**

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**Background:** Well-established benefits of infant-directed speech (IDS), or “motherese,” for infants and toddlers include learning to respond to joint attention (JA), recognizing emotions, and attending to language input (Filipe et al., 2018; Saint-Georges et al., 2013). Young children typically demonstrate an early preference for IDS, however children with autism spectrum disorder (ASD) risk do not often demonstrate the same social orienting preference (Filipe et al., 2018; Kuhl et al., 2005). In this population, preferential attention patterns include non-social stimuli and non-human social partners such as robots (Anzalone et al., 2018; Boccanfuso et al., 2017; Chevalier et al., 2020; Zheng et al., 2018). For some children, interactions with robots have been characterized by increased turn-taking, more frequent joint attention, and increased language use (David et al., 2020; Chevalier et al., 2020). However, specific aspects of robots that elicit heightened social interest remain to be understood. Thus, directly comparing child social attention to *motherese* versus *robotese* (e.g., the speech and gestural qualities of robots) may yield novel insight regarding such preferences.

**Objectives:** The current study utilizes eye-tracking paradigms to compare visual attention patterns of infants and toddlers to contrasting, dynamic social stimuli that include both *motherese* and *robotese*.

**Methods:** Participants included a sample of ten typically developing infants and toddlers ( $n = 10$ ) age 7-17 months ( $\pm 2$  weeks). Consistent with prior eye-tracking empirical studies with young children, we measured gaze fixation, duration, and total looking time in the context of novel video stimuli (see Figure 1). Child developmental profiles were obtained using the *Mullen Scales of Early Learning* (MSEL; Mullen, 1995) and the *Early Social Communication Scales* (ESCS; Mundy et al., 2013).

**Results:** Preliminary eye-tracking results indicate similar patterns of visual attention for both IDS and robotese conditions. Patterns of heat maps in each stimuli condition indicate that children allocate attention preferentially for faces in both the motherese and robotese conditions (see Figure 1). An exemplar stimuli video clip including social agents providing both IDS and robotese cues simultaneously, gaze plot trends confirm allocation of visual attention in a triadic manner (see Figure 2). This exemplar highlights the finding that young children looked back and forth between the robot, woman, and shared object of interest and indicates that infants respond to the speech and gestural qualities of both social agents similarly.

**Conclusions:** Findings from the current study confirm the preferential attention patterns in young children typically demonstrate in response to IDS/*motherese* are also observable in eye-tracking paradigms. And, these patterns are not exclusive to IDS; children also allocated and sustained similar patterns of visual attention to *robotese*. Given the growing utility and relevance of social robotics as engagement tools for individuals with ASD and autism risk, our results indicate social robotics may also be a potential social attention and engagement tool for very young children. Future studies should investigate visual patterns observed in the current study with neurodiverse samples to examine potential implications for robotics as a tool to facilitate social orienting and to target attention behaviors in early intervention.

**423.052 (Poster)** Visual Attention to the Mouth and Language Acquisition in Infants with and without Autism Spectrum Disorder during the Second Year of Life: Considering Communicative Context

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**Background:** Infants show shifting patterns of social visual engagement to caregivers' faces over the first two years of life, which is associated with the development of speech and language abilities: typically developing (TD) infants show increases in mouth-looking around the time of first spoken words (Lewkowicz et al., 2012), and this is positively associated with expressive language abilities (Habayeb et al., 2021). In contrast to TD infants, infants later diagnosed with autism spectrum disorder (ASD) exhibit persistent mouth-looking over the first two years of life (Jones&Klin,2008), the adaptive value of which may differ depending on specific child and stimuli characteristics. Prior studies, however, predominantly focus on infant-directed speech (ID-speech), or do not differentiate between ID-speech and infant-directed song (ID-song) contexts. ID-song exaggerates the characteristics of ID-speech through increased rhythmic predictability, repetition, and audiovisual synchrony, which promotes attention to the mouth (Sahoo et al., 2021). Additionally, infants with ASD attend to ID-song for longer durations, and at levels comparable to TD infants, than ID-speech (Macari et al., 2020).

**Objectives:** Investigate the differential adaptive value of visual attention to ID-speech and ID-song on language development in infants with and without ASD.

**Methods:** Participants were chronological age-matched infants between the ages of 10 and 25 months (ASD ( $n=54$ ,  $M_{age}(SD)=20.43$  (3.59) months); TD ( $n= 28$ ,  $M_{age}(SD)=19.09$  (4.18) months). Eye-tracking data was collected while infants viewed videos of actresses across three communicative contexts: (1) ID-speech, (2) ID-song-without-gestures, and (3) ID-song-with-gestures (i.e., fingerplay). (ID-song with and without gestures are both ecologically valid social interaction styles but are associated with different patterns of visual engagement (Nicholson et al., 2021); hence they are considered as separate communicative contexts here.) Visual fixation to the actresses' mouth was compared across communicative contexts in TD and ASD infants; within-group correlations tested for associations between visual fixation and concurrent *Mullen* receptive and expressive language age equivalence scores within each communicative context.

**Results:** There was a significant effect of communicative context on levels of mouth fixation ( $p<.001$ ) such that ASD and TD infants look more to mouths in ID-song-without gestures than ID-song-with gestures or ID-speech contexts, which did not differ from each other. TD infants fixated more on mouths than ASD infants overall ( $p=0.015$ ). Among TD infants, mouth-looking to ID-speech was positively associated with expressive language ( $r=0.44$ ,  $p=0.028$ ) and mouth-looking to ID-song-with-gestures was positively associated with expressive ( $r=0.48$ ,  $p=0.032$ ) and receptive language ( $r=0.77$ ,  $p<.001$ ). In ASD infants, mouth-looking to ID-speech and ID-song-with-gestures were not associated with language ability, but mouth-looking to ID-song-without-gestures was positively associated with receptive language ( $r=0.29$ ,  $p=0.041$ ).



**Conclusions:** Although ASD and TD infants' visual fixation patterns varied similarly across different communicative contexts, the adaptive value of mouth-looking to ID-speech and ID-song (with and without gestures) on language development differed by diagnosis and communicative context, potentially reflecting different underlying mechanisms. Future research will investigate the processes linking mouth looking during ID-song and ID-speech contexts with language development in ASD and TD infants. These findings have implications for early interventions aimed at improving language development in infants at risk for ASD.

## VIRTUAL POSTER SESSION — EARLY DEVELOPMENT (< 48 MONTHS)

### 523 - Early Development (< 48 months) --- (V)

**523.008** (*Virtual Poster*) An Examination of Social-Communication Behaviours in Infants and Toddlers in the General Population  
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**Background:** Children's development is marked by specific behaviours and skills that emerge in a relatively predictable sequence (i.e., developmental milestones), which are monitored through methods such as developmental surveillance, informal checklists, and validated screening tools. Most of the focus on developmental milestone research to date has been on motor skill development, with relatively fewer studies examining social-communication milestones. Further, available guidelines often do not cite the sources of data used to operationalise the milestones described. As differences in social-communication development are key predictors of a diagnosis of autism, it was of interest to examine the development of these behaviours in the general population. Examining when children typically achieve such milestones using a large, representative sample may further inform when markers of social-communication development could be considered delayed.

**Objectives:** The primary aim of the current study was to further our understanding of the chronological ages at which most infants and toddlers achieved specific social-communication and language milestones. A secondary aim was to ascertain whether there are any gender differences in these social-communication and language milestones. Lastly, we aimed to examine the subgroup of infants and toddlers who do not achieve these milestones at set ages, and examine what proportion had a diagnosis of autism, developmental and/or language delay, or were typically developing.

**Methods:** Participants included 13,507 children (7016 male, 6491 female) who were monitored by Maternal and Child Health (MCH) nurses using a developmental surveillance tool for autism: Social Attention and Communication Surveillance (SACS) during one or more free routine health checks at 12, 18, 24 and/or 42 months. The checklist used at each time point contained 12-15 social-communication items which the MCH nurse rated as 'typical' or 'atypical' based on elicitation of behaviours during the health check.

**Results:** The results suggested that for each of the behaviours (i.e., developmental milestones) monitored, there were  $\geq 90\%$  'typical' responses for all items except pointing at 12-months (85.8%). When looking at gender differences, a higher proportion of females had typical responses on all social-communication and language milestones compared with males across age groups, though not all differences were significant. It was noteworthy that for some social-communication behaviours, the majority ( $\geq 70\%$ ) of children who were rated as having an 'atypical' response were in the typically developing group: for pointing, waving/gestures, expressive and receptive language, and imitation at 12-months, for expressive and receptive language, and points to facial features at 18-months, and for expressive language and two-word utterances at 24-months.

**Conclusions:** The findings of this study can inform our understanding of the emergence of social-communication milestones, and help contextualise observed, or not observed, behaviours across early development. This, in turn, will assist professionals to interpret, and communicate to parents, when particular key early markers of autism (e.g., lack of pointing at 12 months) may be present in typically developing children. The findings have implications for MCH nurses and other primary health practitioners, as they may help normalise certain social-communication behaviours not present at expected 'milestones' with families.

**523.009** (*Virtual Poster*) Atypical Developmental Trajectories and Loss of Skills in Children at Elevated Likelihood for Autism Spectrum Disorder.  
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**Background:** Prospective studies, in which children at elevated likelihood (EL) for ASD are followed from birth until 36 months, showed that on a group level, children with ASD demonstrated increasing trajectories of non-verbal and language skills over time. However, loss of language skills occurred in a subset of children (Landa et al., 2013). Other studies indicated a largely intact typical development between 2-6 months followed by declining trajectories and loss of early social-communicative skills in the majority of children who receive an ASD-diagnosis (Ozonoff & Iosif, 2019; Pearson et al., 2018). Since these recent findings suggest that declining trajectories could be the norm in ASD development rather than an exceptional subtype, additional research on early onset patterns is needed.

**Objectives:** The aims of this study were therefore to examine 1) initial developmental levels at 10 months in children with typical development (TD), non-typical development (non-TD) and ASD, 2) whether there are increasingly diverging or atypical trajectories over the first three years in ASD-children, and 3) levels of skill loss in TD, non-TD and ASD-children.

**Methods:** The sample included 50 children with an older sibling with ASD (EL-sibs) and 37 children with an older sibling with typical development (i.e., siblings with a typical likelihood for ASD or TL-sibs). Children were grouped based on their best-estimate outcome at 36 months: TD (n=52),

non-TD ( $n=22$ ) and ASD ( $n=13$ ). A prospective, longitudinal study was conducted in which non-verbal and language skills (MSEL) and social-communicative difficulties (ADOS-2 Social Affect) of EL-sibs and TL-sibs were measured at 10, 14, 24 and 36 months.

**Results:** Multigroup Latent Growth Curve Analysis indicated that at 10 months, the ASD-group showed significantly lower levels of non-verbal ( $M_{INTCP}=13.96, p<.001$ ) and receptive language skills ( $M_{INTCP}=10.72, p<.001$ ) compared to TD ( $M_{INTCP}=15.29, p<.001$  and  $M_{INTCP}=12.39, p<.001$ ) and non-TD ( $M_{INTCP}=14.27, p<.001$  and  $M_{INTCP}=11.68, p<.001$ ) groups. As expected, the ASD-group showed increasing patterns of non-verbal and language development, however, their average growth over time was smaller (Range  $M_{slope}=.61-.87, p<.001$ ) as compared to non-TD (Range  $M_{slope}=.73-.89, p<.001$ ) and TD (Range  $M_{slope}=.85-.96, p<.001$ ) groups. Regarding social-communicative difficulties, similar slowly increasing, almost plateauing trajectories were found over groups. Further, the ASD-group showed the most difficulties across ages starting from 14 months ( $M_{INTCP}=4.71, p<.001$ ) as compared to TD ( $M_{INTCP}=1.74, p<.001$ ) and non-TD ( $M_{INTCP}=3.09, p<.001$ ) groups. Declining raw scores on the non-verbal and language scales of the MSEL between any two visits occurred in 31% of ASD, 23% of non-TD and 11% of TD-children. Although more ASD-children showed a decline, mainly in language domains after 14 months, differences between groups were not significant ( $\chi^2(2)=3.317, p=.190$ ).

**Conclusions:** Our findings indicate atypical non-verbal and receptive language functioning for ASD already at 10 months. All outcome groups showed increasing trends over time, but ASD-children showed slower growth in non-verbal and language skills from 10-36 months (Fig.1). Although also part of normative development, skill loss, especially after 14 months and in language domains, should be followed-up in children at EL for ASD. Given limitations associated with use of ADOS-2 Calibrated Severity Scores, additional prospective research examining social-communicative skill loss is required.

### **523.010** (Virtual Poster) Biobehavioral Profiles of Social Impairments in Autism Spectrum Disorder and Fragile X Syndrome

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**Background:** The heterogeneity of autism spectrum disorder (ASD) creates diagnostic challenges, pointing to a need for robust, objective markers of symptomology. Challenges are exacerbated by the phenotypic overlap between ASD and social anxiety, in addition to discreet populations with shared features, like fragile X syndrome (FXS). Biobehavioral measurement approaches integrate behavioral and biological data, and they have the potential to supplement diagnoses and shed light on the mechanisms underlying social impairments. They have particular utility for children with cognitive impairments, whose symptoms may be difficult to assess with traditional instruments. Biobehavioral measures include negative affect (NA), a biological tendency towards negative emotions; and respiratory sinus arrhythmia (RSA), the beat-to-beat variability in heart rate associated with respiration. Both are associated with impairments in FXS and non-syndromic ASD (nsASD) and predict ASD and social anxiety symptoms within these populations. However, no work has combined these measures to understand profiles of social impairments across nsASD and FXS in preschoolers with cognitive impairments.

**Objectives:** To evaluate: 1) whether baseline RSA and NA differ in nsASD, FXS, and typical controls, and 2) whether RSA regulation and NA predict ASD or social anxiety symptoms.

**Methods:** Participants included 120 preschoolers with nsASD ( $n=47, n_{males}=40, M_{age}=42.9$  months), FXS ( $n=41, n_{males}=29, M_{age}=45.4$ ), or TD ( $n=32, n_{males}=25, M_{age}=45.6$ ). Mean RSA was collected via electrocardiogram during a seated baseline condition; NA was assessed with the Childhood Behavior Questionnaire (CBQ); ASD symptom severity with the Autism Diagnostic Observation Schedule, Second Edition; social anxiety with the Spence Preschool Anxiety Scale; and developmental ability (DQ) with the Mullen Scales of Early Learning (MSEL).

**Results:** Obj1: RSA did not differ across groups ( $F(3, 116)=.253, p=.859$ ; partial  $h^2=.004$ ) controlling for DQ. Groups differed in NA ( $F(2, 117)=4.33, p=.015$ ; partial  $h^2=.063$ ). Post hoc analyses suggested the TD group had lower NA than the nsASD group ( $p=.007$ ), but not the FXS group ( $p=.120$ ); the nsASD and FXS groups did not differ ( $p=.261$ ). Obj2: RSA was related to ASD symptoms for the nsASD group only ( $B=-.461, p=.018$ ). There was a relationship of NA to social anxiety in the nsASD group ( $B=1.49, p=.018$ ) and the FXS group ( $B=3.06, p<.001$ ).

**Conclusions:** This study is the first to evaluate RSA and NA in cognitively impaired preschoolers with nsASD and contrast them with FXS. Contrary to expectations, we found no group differences in baseline RSA, potentially due to developmental effects. However, reduced RSA regulation was uniquely associated with elevated ASD symptoms in the nsASD group. This finding supports the interplay of biological competence to the expression of ASD clinical profiles and aligns with theoretical and empirical work documenting the relationship between RSA and social engagement. We also extend findings of elevated NA to preschoolers with nsASD who have cognitive impairments and report an association between elevated NA and increased social anxiety in both nsASD and FXS. This suggests that NA, which emerges early in development, may be a risk marker for the onset of later social anxiety in both nsASD and FXS.

### **523.011** (Virtual Poster) Caregiver Report of Autism and ADHD Symptoms in a Community Sample of Toddlers

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**Background:**

Co-occurrence of autism and ADHD has been well-documented in clinic-referred samples, including preschool age autistic children. In non-clinic referred samples, autism and ADHD have also been associated, suggesting that co-occurrence is not limited to clinic-referred populations. Limited work has examined associations between autism and ADHD symptoms in non-clinic-referred toddlers. During toddlerhood, autism can be diagnosed but ADHD is less often evaluated. Identifying and understanding early co-occurrence of autism and ADHD symptoms may facilitate evaluation and initiation of targeted interventions.

#### Objectives:

To examine relationships between autism and ADHD symptoms in a community sample of toddlers recruited through primary care during well-child visits. Our goals were to understand patterns of co-occurrence and explore their relationship to age and sex in toddlers.

#### Methods:

Participants were  $n=1631$  toddlers ages 14-44 months ( $M=19.5$ ,  $SD=3.5$ ) recruited through primary care clinics. Autism and ADHD symptoms were assessed by parent report on the Child Behavior Checklist (CBCL). Toddlers were classified as being "Elevated" on the autism and/or ADHD scales if their CBCL T-scores were in the Borderline or Clinical range. We employed Pearson's correlations using raw scores and general linear models to explore relationships between autism, ADHD symptoms, sex, and age. Follow-up pair-wise t-tests were corrected for multiple comparisons using the Benjamini-Hochberg correction.

#### Results:

Autism and ADHD symptoms were significantly correlated ( $n=1631$ ;  $r=.49$ ,  $p<.001$ ). Overall 5% ( $n = 82$ ) toddlers were classified as Elevated on one or both scales. Examining the scales separately, 1.5% ( $n = 24$ ) were elevated on ADHD only, 2.3% ( $n = 38$ ) were elevated on autism only, and 1.2% ( $n = 20$ ) were elevated on both autism and ADHD. Among toddlers who were elevated for autism, 34% were also elevated for ADHD. Among toddlers who were elevated for ADHD, 45% were also elevated for autism. There was no difference in the proportion of males in any Elevated group. Toddlers elevated for both autism and ADHD ( $M=24.15$ ,  $SD=6.54$ ,  $F=39.5$ ,  $p<.0001$ ) and elevated for only autism ( $M=22.84$ ,  $SD=5.32$ ,  $F=39.01$ ,  $p<.0001$ ) were older than children not elevated on either scale ( $M=19.39$ ,  $SD=3.31$ ). Toddlers elevated for ADHD did not differ in age from the other groups ( $M=20.79$ ,  $SD=4.49$ ). Children who were older ( $F=11.25$ ,  $p<.001$ ), male ( $F=18.54$ ,  $p<.0001$ ), and had higher autism scores ( $F=503.75$ ,  $p<.0001$ ) were more likely to have higher ADHD symptoms. Both age and ADHD symptoms were associated with higher autism symptoms whereby older toddlers with higher ADHD symptoms had higher autism symptoms ( $F=107.44$ ,  $p<.0001$ ). Males were more likely to have higher autism symptoms; however, this association was no longer significant when ADHD symptoms were included.

#### Conclusions:

Autism and ADHD symptoms are correlated in a community sample of toddlers. Demographic and clinical factors predicted symptom elevations, with a higher likelihood for autism in the context of older age and ADHD symptoms. Among toddlers with elevated symptoms of either disorder, over one-third had elevated symptoms of the other disorder. Toddler ADHD screening, though not routinely performed, may help with early identification of neurodevelopmental disorders. Results indicate co-occurring symptoms can be identified early which can facilitate appropriate treatment.

**523.012** (Virtual Poster) Development of Early Screening for Communication and Social Skills (ESCoMS) Instrument: Predictive Validity  
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**Background:** Early identification of autism facilitates early intervention and improves outcomes. Few tools exist to effectively screen infants for autism. We had reported the development of a 24-item screening tool, ESCoMS (Early Screening for Communication and Social skills) using a mixed methodology design (Swaminathan.D et al; INSAR 2020). We now report on the evaluation phase. This work was supported by the Indian Council for Medical Research.

**Objectives:** The objective was to evaluate the predictive validity of ESCoMS by following up a cohort of infants between 9 and 18 months after six months.

**Methods:** The 24 item ESCoMS was administered to two groups of infants between the ages of 9-18 months from various facilities within Bangalore in South India. The two groups were as follows: Normal controls - children who were born full term, without NICU admission and had been developing age appropriately and a High-Risk group - children who were born pre-mature or had history of NICU stay, seizures or developmental delays. A total of 592 normal controls and 150 high risk infant – toddlers were recruited for this phase from many centers around the city.

Six months later, 300 participants could be followed up to evaluate for possible autism diagnosis using DSM 5 and ICD 10 by a clinician blind to the respondent's performance on ESCoMS at baseline. Additionally, a variety of autism quantitative measures were used to confirm the trend of

development. The instrument's performance accuracy was calculated in terms of sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV). For the predictive validation phase, a cut-off of 11 had been set for infants between 9-12 months and a cut-off of 9 for infants between 13-18 months, based on a ROC value obtained from phase I.

Results: Of the 300 children seen at follow up 16 children (12-High-Risk group, 4-control group) were considered highly likely to meet diagnosis based on clinical criteria (ICD 10 and DSM 5) by trained clinicians.

For the 9-12-month-old infants, at the given cut off of 11, the sensitivity was 33.3%, specificity was 89.1%, PPV of 41.9% and NPV of 94.6 %. For the 13-18-month-old infants, at the given cut off of 9, the sensitivity was 76.9% and specificity was 88.5%. PPV of 52% and NPV of 97%. To depict the predictive power of EScMS, ROC Curves were calculated separately for both age groups, considering DSM 5 as gold standard. AUC for 9-12-month-old infants was 0.647 (p-value: 0.099) and for 13-18-month-old infants was 0.846 (p-value: <0.001).

EScMS showed significant correlation with other measures (Table 1).

Sensitivity and Specificity for EScMS was calculated at different cut-off points. A cut-off of 8 showed best sensitivity of 66.7% and 84.6% and specificity 67.3% and 85.6% for the 9-12-month and 13-18 month age groups respectively.

Conclusions: This is the first screening tool for Indian children below 18 months of age. The scale is more successful at screening children above 13 months of age, which is noted across all available behavioral screening measures for this age group.

### **523.013 (Virtual Poster)** Examining the Association between Neurodevelopmental Quantitative Trait Variation in ASD Probands and Their Younger Siblings at 36 Months

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Background: Younger siblings of individuals with ASD are at increased risk for ASD, as well as other neurodevelopmental impairments. Previous studies of biological siblings and twin pairs indicate that ASD symptoms and related traits cluster within families. Few prospective studies of siblings have evaluated how proband traits may inform sibling outcomes.

Objectives: The current study examined neurodevelopmental quantitative trait variation and diagnostic status among probands with ASD and their younger siblings.

Methods: We examined the association between scores on the Social Communication Questionnaire (SCQ) in probands and scores on the Social Responsiveness Scale (SRS), Vineland Adaptive Behavior Scales (VABS), and Mullen Scales of Early Learning (MSEL) in siblings at 36 months in 180 sibling pairs from the Early Autism Risk Longitudinal Investigation (EARLI). Sibling 36-month diagnosis of ASD, non-typically developing (Non-TD), or typically developing (TD) was determined based on clinical diagnosis, ADOS score, and the MSEL early learning composite. Linear regression was used to estimate the relationship between proband trait and sibling trait. An interaction term between proband SCQ and outcome group (ASD / Non-TD vs. TD) was then added to assess if the trait relationship differed by sibling diagnosis.

Results: At 36 months, 40 siblings (22%) received an ASD diagnosis, 56 (31%) siblings were determined to be Non-TD, and 84 (47%) siblings were TD. Increasing SCQ score of the proband was found to significantly predict a decreased VABS composite score ( $\beta = -0.32$ ,  $p = .04$ ) in the sibling. Models including a proband SCQ by sibling diagnosis (ASD / Non-TD vs. TD) interaction suggested that proband SCQ score significantly predicted poorer sibling VABS composite score among those defined as ASD/Non-TD ( $\beta = -0.92$ ,  $p = .001$ ). Additional analyses indicated a relationship between proband SCQ and sibling expressive language VABS score among those defined as ASD/Non-TD ( $\beta = -1.06$ ,  $p = 0.006$ ). No other statistically significant relationships were identified between proband SCQ and sibling traits.

Conclusions:

Associations between the proband's neurodevelopmental quantitative traits and younger sibling outcomes may help in the early identification of specific neurodevelopmental impairments among high-risk (HR) siblings. Specifically, proband ASD symptomatology assessed by the SCQ may be associated with impairment level in affected younger siblings.

### **523.014 (Virtual Poster)** The Preschool Brain Imaging and Behaviour Project: A Transdiagnostic Approach to Identify Neurodevelopmental Subgroups and Trajectories in a Large European Multi-Centre Study

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**Background:** Neurodevelopmental conditions (including autism, ADHD, developmental delay) affect approximately 10% of individuals worldwide and can significantly impact a person's quality of life (Mizuno et al., 2019; Lau-Zhu et al., 2019). Key barriers to the development of more effective support strategies are heterogeneity within single conditions, substantial overlap between conditions, and lack of, or incomplete, understanding of underlying mechanisms. The Preschool Brain Imaging and Behaviour Project (PIP) is the first European collaborative multi-site longitudinal study aimed to link individual variation in brain development and function to social, cognitive and emotional development in preschoolers with ADHD, autism, developmental delay, epilepsy, or typical development. The goal is to identify subgroups within or across established diagnostic categories to better predict developmental outcomes, and to develop more tailored support strategies. However, preschoolers, especially preschoolers with neurodevelopmental conditions (who may experience additional difficulties), pose significant challenges for reliable assessments. For any measure to have potential clinical utility as a prognostic biomarker for preschoolers, it is essential that it is feasible and accessible for this age range.

**Objectives:** To assess the feasibility of a multi-modal protocol to identify prognostic biomarkers in preschool children.

**Methods:** Across five sites in Europe (in the Netherlands, Belgium, France, Sweden and the UK), the PIP study aims to longitudinally track the development of a cohort of 480 preschool children (autism = 180, ADHD = 50, epilepsy = 20, developmental delay = 50, neurotypical = 180) between the ages of 2 ½ and 6 years old. Six dimensional transdiagnostic biobehavioural domains (executive function, emotion processing, sensory processing, reward processing, predictability and social processing) are assessed across multiple levels using behavioural, cognitive, eye-tracking, EEG and MRI measures, and a novel battery of touchscreen tasks.

**Results:** Data collection for the PIP study is ongoing. Analyses presented here are preliminary using data collected up to June 2021 (N = 84). Behavioural, cognitive, EEG, and eye-tracking measures showed high completion rates (behavioural = 95%, cognitive = 93%, EEG = 86%, eye-tracking = 83%). Furthermore, our novel touchscreen battery showed good psychometric properties (split-half reliability) with preschoolers across tasks measuring social processing (0.85), reward learning (0.71) and executive functioning (sustained attention (0.95); inhibitory control (0.87)). For MRI (conducted during children's natural sleep), completion rates for structural T1/T2 across sites was 63%, with similar rates for autistic and neurotypical children.

**Conclusions:** At the INSAR 2022 meeting, feasibility data from our multi-modal PIP protocol will be presented from a larger cohort of preschoolers, with additional data quality analyses, and in relation to child clinical profiles. It is essential to understand the factors that may contribute to data completion rates in preschoolers, to ensure that particular subgroups of children are not disproportionately excluded to accurately predict a child's development or tailor support.

### 523.015 (Virtual Poster) Validation of the Tele-RITA-T

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**Background:**

The COVID-19 pandemic has emphasized the need for telehealth and remote evaluations. We have developed a modified Tele- RITA-T screening evaluation and to continue to evaluate and screen toddlers with suspected ASD during the pandemic

**Objectives:**

To validate a modified version of the RITA-T as a telehealth tool for those who are 18-36 months. Identify a cut off score to differentiate between those with ASD and non-ASD.

**Methods:**

The Tele- RITA-T includes modified activities and behavioral prompts that the parent is instructed to complete with the toddler. These prompts mirror the validated items drawn from the RITA-T. The Tele- RITA-T has a maximum score of 20 (vs. 30 for the RITA-T). After consent was obtained, a trained research assistant instructed the families on how to administer each prompt, and then scored the test. The diagnostic remote evaluation then included history, observation of play and structured prompts developed by this group: the EASI (Early Autism Screening Inventory). Diagnostic evaluation included the CARS-2 and the application of the DSM-5 criteria.

#### Results:

109 toddlers have been enrolled and evaluated using the Telehealth RITA-T. Ages varied between 18 and 34 months with a mean of 30 months. From the 109 toddlers, 29 had received the interactive RITA-T. The Tele-RITA-T correlated very well with scoring of the in-Person RITA-T. A cut off score of 10 on the Tele-RITA-T had a PPV of 90% for a diagnosis of ASD. All toddlers who previously scored in the high-risk range for ASD on the interactive RITA-T, had a score higher than 9 on the modified Tele- version.

#### Conclusions:

The Tele-RITA-T is an effective measure for the screening of toddlers for ASD risk by telehealth. Its administration with the structured observation checklist EASI improves the identification of ASD risk at a cut off score above 10.

**523.016** (Virtual Poster) Neural Coding of Exaggerated Speech in Young Children with and without Autism : Evidence from Mandarin Chinese  
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Background: Caregivers adopt exaggerated or child-directed speech when talking to infants and young children. Exaggerated speech is typically characterized by expanded vowel formant space, increased pitch range, and prolonged voice onset time (VOT) (Cristia, 2013; Fernald & Mazzie, 1991; Kuhl, 1997). It has been shown that exaggerated speech can not only promote early phonetic and language development (Tsao et al., 2004; Zhang et al., 2011) but also facilitate second-language learning in adults (Zhang et al., 2009). Speech perception studies have demonstrated neural processing impairment of linguistic pitch information (e.g., Chinese lexical tone; Yu et al., 2015, 2021) and time-related features of consonants (Kuhl et al., 2005) as well as deficits with auditory temporal processing (Meilleur et al., 2020) in children with autism. It is therefore important to investigate whether exaggerated speech can benefit the neural coding of the specific phonetic features and the underlying mechanisms.

Objectives: Given that linguistic pitch and consonant features can be particularly challenging for speech perception of autistic children, we aimed to specifically examine whether and how exaggerated f0 and VOT affect the neural coding of lexical tone and stop consonant in young Chinese-speaking children with autism and their typically developing (TD) peers.

Methods: The present study included 20 children with autism (mean age = 43.5 months) and 24 age-matched TD children. Exaggerated and non-exaggerated lexical tone stimuli were synthesized using the syllable /i/, and consonant stimuli from the CV syllable /pi/. Acoustic parameters of the exaggerated and non-exaggerated stimuli were determined based on measurements of actual child-directed utterances and existing literature. EEG data were recorded as the participants were instructed to watch self-chosen muted cartoons and ignore any sound presented through insert earphones. Statistical analyses of the amplitude and latency of the P1 and N2 components were performed using linear mixed-effect models.

Results: For the P1 component, the autism group but not the TD group showed significantly enhanced P1 amplitude to the non-exaggerated lexical tone compared to the exaggerated tone. No other effects were found for P1. For the N2 component, the autism group responded significantly greater to the lexical tone with exaggerated f0, whereas the TD group showed no effect of f0 exaggeration. Additionally, the autism group had significantly longer N2 latency to the syllable with exaggerated VOT, and no latency difference was observed in the TD group.

Conclusions: Acoustic exaggeration affected the neural coding of lexical tone and stop consonant in young children with autism but not the TD children. One major observation was increased N2 amplitude responding to the exaggerated lexical tone in autism. Given the functional role of auditory N2 (or developmentally emerging N1) in higher-order sensory integration and phonetic perception (Čeponienė et al., 2009), the effect on N2 might reflect a facilitation effect on the neural coding of lexical features in autism. Although different elements of exaggerated speech may affect distinct aspects of speech processing, our finding suggests the utility of acoustic exaggeration targeting specific challenging phonetic properties to promote phonetic learning and speech processing of young children with autism.

**523.017** (Virtual Poster) Phenotypic Characteristics of Children with Autism Spectrum Disorder By Parental Age: Study to Explore Early Development (SEED)

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#### Background:

Many studies report an association between the risk of having a child with autism spectrum disorder (ASD) and greater parental age at the time of the child's birth, but few have closely examined whether specific ASD-related symptoms or behaviors are more strongly associated with parental age than others.

## Objectives:

To address this gap, we examined scores from parent-report measures and clinical assessments of ASD symptoms and behavioral problems in young children with ASD to determine if these scores varied according to parental age.

## Methods:

The Study to Explore Early Development (SEED) is a multi-site case-control study of ASD. Children ages 2–5 years completed behavioral and developmental assessments including the Mullen Scales of Early Learning (MSEL), the Autism Diagnostic Observation Schedule (ADOS), and the Autism Diagnostic Interview-Revised (ADI-R). Scores from the ADOS and ADI-R were used to identify children who met study criteria for ASD. Parents also completed standardized parent-report questionnaires including the Social Communication Questionnaire (SCQ), the Social Responsiveness Scale (SRS), and the Child Behavior Checklist (CBCL). This study included 1,417 children who met SEED criteria for ASD. The number of children with available data varied for each measure, ranging from 1,336 to 1,417 participants.

Scores from each measure were examined across three parental age categories based on the parent's age at the time of their child's birth: both parents <30 years, one parent <30 years, and both parents ≥30 years. Parental age categories were independent predictors in linear regression models. Both unadjusted and adjusted beta coefficients and 95% confidence intervals (95% CIs) were estimated for each parental age category. Adjusted beta coefficients reflected linear relationships between parental age and continuous scores from the clinical and parent-report measures after accounting for these sociodemographic variables: maternal education, maternal race/ethnicity, paternal education, age of child at clinical assessment, child's sex, SEED study site, current household income, and birth order.

## Results:

After adjusting for socio-demographics, younger parents (i.e., both under 30 years) were more likely to report greater levels of ASD-related symptoms on the SCQ ( $\beta=1.3$ ,  $p<0.01$ ) and SRS ( $\beta=6.0$ ,  $p<0.01$ ) and more problem behaviors on the CBCL ( $\beta=2.5$ ,  $p<0.01$ ) compared to older parents (**Table 1**). However, with the exception of scores from the ADI-R and ADOS repetitive behaviors and interest domain for one parent <30 ( $\beta=0.4$ ,  $p<0.05$ ; and  $\beta=-0.3$ ,  $p<0.05$ ), the more in-depth clinical measures (MSEL, ADOS, ADI-R) showed no overall differences by parental age after adjusting for socio-demographics ( $p\geq 0.05$  for all measures).

## Conclusions:

Younger parental age categories (e.g., one or both < 30 years) were more likely to report that their child had greater ASD symptom severity and behavioral problems relative to parents who were both 30 years or older. However, this pattern of results was not observed across most of the clinical assessments. While prior evidence has shown an association between the risk of ASD and parental age, research on the behavioral correlates of ASD risk factors might benefit from including multiple measures and greater consideration of how parental age might influence symptom reporting on certain instruments.

## **523.018** (Virtual Poster) Pilot Findings from the Parc Study: The Interaction between Autism Symptomatology and Adaptive Functioning over Six Months

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**Background:** While adaptive functioning is known to be impaired in children with autism, individual profiles vary significantly in this regard (Alvares et al., 2019). In the context of developmental trajectories, the association between adaptive functioning and autism symptomatology remains unclear. These two domains appear to be linked for some children and appear to develop on independent trajectories for others (Sztatmari et al., 2015). Findings are inconclusive regarding the nature of the association between specific subgroups of autism symptoms with adaptive functioning (Franchini et al., 2018; Gabriels et al., 2005).

**Objectives:** To examine the way in which adaptive functioning and autism symptomatology associate and develop over a 6-month period.

**Methods:** Participants include 37 children with a recent diagnosis of autism (i.e. within the last 6 months; 3 females, mean age = 55.6 months, SD = 9.5 months). Families were recruited in the context of the pilot phase of the Pediatric Autism Research Cohort (PARC) project, an international multi-site study focused on identifying and understanding factors influencing phenotypic expression over time. Parents filled out questionnaires over a 2-year period. For this analysis, we utilized two time points that were six months apart. Questionnaires measured autism symptomatology (Autism Impact Measure; AIM; Kanne et al., 2014) and adaptive functioning (Vineland Adaptive Behavioral Scales; VABS-3; Sparrow et al., 2016). We examined one-tailed Pearson correlations between the VABS total score and the AIM total score and sub-domains, including scores indicating symptoms' frequency and impact on everyday functioning, as well as symptom sub-groups. Correlations were conducted at time 1 and at time 2.

Results: All variables except one were significantly negatively correlated at Time 1 and strengthened at time 2. VABS total scores strongly negatively correlated with AIM total scores at both time points ( $r=-.547$ ;  $r=-.716$ ). Symptoms' impact score also negatively correlated with VABS total scores at both time points ( $r=-.349$ ;  $r=-.564$ ), as well as with symptoms' frequency score ( $r=-.626$ ;  $r=-.758$ ). AIM symptom sub-groups negatively correlated with VABS total scores at both time points: communication ( $r=-.528$ ;  $r=-.774$ ), peer interaction ( $r=-.509$ ;  $r=-.609$ ), social responsiveness ( $r=-.354$ ;  $r=-.704$ ), and repetitive behavior ( $r=-.398$ ;  $r=-.439$ ). Atypical behavior did not significantly correlate with the VABS total score at time 1 ( $r=-.275$ ,  $p=.055$ ), but did at time 2 ( $r=-.457$ ,  $p<.01$ ).

Conclusions: These findings suggest that adaptive functioning associates with parent-report autism symptomatology concurrently and longitudinally. Furthermore, this association appears to strengthen over time. At Time 2, the association between adaptive functioning and symptoms belonging to the DSM-5's criteria A become more prominent than the link between adaptive functioning and symptoms associated with criteria B. The frequency of symptoms more strongly associated with adaptive functioning than the reported impact of symptoms, both concurrently and over time. This may indicate that, beyond parents perceived impact of symptoms, the role of symptom frequency in the development of adaptive skills is worthy of specific exploration. While preliminary and all parent-report, these pilot findings deepen our understanding of longitudinal associations between adaptive functioning and symptomatology and highlight the need for further study of this area.

#### **523.019 (Virtual Poster) Skill Attainment and Loss in Phelan-Mcdermid Syndrome**

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Background: Phelan-McDermid Syndrome (PMS), a genetic condition involving SHANK3, is associated with profound intellectual and multiple disabilities, including severe motor impairments, absence of speech, and neurologic diagnoses such as epilepsy. Major milestones are commonly delayed or not met and considerable loss of developmental skills (i.e., regression) after attainment is often reported.

Objectives: We describe skill attainment and loss among individuals with PMS, focusing on key developmental characteristics that may be tracked by pediatric providers in developmental monitoring. We seek to understand if there are early profiles that may be noteworthy for this condition.

Methods: Parent-reported information about the timing of milestone attainment was drawn from a prospective natural history study of children and adolescents with confirmed genetic diagnoses of PMS. Participants ( $N = 100$ ) were between 3 and 20 years old (mean age 8.8 years; 54% male; 9% Asian, 2% Black, 85% White, 3% unknown race).

Results: Nearly all participants (97%) were able to walk independently, but the age at which this skill was attained was delayed for half of the sample (median [IQR]: 18 [15, 26] months). Non-attainment of language milestones was common: 34% did not attain single words and 61% never attained phrase speech. Of those who did attain at least single words, the age of onset was delayed (median [IQR]: 30 [24, 46] months). Language skills were also commonly reported as lost (24%). Of the entire sample, 39% reported probable or definite loss of other skills, most commonly babbling (35%) and responding to name (14%).

Conclusions: This study contributes to the literature by using semi-structured interviews to obtain information about milestone attainment and loss in a well-described sample of children and adolescents with PMS. The results support the conclusion that individuals with PMS are likely to experience pervasive and widespread delays, and even non-acquisition, of important skills during development. Further, even when acquisition occurs, individuals with PMS appear to be at risk of skill loss. Findings from this study will contribute to the dearth of information regarding the early development of individuals with PMS, informing healthcare providers, families, and other stakeholders of common developmental patterns seen amongst this population.

#### **523.020 (Virtual Poster) The Co-Development of the Pupillary Light Reflex and Sensory Reactivity over Infancy and Their Relationship to the Emergence of Autism: A Multi-Group Cross-Lagged Panel Analysis**

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**Background:** Though the route/s through the aetiology of autism manifest into recognisable symptoms at 2-3 years remains unclear, insights are being provided by longitudinal prospective studies with infants with a family history of autism (who have a 10-20% likelihood of developing autism and a further 20% likelihood of other developmental difficulties). Prospective longitudinal studies have uncovered multiple putative early neurocognitive markers of autism in infancy, with some of the earliest being sensory in nature. Investigating how the development of Sensory Sensitivity (e.g., the Pupillary Light Reflex; PLR) and behavioural Sensory Reactivity interrelated over infancy to influence emerging autism traits may illuminate mechanistic pathways through which symptoms manifest.



**Objectives:** We aimed to explore: a) how pupil Sensory Sensitivity (PLR Constriction Amplitude/Latency) and behavioural Sensory Reactivity longitudinally interrelate over the first two years of life, b) how any earlier Sensory Sensitivity and Sensory Reactivity relate to later dimensional autism-associated social difficulties and repetitive behaviours at 3 years of age, and c) whether familial likelihood for autism influences these relationships.

**Methods:** The sample consisted of 299 infants; 217 had a family history of autism (Elevated Likelihood). The PLR (Latency [onset; ms]) and behavioural Sensory Reactivity longitudinally at 9, 14 and 24 months and autism traits at 3-years. The PLR was induced using stimuli consisting of a bright contrasting change in light; pupil diameter was measured using eye-tracking technology. Sensory Reactivity was operationalised using an adapted measurement invariant metric based on the Perceptual Sensitivity subscale of the Infant/ Early Childhood Behaviour Questionnaire (I/ECBQ; Gartstein & Rothbart, 2003; Putnam, Gartstein, & Rothbart, 2006). The Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) was used to measure autism social and repetitive behaviours trait levels. Multi-group cross-lagged panel analysis we assessed the influence of autism familial likelihood on the infant developmental interrelationship between PLR and Sensory Reactivity and their association with later autism traits. Structural invariance tests were used to determine if relationships between variables within the model significantly differed across familial likelihood for autism (Elevated Likelihood or Typical Likelihood).

**Results:** Across the sample, 9-month Sensory Reactivity positively predicted later autism traits at 3-years. No relationship was found between 9- to 14-month Sensory Sensitivity or Sensory Reactivity in either familial likelihood group. In those with an Elevated Likelihood of autism, 14-month PLR Latency positively predicted 24-month Sensory Reactivity; no association was found in the Typical Likelihood group. In the Typical Likelihood group, 14-month Sensory Reactivity negatively predicted 24-month Latency; no association was found in the Elevated Likelihood group.

**Conclusions:** Findings may represent altered early top-down modulation of low-level sensory processing in emerging autism symptoms. Future investigations should explore additional measures to provide insight into the neural underpinnings of these associations.

### **523.021 (Virtual Poster)** Viability of Virtual Gaze Data in Preschoolers with and without Autism Spectrum Disorder

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**Background:** The COVID-19 pandemic prompted many researchers to shift from lab-based to online research. Eye-tracking is a common method used to study language development in children with Autistic Spectrum Disorder (ASD). One approach to using eye-tracking methods in online studies is recording children's faces as they view the screen and manually coding their gaze. Substantial numbers of children with ASD are often excluded in lab studies for contributing insufficient gaze data (e.g., Venker, 2019; Venker et al., 2020) compared to non-spectrum children (e.g., Venker, 2019; Valteau et al., 2018). Distractions in the home environment may pose even more challenges for viability of online data.

**Objectives:** We sought to determine the feasibility of online at-home eye gaze data collection for preschoolers with and without ASD by quantifying data loss and by evaluating the relation between home events and viability of gaze data.

**Methods:** Thirty children with ASD (18 males, 12 females) aged 36 to 71 months ( $M = 47.27$ ,  $SD = 8.91$ ) and 30 non-spectrum children (18 males, 12 females) aged 24 to 35 months ( $M = 27.57$ ,  $SD = 3.04$ ) participated. Samples were matched at the group level by sex and language. Participants and their caregivers logged into a zoom meeting on their home computer or tablet. Participants completed two trials of a word-learning task in which they heard novel words paired with novel objects. Children then viewed three novel objects on the screen (Figure 1) and were tested on their learning. To evaluate data viability, research assistants manually coded frame by frame for whether children looked at the screen; trials for which children were looking at the screen for at least 50% of the trial were counted as viable. Research assistants also coded for events (e.g., caregiver interruptions) and participant behaviors (e.g., body and head movements).

**Results:** All participants contributed viable gaze data on at least one test trial. Three children with ASD (10%) and one non-spectrum child (3%) only contributed viable data on one of two trials; the groups did not differ ( $p = .62$ , two tailed Fisher's exact test). Participant behaviors were related to trial viability. In particular, the frequency of children's body and head movements during each trial was significantly related to the percentage of track loss ( $r(120) = .37$ ,  $p = .02$ ).

**Conclusions:** Compared to previous studies in which 22% (Venker, 2019) or 27% (Venker et al., 2020) of children with ASD did not provide viable gaze data, the rate of 10% in the present sample is promising. The exclusion rate of 3% for the present non-spectrum sample is also lower than some past research (e.g. 11% in Valteau et al., 2018). Results suggest online studies in a home environment can yield higher rates of viable gaze data than lab studies, despite the presence of distractions. These findings can alleviate concerns of lower data quality for online studies and encourage further research on data viability in the home setting.

### **523.022 (Virtual Poster)** Towards Feeling, Understanding, and Caring: The Development of Empathy in Young Autistic Children

**B. LI<sup>1</sup>, L. Stockmann<sup>1</sup>, E. M. Blijd-Hoogewys<sup>2</sup>, I. Vergari<sup>1</sup> and C. Rieffe<sup>1,3,4</sup>,** (1)Institute of Psychology, Leiden University, Leiden, Netherlands, (2)INTER-PSY, Groningen, Netherlands, (3)Faculty of Electrical Engineering, Mathematics and Computer Science, University of Twente, Enschede, Netherlands, (4)Institute of Education, University College London, London, United Kingdom

**Background:**

Empathy is crucial for maintaining social relationships and for motivating moral and compassionate behaviors (Eisenberg et al., 2010). Autistic people are often portrayed as lacking empathy. Recent research, examining empathy as a multicomponent construct, advocates that, while autistic individuals may have difficulties in understanding others' emotions and thereby might be hindered from responding prosocially, they are not indifferent to others' feelings (Fletcher-Watson & Bird, 2020). This multicomponent approach not only helps removing the negative portrait of autism (Santesteban et al., 2020), but it can also facilitate identifying the unique challenges that autistic people face in empathy development.

#### Objectives:

Aiming to advance our understanding of empathy development in young autistic children, this four-wave longitudinal study examined the development of affective empathy (emotion contagion), cognitive empathy, and prosocial empathy (intent to comfort), in 1-to-6-year-old children with and without autism.

#### Methods:

Children with ( $N = 61$ ;  $M_{age} = 55.49$  months) and without autism ( $N = 145$ ;  $M_{age} = 52.16$  months) and their parents participated in the research, once a year, for four consecutive years. Children were visited either at school or at an intervention center for autism (for the autistic group only), where the experimenter acted out three emotional episodes (happy, angry, and in pain) and evaluated children's empathic reactions. Parents filled out two questionnaires to evaluate their children's empathy abilities.

#### Results:

Consistent with literature, both the experimenter and parents reported lower levels of cognitive empathy and prosocial empathy in autistic children than in non-autistic children. As for affective empathy, whereas the experimenter reported a lower level in autistic children, parents reported no group difference. Consistent with literature, affective empathy remained stable and prosocial actions increased with age in both groups. Yet this increase was stronger in autistic children. While cognitive empathy also increased with age in autistic children, it remained stable in non-autistic children. Possibly, compared to autistic children, non-autistic children reached the more advanced levels earlier, and thus there was less room for increases.

#### Conclusions:

While autistic children encountered difficulties in both cognitive and prosocial empathy, our study showed that they did not lack the capacity to feel for others, and they had potential for developing empathic abilities. Though their struggles in cognitive and prosocial empathy should be interpreted carefully. First, as the "double empathy problem" (Milton, 2012) states, difficulties in understanding others' minds occur not only in autistic individuals, but also in non-autistic individuals, who often struggle to understand the mental states of autistic people. This might explain our discrepancy between experimenter- and parent-rated affective empathy. Second, the prosocial empathy evaluated by our questionnaire described typical empathic reactions of non-autistic people, such as comforting and helping. However, autistic children might display prosocial actions differently, e.g., focusing on problem-solving (Rieffe et al., 2021). Future research should investigate the unique styles of empathy expression and reaction in autistic people, without setting the non-autistic styles as the norm. Besides, it can be informative to examine empathy as a bidirectional interaction, instead of focusing only on how autistic people react to non-autistic people.

## Epidemiology

### ORAL SESSION - 7B — EPIDEMIOLOGY

#### 319 - Epidemiology

**319.001** (Oral) Maternal Inflammatory Conditions during Pregnancy and Risk of Autism Spectrum and Other Neurodevelopmental Disorders  
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**Background:** Maternal inflammation can result from immune dysregulation as well as metabolic perturbations during pregnancy, including maternal type-2 diabetes, gestational diabetes, and pre-pregnancy obesity. Common immune-mediated and cardiometabolic conditions have been shown to be associated with risk of autism and other neurodevelopmental disorders. Much of the supporting data for the association between these maternal conditions and neurodevelopmental outcomes have come from animal models or retrospective epidemiological studies. There remain gaps in our understanding of the role of maternal gestational immune dysregulation and cardiometabolic disorders as potential risk factors for altered neurodevelopment in humans.

**Objectives:** To investigate common maternal immune-mediated and cardiometabolic conditions associated with inflammation during pregnancy and risk of autism spectrum disorders and other neurodevelopmental outcomes in a large and diverse population receiving medical care in the same integrated healthcare delivery system.

**Methods:** This case-control study was nested in the population of children born at Kaiser Permanente Northern California from January 2011 – January 2016 who survived to age two and for whom mothers received healthcare and prenatal care in the 2 years prior to delivery. Three groups of children were included: autism spectrum disorder (ASD, N=311), children with other neurodevelopmental disorders (intellectual disability, learning disability, language delay or developmental delay, cerebral palsy) (DD, N=1291), and a random sample of children from the general population with no ASD or DD diagnoses (GP, N=967). Maternal immune-mediated (infection, asthma, allergy, autoimmune disease) and cardiometabolic conditions (gestational diabetes, diabetes, hypertension (chronic, gestational), preeclampsia, and obesity) diagnosed and recorded during pregnancy were retrieved from the KPNC maternal electronic health records. Covariates included several sociodemographic factors shown in previous studies to be significantly associated with risk of neurodevelopmental disorders and the maternal conditions under study. These included maternal age at delivery, maternal race, maternal education, and child sex. We fit crude and adjusted logistic regression models to estimate the association between maternal conditions during pregnancy and childhood neurodevelopmental outcomes.

**Results:** We found that women diagnosed with asthma were significantly more likely to deliver infants who were later diagnosed with ASD (OR=1.62, 95% CI: [1.15 - 2.29]) or DD (OR=1.30, 95% CI: [1.02 - 1.64]). The risk profile associated with maternal asthma differed significantly between male and female offspring, with increased risks observed only among females for ASD (OR=2.93, 95% CI: [1.63-5.25]; interaction p-value=0.0173) and DD (OR=1.68, 95% CI: [1.18-2.38]; interaction p-value=0.0468). Furthermore, the risk of ASD, but not DD, was significantly associated with obesity (OR=1.51, 95% CI: [1.07 - 2.13]) and increased substantially among women with extreme obesity (OR=2.27, 95% CI: [1.21 - 4.24]), especially in combination with asthma (OR=16.9, 95% CI: [5.13 - 55.71]).

**Conclusions:** Common inflammatory conditions during pregnancy pose a risk for neurodevelopmental disorders in children. Women who experience both asthma and obesity may be especially vulnerable to adverse outcomes and may benefit from early screening and intervention to reduce risks of autism spectrum disorders in their offspring.

**319.002 (Oral) Significant Regional Differences in Autism and Intellectual Disability Risk Associated with Cesarean Section Reflect Background Variation in Cesarean Section Rates**

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**Background:** Prior epidemiological studies investigating the association between repeat cesarean section (C/S) and autism spectrum disorder (ASD) and intellectual disability (ID) have reported mixed results and are limited by lack of diversity inclusion (i.e., racial, ethnic, and geographic) and disability classification method. While primary C/S is frequently precipitated by non-reassuring fetal surveillance, repeat C/S is performed for most subsequent births to avert uncommon--though severe--complications of vaginal birth after C/S (VBAC, e.g., uterine rupture and birth asphyxia).

**Objectives:** Through a case-cohort design, this study evaluates the relationships between ASD and/or ID risk (ASD/ID) and delivery method for children ascertained with ASD/ID across sites participating in the Centers for Disease Control and Prevention's Autism and Developmental Disabilities Monitoring Network (ADDM) through review of evaluations contained in health and education records.

**Methods:** In even-numbered years 2000-2016, 8-year-old children were ascertained with ASD without ID, ASD+ID, and ID without ASD (N=8738, N=3524, N=5527, respectively) across ADDM sites in the mid-Atlantic, Southeastern, and Western US, and linked to birth certificate records. The comparison cohort (N=1,582,307) was composed of all births ascertained through the National Center for Health Statistics corresponding to birth year and ascertainment areas. Delivery method (vaginal delivery, VBAC, primary C/S, repeat C/S) and covariates (i.e., sex, birth year, gestational age, birthweight, parity, maternal age, maternal education, maternal race/ethnicity, maternal fever, premature rupture of membranes, abruptio placentae, placenta previa, breech, fetal distress, and 5-minute Apgar score) were obtained from birth records. Multivariable binomial logistic regression adjusted for covariates were performed to measure ASD/ID risk associated with delivery method in the entire sample and stratified by geographic region.

**Results:** In regard to ASD/ID risk, primary C/S was associated with all case groups, vaginal deliveries were protective against case status, and VBAC had no significant association with any case status (Table 1). Overall, repeat C/S was associated with increased risk for ASD without ID (OR: 1.19; 95%CI: 1.11-1.28), ASD+ID (OR: 1.21, 95%CI: 1.08-1.36), and ID without ASD (OR: 1.27, 95%CI: 1.16-1.39). C/S rates were highest in the mid-Atlantic (28.4%) and lowest in the West (19.7%). Regional variation existed in the relationship between repeat C/S and ASD/ID risk (Figure 1). Regarding repeat C/S and ASD/ID risk, the West demonstrated no significant association (ASD without ID [OR:1.08; 95%CI: 0.93-1.27], ASD+ID [OR: 1.00, 95%CI: 0.77-1.31], and ID without ASD [OR: 1.01, 95%CI: 0.83-1.23]), the Southeast maintained significant relationships in all case groups, and the mid-Atlantic had mixed results.

**Conclusions:** Significant regional differences in ASD/ID risk associated with C/S reflected background variations in C/S rates. Repeat C/S in Western states occurred least frequently and was not significantly associated with ASD or ID. Less clearly delineated was the relationship between C/S rates and associated ASD/ID risk in the mid-Atlantic and Southeast. Understanding how regional differences in C/S indications may influence their association with ASD/ID could provide insight into underlying mechanisms that link these phenomena. In particular, further investigation is merited into maternal indications for primary C/S that recur in subsequent pregnancies and health care practices that vary regionally.

**319.003 (Oral) Maternal Autoantibodies and Autism-Risk Prediction in the EMA Study**

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**Background:** Autism spectrum disorder (ASD) affects ~2% of the US population and the incidence is on the rise; however, we still lack biomarkers that predict autism risk to facilitate early intervention services. We previously reported maternal IgG cross-reactivity to eight brain proteins (CRMP1, CRMP2, GDA, LDHA, LDHB, NSE, STIP1, and YBOX) and found that reactivity to a combination of two or more specific antigens (MAR ASD+ patterns) was highly accurate to predict autism risk in up to 20% of the ASD study population.

**Objectives:** This project aimed to expand upon our previous studies and test the accuracy of our MAR ASD+ patterns: CRMP1+GDA, CRMP1+CRMP2, NSE+STIP1, CRMP2+STIP1, LDHA+YBOX, LDHB+YBOX, GDA+YBOX, STIP1+YBOX, and CRMP1+STIP1 to predict ASD-risk in a new cohort, using samples from the prospective EMA study.

**Methods:** This prospective case-control study used plasma samples obtained from mothers whose children were enrolled in the EMA (Early Markers of Autism) study. This project included three study groups: ASD (N= 540), developmental delay (DD, N=184), and general population controls (GP, N=420). Maternal IgG reactivity against the eight protein antigens was determined by Enzyme-Linked Immunosorbent Assay (ELISA) using commercially available proteins. To evaluate the association for each pattern with child outcomes, we used Fisher Exact Test ( $p < 0.05$ ) and calculated the odds ratios (ORs) with 95% confidence intervals.

**Results:** We tested the MAR ASD+ patterns from our previous study and found that 10% of the ASD samples had significant IgG reactivity to any pattern combo vs 1% of controls ( $p < 0.001$ , OR 7.81, 95% CI from 3.32 to 22.43) which means that having maternal antibody reactivity to any pattern increases almost 8 times the ASD-risk relative to the controls, and almost 3 times compared to the developmentally delayed group ( $p=0.01$ , OR 2.77, 95% CI from 1.19 to 7.47). Of interest, 4% of the DD group reacted to some of the patterns but did not reach statistical significance ( $p=0.07$ , OR 2.72, 95% CI from 0.77 to 9.96), suggesting that reactivity to any MAR ASD+ pattern is not significant in the GP or DD groups, but is highly specific to the ASD group.

**Conclusions:** This is the first report that uses the MAR ASD patterns of reactivity to predict autism risk in a prospective study demonstrating the presence of maternal autoantibodies during gestation. The MAR ASD patterns covered up to 10% of the ASD population in the EMA study and were significantly correlated to ASD outcomes.

### **319.004 (Oral) Maternal Diagnoses in Pregnancy and Risk of Autism Spectrum Disorder**

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**Background:** The potential etiological role of maternal health during pregnancy in autism spectrum disorder (ASD) has received growing attention. Nevertheless, studies have often focused on a narrow range of diagnoses and failed to account for the potential effects of co-occurring conditions.

**Objectives:** This study sought to systematically investigate the association between maternal diagnoses in pregnancy and the risk of offspring ASD, accounting for correlations between diagnoses. Furthermore, we leveraged timing of diagnoses and a sibling study design to examine impacts of familial confounding on estimated associations between maternal non-chronic diagnoses and ASD.

**Methods:** This exploratory study used a population-based sample from Denmark to assess associations between maternal diagnoses before and during pregnancy and risk of ASD. The study included children born in 1998-2007 and their mothers. Maternal diagnoses were based on ICD-10 codes and classified as chronic and non-chronic diagnoses using the Chronic Condition Indicator developed by the Agency for Healthcare Research and Quality. Cox proportional hazard regression models were fit to quantify the risk of ASD associated with maternal diagnoses around pregnancy. All models were adjusted for the child's year of birth, maternal age at childbirth, and the total number of maternal diagnoses around pregnancy. To assess potential familial confounding, we first compared the associations between ASD and maternal non-chronic diagnoses recorded during the period from 24 to 48 months before the child's birth with those recorded during the 24-months period before the child's birth. Under the assumption that the non-chronic diagnoses recorded 24 to 48 months before the child's birth do not have an impact on the risk of offspring ASD, non-null effects could be suggestive of a potential bias in the estimated associations. Second, we conducted sibling analysis to indirectly adjust for familial confounding.

**Results:** The analytic sample included 653,580 children (7,866 ASD; 645,714 controls) born to 425,399 mothers. We tested 90 chronic and 241 non-chronic maternal diagnoses (ICD-10 codes) for an association with ASD. After controlling for multiple testing, 10 chronic and 22 non-chronic diagnoses were statistically significantly associated with ASD (Table 1). In a multivariable model concurrently including these 32 diagnoses, five chronic and 15 non-chronic diagnoses were significantly associated with ASD (Table 1). Pregnancy complications and injuries accounted for a major portion of the non-chronic maternal diagnoses associated with risk of ASD (e.g., diabetes mellitus in pregnancy: HR=1.28, 95%CI: 1.08-1.51; skull and facial bones fractures: HR=1.61, 95%CI: 1.09-2.37), and maternal psychiatric diagnoses were most strongly associated with ASD among the chronic ones (e.g., major depressive disorder: HR=1.89, 95%CI: 1.39-2.56). Results from the timing of diagnosis and sibling analyses provided limited evidence for the role of familial confounding in the observed associations.

**Conclusions:** Testing the wide range of maternal diagnoses and accounting for their co-occurrence, we observed both novel and established maternal conditions around pregnancy associated with ASD. The study findings highlight the importance of maternal health around pregnancy in the risk of offspring ASD. Our findings can inform studies exploring mechanisms of ASD etiology and help with identifying high-risk pregnancies.

**410.060** (Poster) A Mixtures Approach to Assessing the Association of Prenatal Diet and Autism-Related Outcomes in the EARLI Study  
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**Background:**

Maternal diet plays a key role in fetal brain development, and a growing body of evidence indicates an association between specific nutrients, such as folic acid and vitamin D, and Autism Spectrum Disorder (ASD) diagnoses. However, studies have not investigated the combined effects of dietary components captured as food groups on ASD and ASD-related traits. Operationalizing maternal diet as component food groups, rather than component nutrients, not only captures combined intake of nutrients, but also more readily aligns with the way individuals conceptualize diet to facilitate clearer dietary recommendations.

**Objectives:**

We sought to use Bayesian mixture modeling to estimate the combined and interactive effects of prenatal intake of multiple food groups on ASD-related traits.

**Methods:**

Study participants were drawn from the Early Autism Risk Longitudinal Investigation (EARLI), a high autism probability cohort that followed mothers who had a child with ASD through a subsequent pregnancy until that child was three years old. Autism-related traits were measured in the child at 36 months using the Social Responsiveness Scale (SRS), which measures social traits related to autism. Maternal diet data was captured mid-pregnancy using a validated Food Frequency Questionnaire. Diet data was converted into servings per day of seventeen *a priori* food groups, selected based on their established relationship with health outcomes and potential role in neurodevelopment, including fruit, alcohol, red meat, processed meat, dairy, whole grains, nuts, legumes, and subcategories of vegetables and fish. The combined effect of standardized servings per day of these food groups on raw SRS scores was assessed using Bayesian Kernel Machine Regression (BKMR). Posterior Inclusion Probabilities were assessed to determine the ten food groups that had the greatest association with SRS scores, and models were rerun after variable selection.

**Results:**

BKMR results did not indicate a significant mixture effect of the food groups on child SRS scores. However, two food groups demonstrated associations with SRS scores when servings per day of other food groups were fixed at their 50<sup>th</sup> percentile (Figure 1). Increased red meat intake was associated with an increase in child SRS scores (indicative of a stronger autism phenotype) (association comparing the 75<sup>th</sup> to 25<sup>th</sup> percentile = 4.45, SD = 2.6), while increased leafy green vegetable intake was associated with a decrease in child SRS scores (association comparing the 75<sup>th</sup> to 25<sup>th</sup> percentile = -5.65, SD = 3.5), though confidence bands were wide (Figure 2). Adjustment for several factors, including maternal body mass index and demographics, yielded similar results.

**Conclusions:**

Our work did not indicate an overall mixture effect of prenatal intake of food groups on child SRS scores. However, prenatal intake of red meat demonstrated a positive association and intake of dark leafy greens demonstrated a negative association with child SRS scores. Given the support for a role of prenatal inflammation in neurodevelopment, it is possible that pro- and anti-inflammatory effects of these foods, respectively, could serve as an explanation for these findings, which should be investigated further.

**410.061** (Poster) Additive or Interactive Associations of Eczema with Genotypes of GST Genes (GSTM1, GSTP1 and GSTT1) in Relation to ASD and ASD Severity in Jamaican Children

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**Background:** Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by impaired social and communication skills, and repetitive, stereotyped behavior. There is evidence of increasing comorbidity of eczema with ASD. Polymorphisms in glutathione S-transferase (GST) genes can influence susceptibility to increased oxidative stress, which is a possible underlying mechanism for both eczema and ASD.

**Objectives:** To investigate additive or interactive associations of eczema, with three GST genes in relation to ASD and ASD severity in Jamaican children.

**Methods:** Using data from 344 pairs of age ( $\pm 6$  months) and sex-matched ASD cases and typically developing (TD) controls ( $n=688$ ), we assessed additive and interactive associations of eczema with polymorphisms in three GST genes (*GSTM1*, *GSTP1* and *GSTT1*) in relation to ASD, based on conditional logistic regression models. Using data from ( $n= 344$ ) ASD cases, we used General Linear Models to assess the association of eczema, and its possible interaction with the GST genes in relation to ASD severity as measured by Autism Diagnostic Observation Schedule-Second Edition (ADOS-2) standardized total, as well as the Social Affect (SA) and Restricted and Repetitive Behaviors (RRB) domains specific comparison scores (CSs).

**Results:** Most ASD cases (71.8%) and TD controls (74.4%) were 48 months or older and 83% of both groups were male. After adjusting for child's age and history of breastfeeding in an additive model, eczema was not significantly associated with either ASD [Matched Odds ratio (MOR) and 95% Confidence Intervals (CI): 1.0 (0.7, 1.4),  $P=0.96$ ] or ASD severity (all  $P > 0.27$ ). However, in a recessive genetic model for *GSTP1*, we found a significant interaction between eczema and *GSTP1* in relation to ASD ( $P = 0.03$ ). Among children with Val/Val genotype the odds of eczema in ASD cases was 1.94 that of TD controls [adjusted MOR (95% CI) = 1.94 (0.97, 3.89),  $P = 0.06$ ], while there was no significant association between eczema and ASD among children with Ile/Ile or Ile/Val genotypes [adjusted MOR (95% CI) = 0.85 (0.60, 1.20),  $P = 0.35$ ]. We also identified a marginally significant interaction between eczema and *GSTM1* in relation to ASD severity after adjusting for aforementioned covariates ( $P = 0.09$ ). Specifically, among ASD cases with *GSTM1* DD genotype, those with eczema had a marginally significant higher mean of ADOS-2 SA domain CS than those without eczema (7.3 vs. 6.8,  $P = 0.08$ ), whereas, there was no significant association between eczema and ADOS-2 SA domain CS among ASD cases with I/I or I/D genotype (adjusted mean in ASD cases with and without eczema = 7.2 vs. 7.3,  $P = 0.67$ ).

**Conclusions:** Our findings suggest no additive associations between eczema and ASD or ASD severity. However, we found an interactive association of eczema with *GSTP1* in relation to ASD, as well as a marginally significant interactive association of eczema with *GSTM1* in relation to ASD severity as measured by ADOS-2 SA domain CS. These findings are consistent with the role for GST genes in oxidative stress, ASD, and eczema, though their replication in other populations is warranted.

**410.062 (Poster)** An Exploratory Investigation of Organic Chemicals in Baby Teeth: Differences between Children with and without Autism. **R. Palmer<sup>1</sup>**, L. Heilbrun<sup>2</sup>, K. Favela<sup>3</sup> and R. Blase<sup>1</sup>, (1)The University of Texas at San Antonio, San Antonio, TX, (2)University of Texas Health Science Center at Houston, San Antonio, TX, (3)South West Research Institute, San Antonio, TX

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**Background:** Shed baby teeth have been established to hold a record of exposure to heavy metals *in utero* and early childhood 1,2. Semi-volatile organic chemicals have been studied in shed baby teeth as a potential epidemiological tool to identify environmental triggers of developmental disorders such as autism.

**Objectives:** Here we have applied our comprehensive high-throughput non-targeted screening method to extensively catalog and categorize semi-volatile organic chemicals in shed baby teeth. Chemical exposures and concentrations in teeth were then compared between children and without autism.

**Methods:** Parents of children with and without autism donated their child's baby teeth as part of the UTHSCSA *Autism Tooth Fairy Project* to investigate toxicant exposures occurring during development. After removing the root and tissue material, each tooth was wiped with Isopropyl alcohol and ground to a powder using a mortar and pestle. Approximately 0.1 g of each ground tooth sample was spiked with a surrogate solution and extracted three times with 1.0 mL each of 90:10 Dichloromethane:Ether. The three 1.0-mL aliquots were combined and concentrated to a final volume of 50  $\mu$ L. A method blank consisting of 0.1 g of cleaned and heat-treated hydroxyapatite was extracted the same way. Comprehensive two dimensional Gas Chromatography Time-of-Flight Mass Spectrometry (GCxGC/TOFMS) analysis was performed using an Agilent 7890 gas chromatograph coupled to a LECO PEGASUS 4D. The assay was both targeted (using 134 authentic standards) and non-targeted.

**Results:** A total of 11,971 chemicals from 38 shed baby teeth were cataloged, including unknowns without a suitable library match. The average was 315 compounds per tooth. Of 42 teeth, 22 were from children with autism spectrum diagnoses and 20 were from typical developing children. In general these are xenobiotic compounds with a high confidence score, many of potential interest as toxic agents. A total of 161 compounds of interest were identified. Topical analgesics, ingredients of personal care products, flavors, fragrances, solvents, insecticides and repellants were well represented in the data-set, suggesting the oral or dermal absorption routes of deposition as an active mechanism.

**Conclusions:** Hair, urine, or saliva samples provide limited measures of exposures because they only reflect relatively recent exposures. As teeth begin to form in the 2nd trimester, layers of dentin are deposited (similar to rings on a tree). These layers sequester chemicals the child has been exposed to during gestation and early childhood. Information stemming from the "tooth exposome" is important for informing future epidemiologic research about the types of compounds that are present during critical periods of development. This research has implications for chemical avoidance and prevention of neurodevelopmental disabilities such as autism.

**410.063 (Poster)** An Exploratory Study in Pain Assessment Bias: Effects of Autism and Intellectual Disability on Pain Assessment By Medical Professionals.

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**Background:** Pain is a subjective experience, thus, self-report is considered the clinical “gold standard” for pain assessment. Reliance on traditional self-report measures could be problematic for autistic individuals due to differences in social communication or pain expression. Observation-based tools that aim to capture verbal, nonverbal (e.g., facial expressions, posturing), and other physiological or behavioral changes associated with pain have become the clinical “silver standard”. However, these tools may be influenced by medical provider bias in pain assessment. Challenges in assessing pain and lack of provider education are likely two of the biggest obstacles to appropriate pain management in autism.

**Objectives:** To investigate medical providers’ bias in pain assessment for autistic individuals.

**Methods:** We recruited medical providers with at least 1 year of professional experience (n=168) to participate in an online experiment regarding pain assessment. We paired 10 short vignettes with a 6-second video of an adult experiencing pain in a medical setting. Each vignette described a patient who was either neurotypical (n=5), autistic (n=3), or had intellectual disability (n=2). Vignettes described the patient history and the current healthcare encounter (e.g., broken ankle assessment in the emergency department). After reading the vignette and watching the video, participants rated how much pain they estimated the person in the video was experiencing on a visual analog scale (0-100). The 10 videos were distributed across gender (women=5 and men=5) and race (Black=3, White=7). Video and vignette pairings were presented in 2 versions (mixing videos across vignette conditions for experimental balance), interleaved across participants.

**Results:** While participants were alternatively assigned to experimental version, between the two versions, the participant groups were significantly different in age, gender, race, and medical profession. The groups also differed on overall estimated pain ratings (average pain rating in version 1:  $37.14 \pm 20.82$ , n=83; version 2:  $44.51 \pm 22.91$ , n=85;  $p < 0.0001$ ). Given the significant differences in group demographics, we explored the effects of autism diagnosis, and intellectual disability, while correcting for potential bias associated with experimental version, as well as gender and race of the person in the video. In version 1, autism diagnosis was associated with higher pain ratings ( $\beta = 7.130$ ,  $t = 3.542$ ,  $p < 0.0001$ ) and intellectual disability was associated with lower pain ratings ( $\beta = -9.197$ ,  $t = -4.451$ ,  $p < 0.0001$ ) compared to the neurotypical group. In version 2, autism diagnosis was associated with lower pain ratings ( $\beta = -5.734$ ,  $t = -2.924$ ,  $p = 0.004$ ) and intellectual disability was associated with higher pain ratings ( $\beta = 12.103$ ,  $t = 5.334$ ,  $p < 0.0001$ ) compared to the neurotypical group.

**Conclusions:** This exploratory study provides the first experimental evidence of possible provider bias in pain assessment for autistic adults or adults with intellectual disability, but suggests there may be many different factors important in pain assessment. Addressing assumptions or false beliefs about biological differences in pain tolerance for autistic individuals could begin to mitigate pain mismanagement in this population.

**410.064 (Poster)** Tracking Health in Kids (THinK)

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**Background:** Links between fevers and autism have been proposed in the clinical literature for several years. Anecdotal reports suggest the possibility of improvements in behavior for children with autism when these individuals experience a fever. Despite a substantial number of anecdotal reports, there is surprisingly little published data examining these effects. Data from the Simons Simplex Collection revealed that, of a sample of over 2000 children, 17% of families reported, retrospectively, that their children’s behavior improved when they had a fever. One other prospective study found that 83% of children demonstrated a significant improvement in behavior during fever in at least one domain of the Aberrant Behavior Checklist (ABC).

**Objectives:** The current study aimed to investigate, prospectively, whether we could replicate the findings of associations between autism and improvements in behavior during fever in a way that remedies the methodological limitations of previous studies. We set out to understand the degree to which children with ASD have specific and unique responses to fever, and whether these behavioral responses to fever differ from behavioral responses to other medical events not involving a fever.

**Methods:** This study consisted of 244 children between the ages of 2-7; 141 were diagnosed with ASD, the remaining 103 were not. Families collected data through a phone application three times per week to report whether anything out of the child’s day-to-day routine occurred (e.g., travel, missed appointments, sickness, etc.). Parents were asked to explain the event that transpired, record the child’s temperature, and respond to questions that pertained to the child’s behavior during the event. Additionally, parents recorded “baseline” temperatures and behavioral ratings at times in which no significant event had occurred.

**Results:** Multilevel modeling revealed a significant main fixed effect of fever conditions, suggesting that children’s social behavioral ratings (including items such as communication, play, happiness), level of eating and sleeping, and emotional and behavioral problems (including anxiety, behavior management, and irritability) worsened when they had a fever. Moreover, a significant interaction effect was observed for fever condition and diagnosis on the social behavioral ratings, where children with ASD were reported to show increasingly worsening social behavioral ratings during fever than those without ASD. No interaction effect was found for fever condition and diagnosis on eating and sleeping or emotional and behavioral problems. Data is still being analyzed to determine whether the behavioral differences during fever differ from behavioral differences during other non-fever medical events.

Conclusions: Behavioral changes during fevers were observed across the whole sample as compared to baseline recordings. Interaction effects (in which children with ASD exhibited different behavioral responses than children without ASD) were only present for ratings of social behaviors (such as happiness, play, and communicating ideas). We do think that behavioral improvements during fever is a phenomenon that occurs in a subset of individuals (based on consistent anecdotal reports). However, using a nuanced design like this and a relatively short period of time of study inclusion creates smaller sample sizes than may be necessary to identify this subgroup.

**410.065 (Poster) Features That Best Define the Heterogeneity and Homogeneity of Autism in Preschool-Age Children: A Multisite Case-Control Analysis Replicated across Two Independent Samples**

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**Background:**

The heterogeneous nature of autism spectrum disorder (ASD) complicates the search for risk factors and effective treatment options. Previous studies on early ASD phenotypes reported between two and four subgroups that diverge on measures of developmental functioning (e.g., language abilities) and dysregulation (e.g., sleep problems) and converge on measures of sensory dysfunction. However, the number of subgroups is variable across analyses. Lack of replication makes it difficult to generalize and interpret individual study results. Another approach is to quantify the most distinguishing and common features of young children with varying levels of ASD symptoms. This approach could highlight symptoms that can be documented and treated versus those that additionally can be the focus of etiologic research.

**Objectives:**

Our objectives were to identify behavioral and developmental features that best define the heterogeneity and homogeneity in 2-5-year-old children with ASD and those with subthreshold ASD characteristics.

**Methods:**

Children were enrolled in a multisite case-control study of ASD. Behavioral and developmental data were collected from mothers and child evaluations. All children were asked to complete an early learning assessment. Participants with a positive ASD screen score or prior ASD diagnosis were additionally asked to complete gold-standard ASD measures. Children in the ASD group met study criteria based on these measures; children who did not meet study criteria were categorized as having subthreshold ASD characteristics. Multiple correspondence analysis (MCA) was employed to address the research objectives. MCA is a statistical technique that summarizes response profiles among categorical variables to reveal patterns in complex datasets. Each data point is plotted in multi-dimensional space to determine its proximity to an origin defined by distance measures. Datapoints farthest from the origin suggest considerable variation from the most common profile. Datapoints closest to the origin suggest little variation from the most common profile.

**Results:**

There were 1,480 children with ASD (81.6% boys) and 594 children with subthreshold ASD characteristics (70.2% boys) in the total sample, which was split into two samples based on SEED phase completed (i.e., Phase 1 or 2). Aggression, anxiety/depression, and sleep problems constituted one dimension that explained between 49% and 65% of the variance in ASD symptoms in both samples and in both groups of children. Expressive and receptive language skills constituted a second dimension that explained an additional 15% to 30% of the variance in both samples and in both groups of children. Atypical sensory response contributed to homogeneity in children with ASD but not those with subthreshold characteristics in both samples.

**Conclusions:**

Our findings suggest that dysregulation and developmental abilities are features of the broad spectrum of ASD symptoms that can impact functioning whereas sensory dysfunction may be a core feature of the disorder. Documentation of factors that contribute to diversity of early childhood phenotypes – especially aggression, anxiety/depression, and sleep problems – may support clinical monitoring and tailor individualized treatments. Since sensory dysfunction defines the most common ASD profile, evaluation and treatment of sensory concerns may lessen the impact of sensory deficits and guide future research on sensory dysfunction.

**410.066 (Poster) Associations between Intellectual Disability and Social Determinants of Health in Pre-School Age Children with Autism According to Maternal Race/Ethnicity**

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#### Background:

The Centers for Disease Control and Prevention estimate that about 53% of pre-school-aged children with autism spectrum disorder (ASD) have co-occurring intellectual disability (ID) (<https://www.cdc.gov/mmwr/volumes/69/ss/ss6903a1.htm>). In the U.S., ID is disproportionately identified in non-Hispanic Black (NHB) and Hispanic (HISP) children compared to non-Hispanic White (NHW) children in the population overall and among children with ASD. Social disadvantage is a leading risk factor for ID, and NHB and HISP families are more likely to experience social disadvantage than NHW families. Yet no identified study has explored whether social disadvantage is more strongly associated with ID in NHB and HISP children than NHW children with ASD.

#### Objectives:

Our objectives were to assess in a large community-based sample of children with ASD whether (1) NHB and HISP children were more likely to be classified as having ID than NHW children; (2) NHB and HISP families were more likely to experience social disadvantage than NHW families; and (3) social disadvantage was more strongly associated with ID among NHB and HISP than NHW children, independent of other established risk factors (e.g., premature birth).

#### Methods:

Children aged 2-5 years were enrolled in a multisite case-control study of ASD. Children classified as having ASD met cut-off criteria on gold-standard diagnostic measures. ID was defined as a Mullen Scales of Early Learning visual reception t-score of  $\leq 30$  points (i.e., proxy for nonverbal intelligence). Pre- and post-natal histories were obtained from a detailed maternal interview to identify factors associated with ID, which served as covariates in adjusted logistic regression analyses. Potential indicators of social disadvantage were obtained from the same interview and served as independent variables. Maternal race/ethnicity was also obtained from the same interview and was used to stratify regression models.

#### Results:

There were 1,284 children with ASD (81.4% boys) in the sample, of which 740 (50.7%) were NHW, 337 (23.1%) were NHB, and 207 (14.2%) were HISP. NHB and HISP children were significantly more likely to have ID than NHW children, and significantly more likely to experience social disadvantage (Table 1). Income relative to the federal poverty level (aOR 2.06; 95% CI = 1.34, 3.18), language spoken in the home (aOR 1.53; 95% CI = 1.03, 2.29), and maternal education (aOR 1.73; 95% CI = 1.27, 2.36), were associated with ID in the entire sample. However, none of these socioeconomic factors were associated with ID *within* racial/ethnic groups.

#### Conclusions:

NHB and HISP children with ASD were disproportionately identified with ID and social disadvantage when compared to NHW children in our sample. Consistent with previous studies, we found that social disadvantage was associated with ID for all children with ASD. However, in analyses stratified by race/ethnicity, no individual indicators of social disadvantage were associated with ID. These results suggest that there may be factors not measured in this study associated with the disproportionate burden of ID in NHB and HISP children with ASD, or that stratified sample sizes were not adequate to detect statistical differences. We next plan to explore county-level indicators of structural inequality such as racial segregation and income inequality to determine their influence on ID in different racial/ethnic groups (<https://www.countyhealthrankings.org/reports>).

#### **410.067 (Poster)** Autism Spectrum Disorder and Possible Related Factors in Pregnancy

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#### Background:

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that occurs in the early developmental period of life and characterized by deficits in social communication and interaction, along with limited, repetitive behavior or interests. Early diagnosis of ASD facilitates early access to intervention and promotes better developmental outcomes in young children. Therefore, studies focus on early markers while investigating risk factors.

**Objectives:** This study aimed to investigate environmental factors in the pre- and perinatal period and the other possible related factors of ASD, and to compare these variables with those of typically developing peers

## Methods:

A total of 55 children with ASD between the ages 20 and 66 months, who were diagnosed for the first time and 60 typically developing (TD) were included in this cross-sectional study. Children with ASD were selected from pediatric psychiatry outpatient clinic and diagnosed by an experienced child and adolescent psychiatrist, based on DSM 5 diagnostic criteria. The typically developing children who had no history of physical or developmental disabilities were selected for control group. Childhood Autism Rating Scale (CARS) and Autism Behavior Checklist (ABC) were administered by the clinician, to evaluate autism-related symptom severity of ASD children.

## Results:

The mean age of ASD and TD children were found to be  $35.2 \pm 9.6$  months and  $36.1 \pm 8.6$  months, respectively. Groups did not differ by age ( $p > 0.05$ ). The mean scores of CARS and ABC of children with ASD were  $40.6 \pm 3.8$ ,  $87.2 \pm 25.3$ , respectively. There were no significant differences, the method of conception (normal/using assisted reproductive techniques), drug use, smoking, alcohol/substance use, infection, gestational diabetes, gestational hypertension, preeclampsia, increased risk of abortus, hemorrhage, use of vitamins, delivery time (full-term/preterm/postterm) and method of delivery, between two groups ( $p > 0.05$ ). In ASD group, mothers were significantly more exposed to passive smoking ( $p < 0.05$ ). In addition, when the use of vitamin D during pregnancy and natal complications (hypoxia, etc.) were investigated, a significant difference was found between the two groups ( $p < 0.05$ ).

## Conclusions:

Based on our current knowledge of the disorder, it is clear that autism does not have a single cause. Investigation of environmental factors associated with ASD is critical, especially in terms of preventive mental health interventions. Our study has supported the importance of protection from passive smoking and vitamin D supplementation during pregnancy. As a result, regular pregnancy follow-up will enable the detection of risky pregnancies and early diagnosis, as well as preventive interventions.

**410.068 (Poster)** Exploration of Stressful Life Events during Pregnancy As a Risk Factor for Child Neurodevelopmental Outcome in Marbles: A High Familial Risk Cohort

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## Background:

Prenatal stress has been associated with elevated risk of autism spectrum disorder (ASD) in the child. While several types of prenatal stressful life events (SLEs) were not associated with ASD risk, one study<sup>1</sup> of prenatal stress through family discord found an increased risk of child ASD. Maternal stress might be more of a concern for a child at high familial risk due to having an older sibling diagnosed with ASD.

## Objectives:

Be the first to examine in a high familial risk cohort prenatal SLEs in association with ASD or other non-typical development (Non-TD) in the child.

## Methods:

The prospective MARBLES cohort includes 314 women with at least one child with ASD and then became pregnant with another child.

Mothers were asked at the end of their pregnancy if they had experienced any of the following SLEs: 1. Changing or losing jobs, 2. Death of a close family member or close friend, 3. Legal problems, including immigration, 4. Financial problems, including foreclosure, 5. Moving, being separated from family or close friends, or having a family member move into the household, 6. Serious problems or disagreements with relatives, neighbors, or in-laws, or 7. Any other major events, not already specified.

Child neurodevelopment was assessed longitudinally from birth through three years of age by trained psychologists who administered the Autism Diagnostic Observation Schedule (ADOS) and the Mullen Scales of Early Learning (MSEL). An algorithm based on ADOS and MSEL scores previously published by the Baby Siblings Research Consortium<sup>2</sup> was used to classify children with ASD, Non-TD, or typically developing (TD) outcomes.

Multinomial logistic regressions were fitted for the case status outcome, controlling for maternal race/ethnicity, age, and socioeconomic status for each of the seven SLEs separately and for a composite binary independent variable indicating whether 1+ SLE was experienced.

## Results:

Experiencing a death of a close family member or friend was significantly associated with a decreased risk of ASD (OR 0.45, 95% CI: (0.22, 0.90)). Experiencing financial problems (OR 2.23, 95% CI (1.03, 4.81)) and legal problems (OR 5.24 (95% CI: (1.81, 15.20))) were associated with an increased risk of non-TD in the child. All other associations were non-significant. Generally, SLEs during pregnancy were not associated with elevated risk of Non-TD or ASD in the child.

## Conclusions:

Findings agree with previous literature suggesting prenatal SLEs may not be risk factors for ASD and most were not strongly associated with Non-TD risk either. The increased risk of financial and legal problems on Non-TD merits further exploration, though precision was low. The association between experiencing death during pregnancy and ASD in the protective direction was unexpected; this might be explained by the resilience theory where the fetus was exposed to a traumatic event and becomes resilient so the child does not develop ASD later on. Future studies measuring stress using biomarkers or perceived stress are warranted to further understand the true association of prenatal stress and risk of ASD. Experiencing multiple SLEs in one pregnancy should also be explored as a risk factor.

**410.069** (Poster) Exploring the Barriers and Facilitators to Physical Activity Involvement in Autistic Youth with Mild Intellectual Disability  
*C. L. McIntyre, T. Q. Boucher, M. L. Mylett and G. Iarocci, Psychology, Simon Fraser University, Burnaby, BC, Canada*

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**Background:** Autistic youth participate in physical activity (PA) at higher rates than youth diagnosed with intellectual disability (Borland et al., 2020). However, caregivers of children diagnosed with both autism and intellectual disability report that their child experiences significant difficulties obtaining support for physical and leisure activities compared to autistic children (Nichols et al., 2019) and children diagnosed with intellectual disability only (Tint et al., 2017). These youth may not experience the benefits of engaging in PA, such as improved mental health, academic achievement (Boddy et al., 2015), and increased self-efficacy (Menear & Neumeier, 2015). Thus, understanding the unique barriers and facilitators to PA for these youth is critical.

**Objectives:** While previous research has identified some barriers and facilitators to PA involvement for youth with ASD and/or intellectual disability, few studies have gathered this information from youth directly. This study examines barriers and facilitators to PA involvement in autistic youth with mild intellectual disability using semi-structured interviews and caregiver reports.

**Methods:** Fourteen caregivers and their child ranging in age from 8 to 16 years ( $M_{age}=12.23$ ,  $SD=2.51$ , 13 males) diagnosed with autism and mild intellectual disability participated. The Wechsler Abbreviated Scales of Intelligence, Second Edition (WASI-II; Wechsler, 2011) was used to assess youth's cognitive ability ( $M=65.64$ ,  $SD=10.73$ , range 51 to 75). The Health & Wellness and Risk Engagement & Protection Survey (HWREPS; McFee, 2018) was used for caregiver reports of their child's PA preferences. Caregivers also reported on the barriers and facilitators to their child's PA involvement. Youth participated in semi-structured interviews and reported on their PA preferences, the types of activities they dislike, and the things that prevent them from participating in PA. Transcribed interviews were coded using NVivo software.

**Results:** Four core themes were inductively identified by the first and second authors: (1) Intrapersonal Barriers (factors that are intrinsic to the person that impede PA involvement, such as their own cognitions, attitudes, and behaviours; e.g., disliking PA, having a preference for sedentary activities, expressing challenging behaviours that inhibit PA engagement), (2) Interpersonal Barriers (factors that are extrinsic to the person that impede PA involvement; e.g., lack of community support to foster PA engagement), (3) Intrapersonal Facilitators (factors that are intrinsic to the person that enhance PA involvement; e.g., enjoying PA, finding PA intrinsically rewarding, being motivated to improve one's abilities), and (4) Interpersonal Facilitators (factors that are extrinsic to the person that enhance PA involvement; e.g., receiving support and rewards from caregivers).

**Conclusions:** The findings reveal the unique barriers and facilitators to PA involvement in autistic youth with mild intellectual disability. By gathering this information from youth directly in addition to caregiver reports, these findings provide new perspectives on the factors that impede and enhance PA among these youth. The findings can be used to inform interventions designed to reduce barriers and increase facilitators to PA within schools and other organizations. A limitation is our predominantly male sample; future work should include more gender-balanced samples to examine the potentially unique barriers/facilitators to PA for autistic girls with mild intellectual disability.

**410.070** (Poster) Association of Early-Life Exposures to Diet Soda and Aspartame with Autism in Males: A Case-Control Study  
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## Background:

For more than a decade, prospective cohort studies have reported increased cardiometabolic, neurologic, and other risks among adults consuming diet sodas (DS) daily. Since its introduction into the U.S. diet in the early 1980's, case reports have linked the non-nutritive sweetener aspartame – used in most diet sodas (DS) and many other diet beverages and products – with neurological and other health problems in adults. Recently, maternal intake of diet beverages during pregnancy has been associated with increased risk of prematurity and overweight/obesity among exposed offspring, and a case-control study found increased gestational exposure, through maternal diet, to methanol, an aspartame metabolite, among children with autism compared with neurotypically developing children. Methanol may contribute to these outcomes by reducing antioxidant and detoxification capacity, and adversely impacting the maternal gut microbiota and intrauterine environment.

## Objectives:

In this study we tested the hypothesis that early-life exposures to DS and to aspartame, specifically, during gestation and breastfeeding, are associated with offspring autism status.

#### Methods:

We analyzed data from the case-control Autism Tooth Fairy Study, in which biological mothers of offspring with autism spectrum disorders (ASD; cases: n=235) and neurotypically developing offspring (controls: n=121) retrospectively reported their intakes of DS, other diet beverages, and tabletop sweeteners during pregnancy/breastfeeding. Mothers were asked to specify the brand name of each diet product used; aspartame contents of these products were derived from previous publications. We calculated total daily intakes during pregnancy/breastfeeding of DS itself, and of aspartame from these three dietary components. Adjusted exposure odds ratios (ORs) were then calculated for two early-life exposures:  $\geq 1$  DS/day, and  $\geq 177$  mg/day of aspartame (the minimum dosage in 1 aspartame-sweetened diet cola). We calculated ORs separately by sex, and for both sexes combined, for the following: all cases with ASD, all cases with autism, and cases with early-onset autism. ORs were derived using multilevel mixed-effects generalized linear model analyses, adjusted for mother's id, recruitment source, child's ethnicity (non-Hispanic white vs. other), year of birth, mother's education ( $\geq 4$  years of college vs. less), and household income ( $\geq \$100,000$ /year vs. less).

#### Results:

Among males, odds of early-life exposure to  $\geq 1$  DS/day were tripled among autism cases (OR=3.14; 95% confidence interval (CI): 1.02, 9.65) and even greater among early-onset autism cases (OR=3.49; 95% CI: 1.10, 11.08). Higher still among males were odds of early-life exposure to  $\geq 177$  mg/day of aspartame: OR=3.42 (95% CI: 1.12, 10.41) among autism cases, and OR=3.73 (95% CI: 1.18, 11.78) among early-onset autism cases. No statistically significant associations were found for autism in girls, or for total ASD in either sex.

#### Conclusions:

Our findings contribute to the growing literature raising concerns about the safety of consuming diet beverages and products during pregnancy. Because our study utilized retrospective dietary recalls in the context of a case-control study design, future research using prospectively gathered data from large cohorts would be important in confirming these associations. Meanwhile, women should exercise caution, and weigh carefully the potential harm to their offspring, when considering using these products during pregnancy and breastfeeding.

#### **410.071 (Poster) Gestational Diabetes and Risk of Autism Spectrum Disorder**

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#### Background:

Maternal diabetes has been associated with risk of autism spectrum disorder (ASD) in offspring, but careful delineation of risk arising from Type 1, Type 2 or gestational diabetes has not been done. As the three manifestations of diabetes differ in pathogenesis it is important to consider them separately in order to investigate specific mechanisms of effect underlying the diabetes association with ASD.

#### Objectives:

Investigate association between gestational diabetes, specifically, and ASD risk overall, by sex and in ASD subgroups defined by co-occurrence of intellectual disability (ID) or attention deficit hyperactivity disorder (ADHD).

#### Methods:

We applied a population-based cohort design comprised of all live births in Denmark of Nordic-born parents from 1998- 2008. Exposure to gestational diabetes was defined by an ICD-10 code O24.4 recorded in the National Patient Register by specialists for the mother during the index pregnancy. ASD, ADHD or ID in the child was based on reported ICD10 diagnoses (F84.0/.1/.5/.8/.9) by specialists to the Psychiatric Central Research or National Patient Register. We applied Cox proportional hazard regression to estimate the risk of ASD associated with maternal gestational diabetes. Children were followed from 18 months of age until ASD diagnosis, emigration, death or end of follow-up on December 31, 2016, which ever came first. In all models, gestational diabetes was the primary predictor. Covariates included for adjustment were: Model 1 – sex, birth year; Model 2 - model 1+ paternal age, income and education, maternal age, income and education, polycystic ovary syndrome in the mother, parity; Model 3 - model 2 + paternal psychiatric history, maternal psychiatric history. We repeated the analyses by sex and by ASD subgroups (ASD with/without ID; ASD with/without ADHD); co-occurrence was based on diagnostic status of the second condition at the end of follow-up and using multinomial logistic regression to estimate odds ratios (OR). The multinomial logistic regression also adjusted for time at risk in all three models.

#### Results:

The cohort comprised 558,713 births of whom 6,288 (1.1%) were exposed to gestational diabetes and 13,200 (2.4%) were diagnosed with ASD. In fully adjusted models (Model 3), gestational diabetes was associated with about a 50% increased risk for ASD overall, adjusted Hazard Ratio (aHR) 1.56 (95% CI 1.43-1.87); lower risk in females (aHR 1.22 (95% CI 0.90-1.67)) than males (aHR 1.66 (95% CI 1.43-1.93)); p-value for interaction by sex  $p=0.03$ , Figure) and no difference by ID co-occurrence (ASD/-ID: adjusted OR 1.57 (95% CI 1.36-1.82), ASD/+ID: adjusted OR 1.59 (95% CI 1.07-2.34) but somewhat higher risk in ASD with ADHD (adjusted OR 1.74 (95% CI 1.39-2.19) than ASD without ADHD (adjusted OR 1.49 (95% CI 1.26-1.77)).

#### Conclusions:

The estimates of risk for ASD following exposure to gestational diabetes were persistent, robust and fairly stable in magnitude across different multivariate models and ASD phenotypic subgroups, although with higher risks in males than females. The potential impact of unmeasured familial confounding and the potential for shared genetic factors between gestational diabetes and ASD may be contributing to the observed association.

#### **410.072 (Poster)** Maternal Cortisol in 3rd Trimester Predicted Traits of Autism in Offspring at 3 Years of Age. Odense Child Cohort

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**Background:** Prenatal cortisol exposure is essential for neurodevelopment. Based on animal and human studies cortisol levels during 3rd trimester of pregnancy could be associated with offspring risk of Autism Spectrum Disorder (ASD).

**Objectives:** To investigate associations between maternal cortisol during 3<sup>rd</sup> trimester pregnancy and traits of ASD in offspring.

**Methods:** The study included 1,131 mother-child pairs from the prospective Odense Child Cohort. Fasting morning serum cortisol and diurnal urine cortisol/cortisone were collected at gestational week 27-28 and were measured by mass spectrometry.

Offspring ASD traits were assessed at 3 years ( $n=1,131$ ) and at 5 years ( $n=717$ ) using the 13 item DSM-oriented Pervasive Developmental Problems (PDP) subscale from Child Behavior Checklist for ages 1½ to 5 years (CBCL/1½-5). Scale-scores (range 0-26) were dichotomized, and logistic regression models were used to investigate associations between maternal cortisol (continuous and tertile models) and offspring ASD traits (scores above the 90<sup>th</sup> percentile in the Danish national norm material). All regression models were adjusted for maternal age, pre-pregnancy Body Mass Index (BMI), parity, maternal smoking status, maternal educational level and parental psychiatric diagnoses.

**Results:** At birth of the index child, mothers had a mean age of 30 years ( $SD \pm 4.4$  years), median of pre-pregnancy BMI was 23.5 kg/m<sup>2</sup> [21.3; 26.6], 56% were primiparous and 52% gave birth to a boy. At three years of age ASD traits was seen in 20% (116/586) of boys and in 13 % (73/545) of girls. In univariate analysis, the presence of ASD traits were significantly associated with low maternal age, lower pre-pregnancy BMI, primiparity, GA <37 weeks, low maternal educational level and maternal smoking.

Maternal serum cortisol was associated with offspring ASD traits (3<sup>rd</sup> tertile unadjusted odds ratio (OR) [95% confidence interval] 2.02 [1.36; 3.00],  $p < 0.001$ , adjusted OR 1.64 [1.07; 2.52],  $p=0.023$ ). When stratified by offspring gender, this association was only seen in boys (3<sup>rd</sup> tertile: unadjusted OR 2.33 [1.42; 3.84],  $p=0.001$ , adjusted OR 1.82 [1.06; 3.12],  $p=0.029$ ). The association was lost at age 5 (all  $p$ -values > 0.21).

**Conclusions:** Higher maternal serum cortisol in 3<sup>rd</sup> trimester was associated with offspring ASD traits in boys at 3 years of age.

#### **410.073 (Poster)** Maternal Obesity, Diabetes, Preeclampsia, and Asthma during Pregnancy and Risk of Autism Spectrum Disorders and Gastrointestinal Comorbidities in Children

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**Background:** Studies have reported associations between exposure to maternal obesity, diabetes, preeclampsia, and asthma during pregnancy and autism spectrum disorders (ASD) in offspring. There has been little study of associations with ASD comorbid phenotypes, of which gastrointestinal (GI) conditions are the most common. Given emerging evidence of the influence of gut microbiota in ASD diagnosis and presentation, this study examines whether *in utero* exposure to these maternal conditions is associated with ASD with and without comorbid GI disorders.

**Objectives:** To identify risk of gastrointestinal ASD phenotypes associated with *in utero* exposure to maternal obesity, diabetes, preeclampsia, and asthma in a large, representative birth cohort.

**Methods:** This population-based retrospective cohort study included 308,536 mother-child pairs of singletons born between 2001-2014 in Southern California. Mothers and children were followed through electronic medical records. Children were followed until age 5. Data on maternal pre-pregnancy obesity (BMI  $\geq 30$ kg/m<sup>2</sup>), diabetes, preeclampsia, and asthma during pregnancy and child's ASD or GI diagnosis were extracted from EMR. Children were categorized into four groups: 1) no ASD no GI disorders, 2) no ASD with GI disorders, 3) ASD no GI disorders, and 4) ASD

with GI disorders. Multinomial logistic regression models estimated odds ratios (OR) and 95% CI of ASD/GI phenotypes in children associated with the exposure to each of four maternal conditions adjusting for birth year, maternal age, parity, maternal race/ethnicity, maternal educational qualifications, smoking in pregnancy, history of comorbidity, maternal mental health issue, census-tract parent income at age one, and child's sex.

Results: Over follow up, 5,131 (1.7%) children were diagnosed with ASD and 77,846 (25%) had GI disorders. Of the total sample, 1,814 (0.6%) had ASD with accompanying GI disorders, 3,317 (1.1%) had ASD without GI disorders, and 76,032 (25%) had GI disorders without ASD. GI disorders were present in 35.4% of children with ASD and in 25.1% of children without ASD. Table 1 presents the covariate adjusted ORs comparing odds of ASD and/or GI disorder diagnosis associated with maternal health conditions, relative to children without ASD or GI disorders. Compared to children without ASD or GI disorders, the four maternal conditions were generally associated with odds of having ASD both with and without GI disorders. However, for each maternal exposure, ORs were greatest in children with both ASD and GI disorders [obesity: 1.29 (1.15, 1.46); diabetes: 1.39 (1.19, 1.64); preeclampsia: 1.55 (1.29, 1.86); and asthma: 1.38 (1.15, 1.65)]. Exposure was also associated with GI conditions in children without ASD.

Conclusions: Exposure to maternal obesity, diabetes, preeclampsia, and asthma *in utero* may increase risk of ASD diagnosis in children with and without GI disorders, with the greatest effect sizes in children with both ASD and GI disorders. These maternal conditions may also increase risk of GI disorders in children without ASD. Further investigation of the role of the gut in effects of these *in utero* exposures on ASD is warranted.

#### **410.074 (Poster) Multiple Birth As a Risk Factor for Autism Spectrum Disorder: Findings from a Large Population**

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Background: The prevalence of ASD has been steadily increasing over the past two decades. According to Autism and Developmental Disability Monitoring (ADDM) Network surveillance, ASD prevalence estimates have increased 175% between 2000 and 2016. In the most recent ADDM reporting cycle in 2016, New Jersey had the highest prevalence at 31.2 per 1,000. The higher prevalence is likely due to more comprehensive access to records leading to better ascertainment and/or to a higher concentration of risk factors such as parental age, increased use of c-section, and higher rates of multiple births (MB). The 2016 New Jersey multiplicity rate was 3.9% while the US rate was 3.4%. MBs are closely associated with these risk factors as well as fertility treatments. In a meta-analysis of perinatal and neonatal factors, multiple births were associated with increased autism risk among other factors such as c-section delivery and low birth weight. The findings regarding multiple births have been inconsistent and further studies from population-based studies are needed.

Objectives: The objective of this study was to estimate the incidence of ASD among singletons and multiple births and stratify the findings by birth weight using population-based samples across several cycles of active ASD surveillance between 2010 and 2016.

Methods: The data used in this study was from the New Jersey ADDM site. Ascertainment of ASD cases followed a two-phase process, using health and educational records followed by expert scoring and analysis. The years analyzed for this study included 2010, 2012, 2014, and 2016, totaling 4,051 ASD confirmed cases. Linkage to birth certificates was achieved for New Jersey-born children, thereby confirming their gestational status. Multivariate regression analysis (Poisson Regression) was used, adjusting for birth weight and maternal age.

Results: We compared risk of ASD among singleton and multiple gestational births and found across all surveillance cycles between 2010 and 2016, elevated ASD prevalence among multiple gestational births compared to singleton gestational births (3.7% vs. 1.9%). Adjusting for factors related to multiple births such as maternal age and birth weight, the risk of ASD was 2-times higher among multiple birth compared to singleton births (Crude PR = 1.9; 95% CI: 1.2-3.2; Adjusted PR = 2.0; 95% CI: 1.7-2.4). The prevalence ratio comparing multiple births to singleton births across the surveillance cycles ranged from 1.6 (95% CI: 1.2-2.1) in 2014 to 2.3 (95% CI: 1.7-3.0) in 2012.

Conclusions: Our data show multiple gestation as a risk factor for ASD. Across all surveillance years, ASD was more common in multiple gestation offspring than singleton offspring. When adjusted for common confounding variables such as low birth weight and advanced maternal age, there was still an elevated prevalence in multiple birth gestations compared to singleton births in all surveillance years. Greater multiple births in NJ may contribute to higher prevalence estimates in NJ compared to other states. Future studies should adjust for fertility treatments as well as c-section delivery.

#### **410.075 (Poster) Prenatal Fine Particulate Matter Nitrate Exposure and Childhood Autism Spectrum Disorders**

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Background: Emerging evidence suggests that prenatal exposure to particulate matter with aerodynamic diameter < 2.5  $\mu\text{m}$  (PM<sub>2.5</sub>) increases the risk of autism spectrum disorder (ASD). Ambient nitrate (NO<sub>3</sub>) is a significant component of PM<sub>2.5</sub>; it originates from the atmospheric oxidation of nitrogen oxides and nitrous oxide gas emissions generated mainly from combustion sources (e.g., motor vehicle traffic and power plants). The neurodevelopmental toxicity of ambient NO<sub>3</sub> is unknown.

**Objectives:** To examine the association of ASD with prenatal exposure to ambient PM<sub>2.5</sub>-NO<sub>3</sub> in a large representative cohort.

**Methods:** This population-based retrospective cohort study included 316,117 mother-child pairs with singleton deliveries in a large integrated health care system in southern California from 2001-2014. Children were followed using electronic medical records from birth up to December 31, 2019. Monthly estimates of PM<sub>2.5</sub>-NO<sub>3</sub> with a 1 km spatial resolution were obtained from a hybrid model developed by the Dalhousie University Atmospheric Composition Analysis Group. Prenatal exposure to PM<sub>2.5</sub>-NO<sub>3</sub> was assigned to each maternal address during the entire pregnancy, first, second, and third trimester, and were tested for associations with ASD diagnosis using Cox regression models adjusting for covariates. To evaluate the independence of the associations, we adjusted NO<sub>3</sub> model for the PM<sub>2.5</sub>. We also included “remainder PM<sub>2.5</sub> (e.g., total PM<sub>2.5</sub> minus NO<sub>3</sub>)” in the model to adjust for potential residual confounding due to other components.

**Results:** Over an average follow-up of 9 years, 6,267 children (5114 boys, 1177 girls) had an ASD diagnosis. NO<sub>3</sub> concentration during pregnancy and at each of the trimesters showed significant associations with increased ASD risk, after adjusting for child sex, maternal race/ethnicity, maternal age at delivery, parity, education, maternal commodity, medical centers, household income, maternal pre-pregnancy diabetes mellitus and obesity, birth year, and season. The adjusted hazard ratio (and 95% CI) of ASD risk associated with per interquartile (IQR=1.15 µg/m<sup>3</sup>) increase in NO<sub>3</sub> concentration in first gestational trimester was 1.07 (1.03, 1.12), second trimester was 1.07 (1.03, 1.12), third trimester was 1.07 (1.02, 1.11), and entire pregnancy was 1.11 (1.06, 1.16). These associations were robust to adjustments for total PM<sub>2.5</sub> and “remainder PM<sub>2.5</sub>”.

**Conclusions:** Our findings suggest that higher level NO<sub>3</sub> exposure during pregnancy was associated with increased ASD risk in children. Better understanding of effects of specific PM<sub>2.5</sub> components could lead to more targeted approaches to regulation.

#### **410.076 (Poster) Prenatal and Postnatal Factors Associated with Autism Severity**

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**Background:** Autism spectrum disorder (ASD) is a complex neurodevelopmental condition that involves the interplay of genetic and non-genetic risk factors, causing a wide range of symptoms, which can be described as impairments in cognitive features and social communication, and a presentation of behavioral challenges including repetitive behaviors and highly restricted interests.

**Objectives:** We sought to identify potential prenatal, perinatal, and neonatal risk factors that may affect ASD severity in a population of children who were diagnosed clinically and through the use of ADOS-2 and exhibited a range of symptom severities.

**Methods:** The prospective cohort study included 84 children diagnosed with either mild or severe symptoms of ASD and ranged between 5-16 years old. Individuals that had incomplete clinical and demographic data, classified to exhibit moderate symptom severities, or conditions/cases solely specific to them were excluded from the original 94 cohort subjects. Potential risk factors were compared between 50 children diagnosed with severe ASD and 34 children diagnosed with mild ASD using multiple statistical tests including Mann-Whitney U test, chi-square test and simple and multiple logistic regression tests.

**Results:** Out of the 14 factors analyzed, three factors related to postnatal complications and comorbidities were significantly associated with ASD severe cases. These three were hypoxia ( $p = 0.038$ ); diseases during infancy that required hospital admission ( $p = 0.019$ ); and developmental changes that lead to ADHD as a comorbidity ( $p = 0.002$ ). Additionally, the development of language fluency in children with ASD were identified to be significantly related to severity levels as delayed/nonverbal communication were more common in severe cases ( $p < 0.001$ ), while verbal communication was more common in mild cases ( $p < 0.001$ ).

**Conclusions:** This study has found associations between specific risk factors during infancy and a subsequent diagnosis of individuals exhibiting severe symptoms of ASD. Awareness of the potential non-genetic etiological factors that may influence the severity of ASD is substantial to improve upon the current intervention strategies available as well as develop early and essential diagnostic methodologies that may alter the developmental trajectory ASD and its outcome.

#### **410.077 (Poster) Prevalence of Autism Spectrum Disorder in a Population of New Jersey Adolescents**

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**Background:** ASD is a developmental disability defined by deficits in social communication and interaction and the presence of restricted, repetitive patterns of behavior, interest, or activity that usually persist over a lifetime (1). Indicators and epidemiologic surveys of ASD over the past twenty years indicate a substantial increase in prevalence. Almost all epidemiologic surveys have focused on school age children. ASD prevalence monitoring, at age 8 years, has been conducted in New Jersey and multiple US sites by the CDC Autism & Developmental Disabilities Monitoring (ADDM) Network. The prevalence and characteristics of ASD have not been described in a large US population of adolescents, by an active, comprehensive, epidemiologic study.

**Objectives:** The objective of the study was to estimate ASD prevalence among 16-year-olds born in 1998 residing in a well specified New Jersey area in 2014 and to describe the distribution of ASD in this population by sex, race/ethnicity and socioeconomic status.

**Methods:** The active, multiple source, ADDM ascertainment method was conducted as a 2-phase process involving comprehensive, retrospective review, scoring and analysis of information contained in professional evaluations. The method does not depend on family or practitioner reporting to determine case status and has the advantage of identifying individuals who show the ASD pattern, but did not have documented indication of ASD diagnosis. Prevalence estimates were based on surveillance determined ASD cases identified in a four-county region and population estimates were obtained from National Center for Health Statistics vintage 2019 postcensal estimates.

**Results:** In a population of 31,581 16-year-olds, born in 1998, 557 individuals were identified with ASD, consistent with a point prevalence of 17.6 per 1,000 (95% CI: 16.2-19.2). Males had higher prevalence (28.7 per 1,000; 95% CI: 26.2-31.4), compared to females (6.2 per 1,000; 95% CI: 5.1-7.6), representing a 4.6:1, male to female sex ratio. ASD prevalence was highest among whites (20.1 per 1,000; 95% CI: 17.8-22.6). Black adolescents had an ASD rate of 15.4 per 1,000 (95% CI: 12.9-18.4), while Hispanics had the lowest levels of identified ASD (12.2 per 1,000; 95% CI: 10.1-14.7). White adolescents were 1.3 times (95% CI: 1.1-1.6) and 1.7 times (95% CI: 1.3-2.1) more likely to be identified with ASD than Non-Hispanic Black and Hispanic peers, respectively. Prevalence varied by SES. ASD prevalence was two times greater among adolescents from High SES tracts (25.2 per 1,000 (95% CI: 21.8-29.2) ), compared to peers from Low SES tracts (12.5 per 1,000 (95% CI: 10.9-14.4) ).

**Conclusions:** For adolescents born in 1998 and residing in New Jersey in 2014, we identified overall ASD prevalence of approximately 2%.

**410.078 (Poster)** Prevalence of and Factors Associated with Reports of Child Maltreatment Among Children Identified By the Missouri Autism and Developmental Disabilities Monitoring Network

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**Background:** Children and adolescents with developmental disabilities, in general, have been shown to be at higher risk of reported and substantiated maltreatment, although findings regarding whether this increased risk is shared by youth with autism spectrum disorder (ASD), in particular, are equivocal. Whether or not youth with autism are at greater risk of maltreatment than those without autism, knowledge of factors associated with reports of maltreatment is valuable for the purpose of designing interventions specific to this vulnerable population.

**Objectives:** The objectives of this study were to estimate the percentage of youth with a state-retained record of report of maltreatment and with substantiated child maltreatment; to characterize reports of maltreatment; and to identify demographic and behavioral factors associated with report of maltreatment, among children identified by the Missouri Autism and Developmental Disabilities Monitoring Network (MOADDM) as having suspected (possible or probable) or confirmed ASD.

**Methods:** State records of reports of child maltreatment were matched with records of children and adolescents aged 9-19 years who had been identified through MOADDM 2004-2014 . After calculating descriptive statistics, chi-squared tests and logistic regression were employed to identify demographic factors and autism behavioral correlates (e.g., temper tantrums, sleep problems) associated with having a report of child maltreatment, after adjusting for other factors significantly associated with autism.

**Results:** There were no significant differences between possible, probable and confirmed ASD cases for maltreatment variables, therefore results are presented for the full sample. Twenty-six percent (n=581) of the youth had at least one retained record of a report of child maltreatment, with over half (56.28%; n=327) having multiple reports. Among youth with reports, neglect was the most commonly reported form of maltreatment (70.40%), and 22.2% had a substantiated report. In unadjusted analyses, maltreatment report was associated with African American race, intellectual disability, and almost all autism-associated features assessed. After adjusting for covariates using logistic regression only African American and missing race (OR = 1.47, 95% CI = 1.08-2.01 and OR = 0.40, 95% CI = 0.19-0.83, respectively; comparison group: white), aggression (OR = 1.78, 95% CI: 1.30-2.42) and self-injurious behavior (OR = 1.54, 95% CI = 1.14-2.08) remained significantly associated with child maltreatment report.

**Conclusions:** These data build upon knowledge of the rates of child maltreatment from population-ascertained cohorts of children with ASD symptomatology. More than a quarter of the youth in the sample had reports of maltreatment. This is likely an underestimate given that the state regularly expunges some records of maltreatment. ASD behavioral correlates that increase the likelihood of a maltreatment report among youth with ASD symptomatology may be valuable in identifying children at increased risk and informing preventive interventions.

**410.079 (Poster)** Use of ATLAS.Ti to Improve Efficiency Active Surveillance of Autism Spectrum Disorder

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**Background:** Currently, the largest ASD tracking method, the Autism and Developmental Disabilities Monitoring (ADDM) process, is an active case finding surveillance system involving the expert review of existing health and educational records of 4- and 8-year-old children. The methodology consists of 2 phases. In phase 1, research abstractors read through evaluations searching for specific words or phrases (triggers) that would indicate the need for abstraction. In phase 2, expert clinician reviewers analyze core features of ASD in the records to determine if a case meets the surveillance ASD case definition. However, the ADDM process takes two years to complete one cycle of data due to the need to manually review, abstract, and analyze data for thousands of children across multiple sites. Use of innovative technology such as ATLAS.ti, a text analytic program which allows the creation of auto-coding schemes to automatically find and flag user-specified phrases, can aid in streamlining and partially automating the surveillance process.



**Objectives:** The goal of the study is to develop an alternative automated strategy using ATLAS.ti to expedite both phases of the ADDM surveillance system.

**Methods:** The records of 8-year-olds evaluated through the ADDM method in 2016 were utilized. For abstraction determination, ATLAS.ti was automated to search for specific triggers that would indicate the need for abstraction. The results from a sample (n=66) were reviewed for quality assurance and compared to the results from the ADDM process. To determine the ASD case status, ATLAS.ti automatically identified and coded phrases that were indicative of DSM-5 ASD diagnosis criteria. The coded phrases were then analyzed to determine the case status according to DSM-5 guidelines. A sample (n=234) was used to assess performance and the results were compared to the case statuses determined through the ADDM process.

**Results:** For abstraction determination, a 100% accuracy rate was achieved with ATLAS.ti. There were no cases with an incorrect abstraction decision and no cases found to have abstraction triggers not identified in ATLAS.ti. When determining ASD case status, ATLAS.ti achieved a sensitivity of 85.5% and specificity of 89.5%. Sensitivity and specificity for each individual DSM-5 criteria code were identified (Table 1). The A1 code had the worst performance with a sensitivity of 48.2% but other codes performed with sensitivity and specificity ranging from 70-90%. The ATLAS.ti method was able to shorten the required time to review a single case to about 29 minutes while the ADDM procedure required 56 minutes (48.2% decrease) (Figure 1). The times required for phase 1 and 2 were reduced by 33% and 57.1% respectively.

**Conclusions:** For abstraction determination, the ATLAS.ti method is equally reliable as the ADDM method and more time efficient. It also performed reasonably accurately for ASD case determination and can be used to assist and prompt clinical experts during review. Overall, the ATLAS.ti program can reduce the time necessary to review cases by around half, therefore allowing accurate ASD surveillance to be determined in a timelier program-assisted manner. The ATLAS.ti program can also be further expanded to identify children with ASD through EMRs.

**410.080 (Poster) Role of Metabolic Genes (GSTT1, GSTP1, GSTM1) in Blood Lead Concentrations of Jamaican Children with and without Autism Spectrum Disorder**

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**Background:** Lead (Pb) is a toxic metal and lead poisoning during childhood is associated with neurodevelopmental impairment. Possible association between environmental exposure to Pb and Autism Spectrum Disorder (ASD) has been reported, though the findings are conflicting. Reports also suggest that polymorphisms of glutathione S-transferases (GST) genes play a key role in the detoxification of numerous exogenous chemicals including Pb.

**Objectives:** We investigated interactive associations of three metabolic GST genes (*GSTP1*, *GSTM1*, and *GSTT1*) with ASD status, and possible pairwise gene-gene interactions of these genes in relation to blood Pb concentrations in Jamaican children with and without ASD.

**Methods:** We used data from 344 ASD cases and their 1:1 age- ( $\pm 6$  months) and sex-matched typically developing (TD) controls (2-8 years old). We applied conditional logistic regression (CLR) models to compare various characteristics between ASD cases and TD children. We also used multivariable General Linear Models (GLMs) with the log-transformed blood Pb concentrations as the dependent variable to investigate the interaction between each of the three GST genes and ASD status in relation to blood Pb concentrations, while controlling for a known interaction between *GSTP1* and *GSTT1*, parish at child's birth, SES, consumption of lettuce, fried plantains, and canned fish.

**Results:** At enrollment, 71.8% of ASD cases and 74.7% of the TD controls were 48 months or older. About 83.1% of ASD cases and TD controls were male, and >94% were Afro-Caribbean. We found significantly lower geometric mean blood Pb concentrations in ASD cases than TD controls [1.74 vs. 2.27  $\mu\text{g/dL}$ ,  $P < 0.01$ ]. Also, in a co-dominant genetic model, among children with Ile/Val and Val/Val genotypes for *GSTP1*, ASD cases had significantly or marginally significantly lower adjusted geometric mean blood Pb concentrations than TD controls, after controlling for the aforementioned covariates [Ile/Val: ASD 1.78 vs. TD 2.13,  $P = 0.03$ ; Val/Val: ASD 1.50 vs. TD 1.94,  $P = 0.06$ ]. Similarly, among children with I/I or I/D ( $I^*$ ) genotype for *GSTT1* and *GSTM1*, ASD cases had a significantly lower adjusted geometric mean blood Pb concentration than their TD controls, after controlling for the aforementioned covariates [*GSTT1*  $I^*$ : ASD 1.61 vs. TD 1.91,  $P = 0.01$ ; *GSTM1*  $I^*$ : ASD 1.71 vs. TD 2.04,  $P = 0.01$ ].

**Conclusions:** To our knowledge, this is the first study that investigated interactive associations between GST genes and ASD status in relation to blood Pb concentrations in Jamaican children. Although the overall interactions were not statistically significant, we observed that children with ASD had lower blood Pb concentrations than TD controls, both in additive and interactive models. Also, we observed significantly lower blood Pb concentrations in ASD cases than TD controls among certain GST genotypes, before and after adjusting for several important covariates. Our findings show that having at least one Val allele for the *GSTP1* Ile105Val polymorphism and deletion polymorphism (DD) in *GSTT1* or *GSTM1* are associated with significantly lower blood Pb concentrations in children with ASD than TD controls, suggesting a possible role of these polymorphisms in detoxification of Pb.

**410.081 (Poster)** Sociodemographic Correlates of Health-Related Quality of Life in Children with ASD

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\*This abstract uses identity-first language which may be more representative of the autistic community's preferences.

**Background:** Health-related Quality of life (HrQoL) is an assessment of subjective wellbeing including physical and emotional health, self-esteem, family, friends, and everyday functioning. Currently, the correlates of HrQoL in autistic children focus on symptoms and functional abilities. The effect of sociodemographic correlates on HrQoL remain widely unknown due to lack of reporting or small sample sizes. Among neurotypical children, the literature suggests older age, female gender, low socioeconomic status, and identifying as Black or Latinx are typically associated with a lower HrQoL because of health inequities.

Understanding the effect of these sociodemographic correlates of HrQoL in autistic children is essential to evaluating disparities that may worsen health outcomes and to inform health policymakers accordingly.

**Objectives:** The goal of this study was to investigate the association between sociodemographic correlates of HrQoL in autistic children. Specifically, we explored whether (1) gender, age, household income, ethnicity and parental education were associated with differences in children's HrQoL, and (2) whether the impact of sociodemographic correlates on HrQoL were the same across other neurodevelopmental conditions or typical development.

**Methods:** A sample of children, from the Province of Ontario Neurodevelopmental Network (POND), with a diagnosis of autism spectrum disorder (ASD;  $n=298$ ,  $M_{age}=10.14$ ,  $SD_{age}=1.93$ ) and/or attention-deficit / hyperactivity disorder (ADHD;  $n=461$ ;  $M_{age}=9.71$ ,  $SD_{age}=1.90$ ), and neurotypical controls were recruited ( $n=154$ ;  $M_{age}=10.03$ ;  $SD_{age}=2.03$ ). Parent-reports of ethnicity, education level and household income information were collected. HrQoL was characterized by the Kid-KINDL, a self-report questionnaire for children from 7 to 13 years old.

**Results:** A diagnosis of ADHD ( $\beta=-10.05$ ;  $p<0.0001$ ) or ASD ( $\beta=-8.62$ ;  $p<0.0001$ ) were associated with reporting lower KINDL scores. Age, gender, household income, parental education level, ethnicity, and interactions between any of these variables were non-significant.

**Conclusions:** The results of this study suggest that a diagnosis of ASD or ADHD may be associated with reporting a lower quality of life. The non-significance of sociodemographic variables may be because of sample size or geography, as most of the participants are centralized in urban cities in Ontario where healthcare may be more accessible. Future research is required in larger samples from various geographical regions to better understand the relationship between sociodemographic variables and quality of life.

While the KINDL was used as a measure for HrQoL, it is important to acknowledge that quality of life is a subjective construct and may not be fully captured by an instrument such as the KINDL. To better understand the HrQoL of autistic children, qualitative and subjective HrQoL research is required. This work will be done with the hope to better equip clinicians, health policymakers and support services to empower every child in reaching their full life and health potential.

**410.082 (Poster)** Anxiety Symptoms Among Children with Autism Spectrum Disorders in Vietnam through Pediatric Anxiety Rating Scale

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**Background:** Previous findings in the field showed the high risk of co-occurring disorders in children with autism spectrum disorder (ASD) (Ghaziuddin, 2005). These comorbid disorders add to the impairment and dysfunction in ASD. Studies show that anxiety disorders, particular phobias, and separation anxiety were quite common in children with autism, accounting for about 40–60% (Farrugia et al., 2006; Leyfer et al., 2006). Anxiety disorders were believed to be the leading cause of exacerbation of autism symptoms. Thus, diagnosis and treatment of comorbid conditions could contribute to improved quality of life and general function.

**Objectives:** The present study aimed to identify the prevalence of anxiety symptoms in children with ASD and examine the relationship between parents' awareness of anxiety and anxiety state in children with ASD.

**Methods:** Using a questionnaire was a primary method in this study. A questionnaire was sent to 106 parents who had a child with ASD aged 6-12 years old. Besides general information, the questionnaire includes two parts: (1) The questions about knowledge of parents toward the anxiety in children (17 items) and (2) the Pediatric Anxiety Rating Scale for specific anxiety symptoms in children with ASD. 79.8% of participants were mothers, 18.3% were fathers, 18% had obtained a graduate degree, 56% had received a bachelor's degree. The surveyed parents' age ranged from 23 to 61 years old.

**Results:**

Regarding parents' knowledge about anxiety, none of the parents correctly answered 17 questions. The maximum score that parents can achieve was 14 points, with four parents achieving this score, accounting for 3.8% of the total. Most parents answered correctly from 8 to 12 questions, accounting for 66%. Besides, 15 parents responded only 1 to 5 questions correctly, accounting for 14% of the total number of subjects. The results from PARS indicated that there were 64.2% of children had symptoms of anxiety. In which, the most common signs were: bursting into tears when in a pressure– irritability situation, difficulty concentrating or mind becoming blank, tantrums, sleep disturbance, irritability, etc. The correlation analysis showed no statistically significant correlation between children's anxiety and parents' education level, family's economic status, children's age, and autism level ( $p>0.05$ ). There was a low positive correlation between children's anxiety and parents' knowledge of anxiety ( $p=0.016$ ;  $r=0.23$ ), indicating that the more parents know about anxiety, the more likely their children would have anxiety symptoms.

**Conclusions:** These findings may suggest more attention of parents when taking care of their children because of the high comorbid prevalence of anxiety. Besides, learning about the conditions that may be common in children with ASD is necessary to detect and intervene early. From the results, practice recommendations for families and children with ASD were provided.

**410.083 (Poster) Risk Factors for Emotional and Behavioral Problems in Children with Autism Spectrum Disorders in Vietnam**

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**Background:** The predicting factors of emotional and behavioral problems in children with typical development were indicated in previous studies, for instance, parents' mental health disorders or children's physical health problems, etc. (Nelson et al. 2007, Marcoux et al. 2012, Keyser et al. 2017). These findings established a broad foundation for programs to enhance well-being and treatment for mood and behavior disorders. Like children of the same age, children with ASD also have mental health problems. Determining the risk factors will provide information for building early intervention programs and models to decrease severe symptoms in their later developmental stages.

**Objectives:** Examining whether characteristics of family members, issues in the period of pregnancy, children's development, and education/intervention activities are predicting factors of emotional and behavioral problems in children with ASD.

**Methods:** Questionnaire and interview methods were used to collect information of (1) emotional and behavioral problems and (2) characteristics of family members, issues in the period of pregnancy, development, and education/intervention activities on 76 parents who have a child age 4-11 years old with ASD. Behavior Assessment System for Children, Second Edition (the BASC-2), was used to measure emotional and behavioral problems. In-depth interview methods were used to collect the data. Participants: 86.8% were mothers, 13.2% were fathers. 89.5% of children were male; 55.3% were the first child in the family, 35.5% were second, 7.9% were third. 68.4% studied at inclusive schools, 9.2% studied under the semi-inclusive model, and 22.4% studied full-time in special intervention agencies.

**Results:** Linear regression analysis was used to determine the familial factors impacting on emotional and behavioral issues of children with ASD. The results indicated that the independent variables in the *characteristic of family members* (e.g., personality of parents) influenced 17% the variation of somatization, and 12% the change of depression in children. *The issues in the period of pregnancy* (e.g., age of the parents when the child was born, period of pregnancy, children's birth weight, etc.) influenced 18% and 13% the variation of aggression and depression in children, respectively; these variables influenced 16% the variation of anxiety (difficulties in the period of pregnancy has significant contribution) and affected 11% the variation of withdrawn (numbers of the birth week has significant contribution). The variables in *children's development (cognition, language's ability, eating and sleeping's problems of children)* impacted 30% the variation of aggression, 19% the variation of anxiety, and influenced 13% the variation of depression (eating problem has significant contribution). *The education/intervention activities* (e.g., the form of education and interventional time, total intervention time, etc.) influenced 43% of externalizing problems; these variables also affected 29% the variation of anxiety (education methods at home have a significant contribution).

**Conclusions:** The factors in both parents' and children's abilities can significantly contribute to emotional and behavioral problems in children with ASD. These findings may open and need more research about the influence of pregnancy on these problems.

**410.084 (Poster) Victimization Among Students with Development Disorders Under Teachers' Viewpoint**

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**Background:** Students with developmental disorders (DDs) usually face multiple challenges related to peer relationships when attending inclusive schools in the national education system. These challenges can lead to the experience of victimization in various forms. Adolescents with learning disabilities, intellectual disabilities, ADHD, and autism spectrum disorder who were bullied showed low levels of happy feeling (Lung, F. W et al., 2018). Determining the prevalence, causes, and ways of coping with victimization in children with developmental disorders plays an essential role in children's development and learning in an inclusive environment.

**Objectives:** This study investigates students' victimization experiences with developmental disorders participating in learning at inclusive schools based on teachers' reports to identify the current situation and related factors to raise community awareness about this urgent issue.

**Methods:** This study used a questionnaire to investigate the frequencies of various forms of victimization (i.e., relational, physical, property trespassing, and direct victimization) and causes and solutions for this phenomenon in children with DDs. The questionnaires were distributed to 55 teachers of inclusive classes having at least a child with developmental disorders. 7.3% of participants were male, 92.7% were female; the age was 23 to 54 years old with a mean age of 35.85 years; 89.1% had a bachelor's degree, 5.5% had a master's degree. For most participants, the number of

years teaching children with developmental disorders was less than five years. In 55 reported children with developmental disorders, 30% had autism spectrum disorder, 50.9% had an intellectual disability, etc.; 74.5% were male, and 25.5% were female; the age range from 7-13 years old and mean age was 8.8 years.

**Results:** All children were reported to be victimized by at least one of the forms. Regarding relational victimization, 10.9% were often refused to play together, 7.3% were slandered, and 5.5% were spread out untrue rumors by classmates. Regarding direct victimization, 9.1% was often teased, 5.5% was assigned with a bad nickname, 3.6% was threatened. In addition, there were 16.4% sometimes forced to do errands, 12.7% were kicked, hit by peers, more than 15% were property trespassed, such as taking money, school supplies without children's permission. According to teachers, the causes of victimization were: children with developmental disorders did not like playing with other children, had different behaviors, did not know how to play with peers; the classmates did not understand peers with DDs, and teachers had little time to take care of them. Teachers' most popular solutions involved teaching the difference, respecting and accepting the difference for other students (90.9%), and closely combining teachers and parents to support children (87.3%).

**Conclusions:** The above results showed alert prevalence of children with developmental disorders' victimization experience. These findings suggest future research that examines strategies for coping and reducing victimization among this population. Hence, there is a need for more study on this topic in Vietnam.

## VIRTUAL POSTER SESSION — EPIDEMIOLOGY

### 510 - Epidemiology --- (V)

**510.042 (Virtual Poster)** Are There Sex Differences While Assessing Interactive Associations of Environmental Exposure to Three Heavy Metals Lead (Pb), Mercury (Hg) and Manganese (Mn) with GST (GSTP1, GSTM1 and GSTT1) Genes in Relation to ASD in Jamaican Children **H. Zwiya<sup>1</sup>, M. E. Samms-Vaughan<sup>2</sup>, J. Bressler<sup>3,4</sup>, M. Lee<sup>5,6</sup>, C. E. Byrd-Williams<sup>7</sup>, M. Hessabi<sup>8</sup>, M. L. Grove<sup>3,4</sup>, S. Pellington<sup>2</sup>, K. A. Loveland<sup>9</sup> and M. H. Rahbar<sup>4,8,10</sup>**, (1)UTHealth School of Public Health, Houston, TX, (2)Department of Child & Adolescent Health, The University of the West Indies, Mona Campus, Kingston, Jamaica, (3)Human Genetics Center, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX, (4)Department of Epidemiology, Human Genetics, and Environmental Sciences, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX, (5)Department of Biostatistics & Data Science, School of Public Health, University of Texas Southwestern Medical Center, Dallas, TX, (6)Harold C. Simmons Comprehensive Cancer Center, University of Texas Southwestern Medical Center, Dallas, TX, (7)Health Promotion & Behavioral Sciences, School of Public Health, The University of Texas Health Science Center at Houston, Austin, TX, (8)Biostatistics/Epidemiology/Research Design (BERD) core, Center for Clinical and Translational Sciences (CCTS), The University of Texas Health Science Center at Houston, Houston, TX, (9)Louis A Faillace, MD, Department of Psychiatry and Behavioral Sciences, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, (10)Division of Clinical and Translational Sciences, Department of Internal Medicine, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX

**Background:** Male preponderance is well established among ASD cases, however, the differences between males and females have not been thoroughly assessed in relation to metal exposure including Pb, Hg and Mn. Furthermore, glutathione S-transferase (GST) genes play a crucial role in suppressing oxidative stress caused by metal exposure due to the enzymatic function of the proteins encoded. We investigated possible gene-environment interactions between sex, GST genes, and environmental exposure to three heavy metals in relation to ASD and ASD severity in Jamaican children.

**Objectives:** To determine whether the association between heavy metals and ASD differs in males and females and by the genotypes of three GST genes (*GSTP1*, *GSTT1*, and *GSTM1*).

**Methods:** Using 344 pairs from a 1:1 sex- and age- matched case control study, we applied conditional logistic regression (CLR) models and Generalized Linear Models (GLM) with ASD status and ASD calibrated severity score (CSS) as outcome variables, respectively. Sex was assessed as an effect modifier for the association between each metal and ASD in both unadjusted and adjusted multivariable models. If a significant 2-way interaction was detected between sex and a GST gene, a metal exposure was added subsequently to explore a possible 3-way interaction.

**Results:** There were significant and marginally significant interactions between sex \* *GSTP1* and sex \* *GSTM1*, respectively, upon exposure to Pb ( $P = 0.04$ ,  $P = 0.09$ ) using recessive genetic models and CLR. For *GSTP1*, after adjusting for parental age, child's parish, consumption of salt fish and the interaction between *GSTT1* and *GSTP1*, we found a lower odds of Val/Val genotype for ASD cases than TD controls among females ( $MOR_{females} = 0.23$  95% CI: 0.05-1.11,  $P = 0.06$ ), and higher odds among males ( $MOR_{males} = 1.18$  95% CI: 0.66-2.16,  $P = 0.57$ ). Similar results were detected for the sex \* *GSTM1* recessive model. In GLMs using co-dominant and recessive genetic models, a marginally significant and significant interaction were detected between sex \* *GSTP1* in relation to ASD CSS upon exposure to Hg ( $P = 0.084$ ,  $P = 0.036$ , respectively). For the *GSTP1* recessive model, the mean difference in ASD CSS in those with Val/Val genotype compared to Ile/Ile or Ile/Val genotype was 0.30 for males and -1.34 for females adjusting for parental age, parental education, consumption of shellfish and interaction between *GSTT1* and *GSTP1*.

**Conclusions:** Hg or Pb exposure was significantly associated with ASD in both males and females. When we further evaluated associations with GST genes, significant and marginally significant 2-way interactions with sex were detected, with no significant overall 3-way interactions between sex, gene, and metal exposures. The association of Pb exposure with ASD significantly differed by sex under the *GSTP1* and *GSTM1* recessive genetic models. Similar sex differences in the association between Hg exposure and ASD CSS were detected under *GSTP1* co-dominant and recessive genetic models. While these findings may reflect potential sex-differences in metal detoxification mechanisms and bioaccumulation upon exposure to Pb and Hg, replication is warranted due to limitations in sample size for female participants in this study.

**510.043** (Virtual Poster) Background of Sleep Problems in Preschoolers; Analysis of Factors Including Neurodevelopmental Disorders

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**Background:**

Sleeping is important for children's growth. Therefore, medically, there are concerns that many children have sleep problems in recent years. Previous studies have reported that the percentage of children with sleeping disorder is different depending on countries or presence or absence of developing disorder.

**Objectives:**

The purpose of this study is to research what kind of factors are associated to children's sleep problems and whether sleep problems are different depend on factors.

**Methods:**

We used 2341 children's data (Hiroaki Five-year-old children Developmental Health Check-up Study: HFC Study). We analyzed the following items: JSQP (Japanese Sleep Questionnaire for Preschoolers) score, parent-survey(Income, family composition, and so on) mother and child hand book records, non scoring questions of JSQP and DSM-5 diagnosis JSQP score is the data about sleeping, and the other data is about children's environments, behaviors or characters. We defined sleeping disorder as JSQP-total-score $\geq$ 86 (Simizu, et al.2013), and chi-squared tests were performed to find significant differences of percentages of sleeping disorder due to children's environments, behaviors or characters. Furthermore, Kruskal-Wallis test was performed to find what type of problems appear due to the environment, behavior, or character.

**Results:**

The percentage of sleeping disorder was significantly high in these groups; ASD, ADHD (diagnosis), less than two million yen (annual income), no siblings (the number of siblings), 22:00 or later (bed time), 7:30 or later (wake up time), shorter than 9 hours (sleeping time) and shorter than one hour and one hour or longer (The time it takes to fell asleep). These facts showed different type of problem from each other.

Meanwhile, the percentage of SD was significantly low in these groups; TD, four to seven million yen, two or more siblings, earlier than 21:00 and 21:00 to 21:59, earlier than 6:30, shorter than 10 minutes and shorter than 20 minutes.

There were no significant differences in birth month and child care places during day time.

**Conclusions:**

Developing disorder and some factors in family background or behavior are associated to sleep problems in children. And also, depending on the difference of the factors, the type of sleep problems is different.

**510.044** (Virtual Poster) Disparities in the Proportion of Children with Autism Spectrum Disorder Classified As "Low Functioning" or with Co-Occurring Intellectual Disability: Evaluation of the Impact of Adaptive Behavior Scores

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**Background:** Epidemiologic and clinical studies of autism spectrum disorder (ASD) often rely on intelligence quotient (IQ) scores as the sole criterion for defining co-occurring intellectual disability (ID). However, definitions from ID organizations and diagnostic manuals specify limitations in adaptive behaviors as an additional criterion for ID. U.S. studies have found disparities among children with ASD, with significantly increased frequency of co-occurring ID among non-Hispanic Black (NHB) and Hispanic children relative to non-Hispanic White (NHW) children. Disparities in ID classification among children with ASD could be due to bias resulting from overreliance on IQ testing and insufficient attention to adaptive functioning and contributing social and structural factors.

**Objectives:** We hypothesized that defining co-occurring ID based on having both Mullen Scales of Early Learning (MSEL) and Vineland Adaptive Behavior Scales, 2<sup>nd</sup> Edition (VABS-II), scores  $\geq$  2 standard deviations below the mean would result in a lower proportion of children with ASD classified as having ID than when ID is defined using only MSEL scores. We then examined racial/ethnic disparities in the co-occurrence of ID

among children with ASD using both approaches and hypothesized that incorporating VABS-II scores to classify ID would reduce disparities in the frequency of low intellectual functioning among children with ASD.

**Methods:** The Study to Explore Early Development is a large multisite case-control study of children aged 2-5 years with ASD, developmental delays without ASD, or typical development. This analysis included 1,480 children with an Autism Diagnostic Interview-Revised- and Autism Diagnostic Observation Schedule-confirmed ASD classification. Alternative criteria were used to calculate percentages of children classified as having co-occurring ID based on (i) MSEL Visual Reception (VR) T-score  $\leq 30$ , used as a proxy for nonverbal IQ; (ii) MSEL Early Learning Composite (ELC)  $\leq 70$ ; and (iii) VR T-score  $\leq 30$  and VABS-II Adaptive Behavior Composite (ABC) standard score  $\leq 70$ . Prevalence ratios with 95% confidence intervals were calculated to evaluate racial/ethnic disparities in the frequency of co-occurring ID and whether addition of the VABS-II criterion reduced these disparities.

**Results:** Overall, 49.5% of children met ID criteria based on MSEL VR T-scores alone; addition of the VABS-II criterion reduced the proportion to 34.1%. The percentages of children with VR T-scores  $\leq 30$  were 40.0% for NHW, 64.6% for NHB, and 52.6% for Hispanic children; addition of the VABS-II criterion lowered these proportions significantly to 27.1% (NHW), 44.9% (NHB), and 35.5% (Hispanic). NHB and Hispanic children were approximately 1.6 and 1.3 times, respectively, more likely to meet ID criteria than NHW children. Prevalence ratios were significantly  $>1$  and unaffected by inclusion of the VABS-II ABC  $\leq 70$  criterion. Results using MSEL ELC scores were similar.

**Conclusions:** Using IQ as the sole criterion for ID may overestimate the prevalence of co-occurring ID in preschool children with ASD according to diagnostic criteria, suggesting the need for reexamination of how functioning is classified in ASD research. Our finding that disparities in co-occurring ID persisted after addition of the VABS-II criterion suggests that social and structural factors contributing to these disparities need to be better understood and addressed through additional studies.

**510.045 (Virtual Poster)** Estimating the Prevalence of Autism Spectrum Disorders in 3-Year-Old Children in Community-Based Survey  
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**Background:** In recent years, the prevalence report of autism spectrum disorder (ASD) has been increasing. From the viewpoint of epigenetics, genetic factors and environmental factors influence the expression of the phenotype of neurodevelopmental disorders. Epidemiological surveys are important in these studies, and it is necessary to steadily investigate the annual transition. The US CDC reports a prevalence of ASD aged 8 years at 1.85% (2020), and South Korea (YS Kim) reports a prevalence of ASD aged 7-12 years at 2.64% (95% CI = 1.91-3.37). (2010). Last year, Hirosaki University reported that the prevalence of autism spectrum disorder (ASD) at age 5 was 3.22% (95%CI : 2.66–3.76%) and that there was no change in the 4-year cumulative incidence (Saito M. 2020).

**Objectives:** In this study, we used the SRS-2 Interpersonal Response Scale (SRS-2) and a shortened version of PARS-TR to calculate the estimated prevalence of ASD in community 3-year-olds.

**Methods:** 1090 participants in the 2018 regional 3-year-old development health checkup (participation rate 99.8%: 1093 all subjects) and 1174 participants in the 2019 3-year-old child developmental health checkup (participation rate 97.5%: 1203 all subjects). Survey scale: (1) SRS-2 infant version (sensitivity 0.82 at 52 points of cutoff, specificity 0.80, Stickley, 2017), (2) PARS-TR shortened version ( $\alpha$  is 0.78 in PDD group, non-PDD group at 5 points of rating cutoff as of early childhood) The estimated prevalence of ASD was calculated using 0.67, Adachi, 2008). In parallel, SDQ and sensory profile shortened version were performed. The PARS-TR shortened version was implemented at the site's discretion even if the SRS-2 infant version had a score of 43 points or higher (community risk child standard) or a score of 42 points or lower. Exclude only non-participants. Statistical analysis used t-test and  $\chi^2$  test. This research was supported by the Hirosaki City Commissioned Research Fund, and was explained in writing with the approval of the Hirosaki University Graduate School of Medicine Ethics Committee, and the consent of parents was obtained.

**Results:** In the 2018 survey, 49 boys (8.6%) and 22 girls (4.2%) were SRS-2 infants with 52 points or more, for a total of 71 (6.5%). Of these, 31 responded to the PARS-TR shortened version with 5 points or more. Estimating the prevalence from these, the population ratio was 2.84% (95% CI: 1.997-4.022). Similarly, in the 2019 survey, SRS-2 infant version 52 points or more was 46 boys (7.5%) and 33 girls (5.9%), a total of 79 (6.7%). Of these, 33 responded to the PARS-TR shortened version with 5 points or more. Similarly, when estimating the prevalence of ASD, the population ratio was 2.81% (95% CI: 1.996-3.934), which was almost the same as the previous year's estimate.

**Conclusions:** Using the possibility of ASD diagnosis by SRS-2 and PARS-TR, the estimated prevalence of ASD in 3-year-old children was estimated to be 2.8%. There is no difference compared to the adjusted prevalence of 5-year-olds in the region, and the eyes of ASD that should be detected early in 3-year-old children.

**510.046 (Virtual Poster)** Identifying Classes of Neurodevelopmental Perinatal Risk Factors Among Mothers of Children at High Familial Risk for Autism Spectrum Disorder  
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**Background:** Perinatal complications have been implicated in the etiology of ASD and related neurodevelopmental impairments. Previous approaches to studying these risk factors, such as single factor, sum scores, or weighted sum scores, have been limited in their ability to consider multiple, co-occurring factors and their underlying mechanisms. A novel, person-centered approach can address these shortcomings by allowing for the simultaneous examination of multiple perinatal risk factors through the clustering of mothers.

**Objectives:** The current study utilized data from the Early Autism Risk Longitudinal Investigation (EARLI) to identify classes of mothers based on their reported neurodevelopmental perinatal risk (NPR) factors.

**Methods:** EARLI enrolled pregnant mothers, who had a previous child with ASD, and followed a subsequent child through 36 months of age. NPR factors are pregnancy-related risk factors (e.g., reproductive history, supplement use, perinatal complications) that have been previously associated with poor neurodevelopmental outcomes. NPR factors were collected prospectively through weekly pregnancy diaries, self-report questionnaires, and clinician administered interviews. We conducted a Latent Class Analysis (LCA) using 10 NPR factors reported during the mother's pregnancy with the younger sibling. The best latent class solution was identified using fit statistics and clinical judgement.

**Results:** The sample included 247 mothers (61% white, mean age at sibling's birth = 33.8 +/- 4.74). Our LCA indicated a 4-class solution best fit the data. Class 1 (n = 146, 59%), "Low Complications", was characterized by overall low levels of NPR factors. Class 2 (n = 49, 20%), "High Infection and Mental Health Symptoms", was characterized by mothers most frequently endorsing any infection during pregnancy in combination with diagnoses of depression and anxiety during the pregnancy with the younger sibling. Class 3 (n = 34, 14%), "Vaginal Bleeding and Low Supplement Use", was characterized by increased frequency of reported vaginal bleeding, high pre-pregnancy weight, and poor supplement intake during pregnancy. Class 4 (n = 18, 7%), "Mixed Supplement Use, High Infection, and Moderate Mental Health", was identified based on endorsement of the lowest rates of prenatal vitamin use, along with the highest rates of multivitamin, folic acid, and vitamin D supplement use, as well as high frequency of infection and moderate frequency of depression and anxiety diagnoses.

**Conclusions:** Mothers of children with ASD could be classified into four distinct patterns of NPR factors during their subsequent pregnancy. The high rates of specific NPR factors, such as vaginal bleeding and infection, may serve as targets for intervention, while the unique combination of NPR factors in each class demonstrates how multiple exposures and mechanisms may combine to increase risk for poor outcomes. These findings suggest shortcomings of previous approaches, given that multiple NPR factors, arising from different underlying mechanisms, occur in tandem. Future work will examine the association between the classes identified here with numerous covariates (e.g., ASD polygenic risk score, biomarkers of maternal immune activation) and child neurodevelopment outcomes.

#### **510.047** (Virtual Poster) Inclusion of Low-Income Children in Estimates of the Population Prevalence of Autism Spectrum Disorder: A Data Linkage Study

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**Background:** Epidemiologic studies have found socioeconomic, racial, and ethnic disparities in diagnosing autism spectrum disorder (ASD) in the United States, with resulting prevalence estimates being positively correlated with socioeconomic status (SES) and elevated in non-Hispanic White (NHW) relative to other populations. Previous studies may be biased due to limited population coverage and under-representation of low-income children. Administrative data sources have potential to estimate statewide prevalence of ASD more efficiently and could aid in including lower income populations.

**Objectives:** The aims of this study were to: (1) describe the statewide prevalence of ASD in the state of Wisconsin among children and adolescents between the ages of 5 and 18 years in 2018 using administrative data from the Department of Public Instruction (DPI) and claims for Medicaid covered healthcare for low-income families; and (2) describe the impact of including Medicaid data on observed racial and ethnic disparities in ASD prevalence.

**Methods:** Students with an ASD primary disability code were ascertained through DPI data for those enrolled in public schools in Wisconsin in 2018. Medicaid claims data from 2018 were reviewed for ASD diagnostic information for children and adolescents born between 2000 and 2013. The overall prevalence of ASD was then calculated for each source by dividing the count of individuals with ASD by the total population enrolled in public schools and Medicaid, respectively. To get an unduplicated count of ASD combining the sources, individuals in the Medicaid data were matched to the DPI records based on first name, last name, date of birth, sex, and race. Odds ratios with 95% confidence intervals (CI) were calculated to evaluate the racial and ethnic disparities in the frequency of ASD and evaluate whether disparities based on school data were affected by the inclusion of Medicaid claims.

**Results:** Based on public education data alone, ASD prevalence was estimated to be 14.9 (95% CI: 14.6, 15.2) per 1,000 students. Combining Medicaid and DPI data sources, the unduplicated prevalence of ASD in Wisconsin increased to 19.2 (95% CI: 18.9, 19.5) per 1,000 children and adolescents between the ages of 5 and 18 in 2018. Among low-income children enrolled in Medicaid, ASD prevalence was estimated to be 37.4 (95% CI: 36.7, 38.1) per 1,000. When prevalence was estimated from education data alone, it was significantly lower for Hispanic and non-Hispanic Black (NHB) students relative to NHW students. However, after the inclusion of Medicaid data, Hispanic and NHB children were 1.94 and 1.47 times more likely than NHW children to have ASD, respectively.

Conclusions: Using Medicaid claims data is necessary to obtain a complete prevalence estimate of ASD for the state of Wisconsin. Racial and ethnic differences in ASD prevalence are reversed with the inclusion of these data, as opposed to solely examining those identified as having ASD in public schools in Wisconsin. Further research is needed to determine why children with ASD served by Medicaid are not captured as having ASD based on educational data alone.

**510.048 (Virtual Poster)** Maternal Vitamin D Level and Air Pollution Exposure during Pregnancy: Findings from the Early Markers for Autism (EMA) Study

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Background: Literature has reported that both higher air pollution exposure and lower Vitamin D (VD) concentrations during pregnancy may increase the risk of autism spectrum disorder (ASD). The overall null findings for VD and air pollution in some studies might be explained by potential correlation and confounding effects, as VD from sunlight will decrease as air pollution levels increase.

Objectives: This study aims to explore the existence of an association between maternal VD level and air pollution during pregnancy, and how this relationship affects the association of maternal VD level with ASD and intellectual disability (ID) in the offspring.

Methods: We examined maternal VD levels and air pollution exposure during pregnancy in the Early Markers for Autism (EMA) study, which is a population-based case-control study in Southern California. Children with ASD without intellectual disability (ASD without ID; n=190), ASD with ID (ASD with ID; n=175), ID without ASD (ID only; n=159) were identified through the Department of Developmental Services record and compared to general population controls (n=430) from birth certificate. 25-Hydroxyvitamin D (25(OH)D) was measured in maternal serum samples collected during weeks 15-19 of gestation. 25(OH)D was examined continuously and also dichotomized as deficient/insufficient (<75 nmol/L), and sufficient (≥ 75 nmol/L). Air pollution exposure to NO<sub>2</sub>, Ozone, PM<sub>10</sub> and PM<sub>2.5</sub> for the month prior to the date of the mid-pregnancy serum collection was assigned using measurements from the Environmental Protection Agency's Air Quality System based on the maternal residential address during pregnancy. We first assessed the association of maternal VD level and air pollution exposure using linear and logistic regression models among general population controls. Then we compared the logistic regression models of VD and child outcomes with and without adjustment for four air pollutant exposures. Sociodemographic and maternal characteristics were adjusted in the models, including child sex, birth year, birth reason, maternal age, maternal race/ethnicity, insurance type, county, maternal education, parity.

Results: Maternal VD level decreased with increasing exposure to NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> and increased with increasing exposure to Ozone. The association of VD level with PM<sub>10</sub> (b=-5.53 (-9.65, -1.41)), NO<sub>2</sub> (OR=1.62 (1.08, 2.46)) and PM<sub>2.5</sub> (OR=1.91(1.18, 3.13)) remained significant after adjustment for covariates. There was no significant association of maternal VD level with ASD with ID, ASD without ID or ID without ASD. When adjusting for each of the air pollutant exposures, the above relationships did not change, except that the point estimate of the association between ASD with ID and maternal VD level increased slightly after adjusting PM<sub>2.5</sub> exposure level.

Conclusions: Our results indicated there was an association between air pollution exposure and maternal VD level in mid-pregnancy in general population, but little evidence supporting that the association confounds the impact of maternal VD level on ASD or ID statistically. Future research in large samples is needed to assess both independent and interactive effects of maternal air pollution exposure and VD level on ASD risk, with attention to different developmental time windows.

**510.049 (Virtual Poster)** Parental Occupational Exposures Are Associated with Autism Behaviors.

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Background: Individuals with autism spectrum disorder (ASD) frequently display skill deficits or challenging behaviors such as stereotypy, hyperactivity, or aggressive behaviors. Little research has been conducted showing the role of environmental factors with ASD behaviors and to our knowledge, no studies have been done evaluating parental occupational exposures and cognitive, adaptive, and behavioral scores in children with ASD.

Objectives: The aim of the current study was to investigate the relationship between parental occupational exposures and cognitive, adaptive, and behavioral scores in children with ASD.

Methods: Demographic, diagnostic, and prenatal parental occupational exposure data for 534 children with ASD and their parents were collected in the case-control Childhood Autism Risks from Genetics and Environment (CHARGE) study. Children were assessed using the Mullen Scales of Early Learning (MSEL), Vineland Adaptive Behavior Scales (VABS), and Aberrant Behavior Checklist (ABC). The MSEL is an early learning assessment of child expressive language, receptive language, visual reception, and fine motor skills. The VABS is a parent interview of child adaptive behaviors in communication, daily living, social, and motor skills. The ABC is a parent questionnaire that assesses irritability, social withdrawal, stereotypic behavior, hyperactivity, noncompliance, and unusual speech. Higher MSEL and VABS scores indicate greater skill acquisition whereas higher ABC scores indicate more problem behaviors. Occupational exposures to 16 agents were estimated semi-quantitatively by experienced industrial hygienists (IH) based on parents' job histories. For each agent, mean composite and subscale scores on cognitive, adaptive and behavioral domains were estimated across no, low, and high levels of exposure using ANCOVA models.



Results: As fathers' exposures to auto/mechanic fluids, cutting/machining fluids, pharmaceuticals, ethylene oxide, and plastics/polymers increased, MSEL and VABS scores decreased, and ABC scores increased among children with ASD. Similarly, mothers' occupational exposures to metals, ethylene oxide and anesthetic gases were associated with lower MSEL and VABS scores and higher ABC scores. Specific subscales affected by multiple exposures were expressive language (MSEL), socialization and communication (VABS), and irritability and hyperactivity (ABC).

Conclusions: Several classes of parental occupational exposures showed associations with poorer language and social skills and greater irritability and hyperactivity among children with ASD. This study is among the first to suggest that neurodevelopmental toxicity from parental workplace exposures may play a role in functional impairments for children with ASD.

**510.050** (Virtual Poster) Responses to COVID-19 Pandemic and Their Associations with Neurodevelopmental Traits in a General Population Sample of 5 Years Old Children in Japan

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**Background:** Some studies have reported that COVID-19 pandemic has significant impact on children's mental health. Particularly, UNICEF has advocated that we should have it in mind that children with autism may also have some specific needs for support due to the difficulties.

**Objectives:** This study aimed to investigate responses to COVID-19 pandemic and their associations with neurodevelopmental traits in a general population sample of 5 years old children in Japan.

**Methods:** The subjects were recruited from participants in the 5-year-old developmental checkup in Hirosaki city, Japan. Between July 2021 to August 2021, the 652 children were eligible for the checkup. Caregivers of 463 children (85.7% participation rate) completed and returned the CRISIS AFAR, a questionnaire about COVID-19, and consented to this study (boys:girls =252:211, mean age=63 months). The following measures were used: CRISIS AFAR, the Autism Spectrum Screening Questionnaire(ASQ), the Strength and Difficulties Questionnaire(SDQ), and the Developmental Coordination Disorder Questionnaire(DCDQ) Japanese version. The CRISIS AFAR includes questions about children's daily behaviors and emotions/worries, and it was translated into Japanese by research collaborators. One of the SDQ subscales is "Prosocial behavior" (SDQ-PB). The DCDQ subscales are "control during movement"(gross motor), "fine motor", and "general coordination". Statistical analysis was performed using Pearson correlation coefficient( $p<0.05$ ).

**Results:** 64% of children worried that they might also get infected, and their friend and their family could get infected. 66% of children worried that they might get sick somewhere due to the infection. 40% of children worried that the infection could make him/her sick. 93% of children talk about infections. 92% of children were disappointed with the cancellation of events. Pearson correlation coefficient showed that positive correlation between ASQ and "Worries about their sick" ( $r=0.092$ ,  $p<0.05$ ); negative correlation between ASQ and "Talk about infections"( $r=-0.129$ ,  $p<0.05$ ); positive correlation between SDQ-PB and "Worries about infecting family"( $r=0.150$ ,  $p<0.05$ ); positive correlation between SDQ-PB and "Worries that child might get sick somewhere ( $r=0.091$ ,  $p<0.05$ )"; positive correlation between SDQ-PB and "Talk about infections"( $r=0.114$ ,  $p<0.05$ ); positive correlation between SDQ-PB and "Disappointing with the cancellation of events" ( $r=0.094$ ,  $p<0.05$ ); positive correlation between DCDQ-control during movement and "Talk about infections" ( $r=0.110$ ,  $p<0.05$ ); positive correlation between DCDQ-fine motor and "Talk about infections"( $r=0.186$ ,  $p<0.05$ ); negative correlation between DCDQ-general coordination and "Worries about their sick"( $r=-0.098$ ,  $p<0.05$ ). From the above, 1) The children with autism tend to worry about their own sick and not talk about it. 2) The children with less prosocial behavior tend not to talk about infection, not to worry about infecting them and/or their family, and not to disappoint about cancellation of an event. 3)The children who have difficulty with gross motor and fine motor tend not to talk about infection. 4) The children who have difficulty with general coordination tend to worry about their own sick.

**Conclusions:** This study showed the association between responses to COVID-19 pandemic and neurodevelopmental traits in 5 years old children. We should take neurodevelopmental traits into account when we assess the impact of COVID-19 pandemic on children's mental health.

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**510.051** (Virtual Poster) Significant Adverse Experiences and Neurodevelopmental Difficulties in Childhood and Adolescence: A Scoping Review  
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**Background:**

Adverse childhood experiences (ACEs), including abuse, neglect, and household dysfunction, may impact neurodevelopment in children and adolescents. However, the relationship is complicated by social disparity and the vulnerability of individuals with neurodevelopmental difficulties to experience maltreatment.

**Objectives:**

This study aims to synthesise extant literature associated with ACEs and its association with specific neurodevelopmental difficulties (NDs), including autism spectrum disorder (autism), attention deficit/hyperactivity disorder, language difficulties, learning difficulties, global developmental delay and intellectual disability in children and adolescents.

## Methods:

The Joanna Briggs Institute (JBI) scoping review guidelines were followed to complete the current scoping review. Peer reviewed studies were identified using a comprehensive search strategy across four electronic databases. From a total of 3269 papers screened, 180 were included for full text review. From these, 26 primary studies and 3 case studies were included for data synthesis.

## Results:

There is overwhelming evidence to suggest a positive association exists between ACEs and NDs, with most evidence for an association between the experience of neglect, and language and/or 'autism-like' difficulties. A first group of studies (42%) reported on prevalence of NDs (ranging in 3.85% – 85%) amongst samples of children with a history of ACE. A second group of studies (58%) assessed the association between ACEs and NDs (ORs ranging from 1.24 – 17.5) by comparing NDs in groups of children with and without a history of ACE. Only one included study utilized a longitudinal approach, demonstrating children exposed to family violence in infancy were more likely to exhibit communication and language problems at age ten. Seven included studies explored temporal associations between variables, age and duration of neglect during institutionalisation and subsequent identification of NDs. No studies reported the age of onset of NDs.

## Conclusions:

Whilst an association between ACEs and NDs is clear, the nature of the relationship remains poorly understood. Prospective research is needed to better understand the potential interplay of factors, including timing of exposure to ACEs and its potential impact on the developing brain, as well as trial assessments that differentiate subgroups of trauma as a cause, co-contributor, and consequence of neurodevelopmental difficulties. Also needed are trials to assess the effectiveness of interventions once ACEs are identified. Understanding the role of ACEs and the experience of trauma is important to ensure trauma-informed care, appropriate interventions, and support for neurodevelopmental difficulties. To achieve this, clinicians should routinely ask about ACEs.

**510.052** (Virtual Poster) A Systematic Review and Meta-Analysis of the Prevalence of Suicidality in Autistic and Possibly Autistic People without Co-Occurring Intellectual Disability.

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## Background:

Suicidality is extremely common in autistic people, yet exact prevalence rates vary widely across research (Cassidy, Robertson, Townsend, O'Conner & Rodgers, 2020). It is estimated that 11% to 66% of autistic individuals experience suicidal ideation, and anywhere between 1% to 35% report attempting suicide (Hedley & Uljarevic, 2018). Autistic people without a co-occurring intellectual disability are particularly at risk, being nine times more likely to die by suicide compared to non-autistic people (Hirvokski et al., 2016; Kirby et al., 2019). Moreover, possible undiagnosed autism is also associated with an increased risk of suicidality, along with a higher level of autistic traits seen in adults who have attempted suicide (Cassidy, Bradley, Cogger-Ward & Rodgers, 2021; Richards et al., 2019).

## Objectives:

1) To synthesise the literature and calculate pooled prevalence estimates for suicidality in autistic people and possibly autistic people without co-occurring intellectual disability; 2) To evaluate the influence of person/study characteristics associated with suicidality; 3) To determine the quality of evidence available.

## Methods:

The review was conducted in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and was prospectively registered with PROSPERO (registration no. CRD42021266451). The electronic databases of PubMed, OVID PsycINFO, OVID Embase and OVID MEDLINE and Web of Science were systematically examined from 1992 until July 2021. Eligibility criteria required studies to be published, written or available in the English Language, have an observational design, and employ quantitative methods providing a measure of prevalence.

## Results:

Forty-nine studies were identified for inclusion. Forty-seven of these examined samples or groups of autistic people, seven studies examined possibly autistic people, and four included both autistic and possibly autistic people. The narrative synthesis demonstrated that prevalence in autistic people ranged from 8% to 72% for overall suicidality or suicide risk, 1.6% to 87.7% for suicidal ideation, 12% to 40.9% for suicide plans, along with 1% to 74.6% for suicide attempts or behaviours. Conversely, in possibly autistic people, prevalence ranged from 42.6% to 62% for overall suicidality or suicide risk, 11.5% to 35.4% for suicidal ideation, 10.3% to 46% for suicide plans and 2.85% to 64.9% for suicide attempts and behaviours. The wide ranges in prevalence may be partly explained by differences in sample characteristics and study methodology. A quality assessment of included studies and meta-analysis are forthcoming.

## Conclusions:

High prevalence rates of suicidality are found in both autistic and possibly autistic people. In order to better understand and prevent suicide in these populations, future research should aim to adapt measures of suicidality, identify unique risk factors, and extend existing theories of suicide.

**510.053** (*Virtual Poster*) Biochemical Assessments of Thyroid Profile and Its Association with Cognitive Level Among Children with Autism in a Tertiary Care Center of Bangladesh

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**Background:** The causation of autism is still unknown. Thyroid hormones are important for brain development of a child, which also have immunomodulatory actions. It has a vital role on cognitive function also. So dysregulation of Thyroid hormones may have a potential role in children with Autism Spectrum Disorder (ASD).

**Objectives:** The objectives of this study will assess the thyroid profile and cognitive level among children with Autism and to find out the correlations between them.

**Methods:** This will be a Cross-Sectional case- control study, 100 children will be taken in each group and age range were 2 to 12 years. Random sampling method will be used. ASD children will be selected from out-patient department of Institute of Paediatric Neurodisorder and Autism (IPNA) Bangabandhu Sheikh Mujib Medical University (BSMMU), where the patients will be regularly visited for diagnosis, assessment and management. Autism Spectrum Disorder will be diagnosed by DSM-5 criterias. On the other hand same number of controlled children will be selected with same age group from randomly selected regular schools in Dhaka city. After selecting cases and controls, sample of blood will be collected and examine for Biochemical assays of thyroid function in the form of free triiodothyronine (FT3), free tetraiodothyronine (FT4), thyroid-stimulating hormone (TSH) will be done by using commercially available enzyme-linked immunosorbent assay (ELISA) kits. Cognitive level of ASD children will be measured by trained psychologist with The *Bayley Scales of Infant and Toddler Developme* (BSID-III), The Wechsler *Intelligence Scale for Children* – Revised 4<sup>th</sup> Edition (WISC-R IV) and The Wechsler Preschool and Primary Scale of *Intelligence* Fourth Edition(WPPSI-IV).

**Results:**

For measurement of cognition BSAID III was used among 98.4 % children. 41.3% children had mildly delayed cognition level. It was found that FT3, FT4 levels were almost normal with slightly increased and incase of TSH slightly decreased. No association was present between Thyroid hormone level and cognition level of ASD children.

**Conclusions:** From the result of this study, it may be concluded that there were presence of Thyroid hormone level abnormalities among autism spectrum disorders children with mild impairment of Cognition level. But there was no significant association detected. Therefore, routine thyroid test of pregnant mother and new born may be useful for early detection of thyroid hormone abnormality and also detect the level of impairment of cognition.

**Keywords:** Autism Spectrum Disorder(ASD), Thyroid hormones, , Cognitive level

**510.054** (*Virtual Poster*) Child and Family Factors Predicting Study Inclusion and Participation in a Genetic Study of Autism

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**Background:**

Genetic studies of autism spectrum disorder (ASD) hold tremendous promise for understanding underpinnings and mechanisms of ASD and associated features. However, genetic research has historically failed to adequately enroll and support minority participants towards study completion. Because generalizability of results relies upon equitable representation of individuals and families across the spectrum, the extent to which genetic findings can be generalized to minority groups in the population is unknown. Understanding of factors facilitating or impeding families' inclusion in genetic research can aide in providing support and increasing representation of study findings.

**Objectives:**

We sought to evaluate factors associated with families' participation in one of the 31 clinical study sites within the SPARK (Simons Foundation Powering Autism Research) network, in order to identify barriers to study completion among participating families overall, and among Hispanic or Latinx families.

**Methods:**

Participating families (N=1333, 22% female probands) had at least one member with ASD ("proband"), and were invited to provide genetic and phenotypic information. Linear and logistic regression models were generated to consider child factors (biological sex, age at diagnosis, ASD severity via the Social Communication Questionnaire) and family factors (household income, marital status of biological parents, simplex vs multiplex status) on age at study enrollment, likelihood of genetic sample completion by the proband and two biological parents, and length of time

to proband sample completion. Models were examined for the full site sample, and then again for the subset of families endorsing Hispanic or Latinx descent.

## Results:

Proband age at study enrollment was associated with a number of factors ( $R^2=.26$ ,  $F(6, 940)=56.49$ ,  $p<.001$ ), such that younger age at enrollment was associated with earlier diagnosis ( $t=17.33$ ,  $p<.001$ ), lower ASD severity ( $t=7.47$ ,  $p<.001$ ), household income below the group median ( $t=3.55$ ,  $p<.001$ ), and married biological parents ( $t=-2.67$ ,  $p=.008$ ). Successful return of samples was predicted by earlier ASD diagnosis and married parents ( $\chi^2(6)=26.86$ ,  $p<.001$ ), and proband samples were returned more quickly when probands were diagnosed relatively later ( $t=-2.80$ ,  $p=.005$ ), had household incomes below the sample median ( $t=2.03$ ,  $p=.04$ ), and came from simplex families ( $t=4.02$ ,  $p<.001$ ;  $R^2=.02$ ,  $F(6,902)=4.31$ ,  $p=.005$ ).

In families endorsing Hispanic or Latinx descent, ASD severity and household income also emerged as predictors of successful sample return ( $\chi^2(6)=26.01$ ,  $p<.001$ ), with more likely return when probands had fewer ASD symptoms ( $p=.009$ ) and families' income was below the median ( $p=.001$ ). Thus, although rates of trio sample completion were comparable among families with (62.5%) and without (61.9%) Hispanic or Latinx descent ( $\chi^2(1)=.02$ ,  $p=.89$ ;  $N=1126$ ), we identified unique factors predicting completion for this group of families.

## Conclusions:

Although some factors predicting study completion were shared across subgroups of our participating families, the relative importance of these factors may be unique within subgroups, as family income and ASD severity predicted sample completion specifically for our Hispanic or Latinx families. Understanding factors such as these enables timely identification of strategies to address barriers to participation among Hispanic or Latinx study families. Future work should continue to explore barriers to research participation in order to increase diversity and representation in genetic research.

### 510.055 (Virtual Poster) Examining Associations between Prenatal Biomarkers of Oxidative Stress and ASD-Related Traits Using Quantile Regression

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**Background:** Oxidative stress (OS) has been hypothesized as a mechanism involved in autism spectrum disorder (ASD) etiology, given the potential susceptibility of the fetus to reactive oxidative species and the importance of OS pathways in neurodevelopment. However, prospective research assessing prenatal OS and ASD-related outcomes in the child is lacking.

**Objectives:** To examine the association between prenatal OS and child ASD-related outcomes.

**Methods:** Participants (n=153) were drawn from the Early Autism Risk Longitudinal Investigation (EARLI), a multisite enriched risk cohort following pregnancies among women who already had an autistic child. Biomarkers of OS, including glutathione (GSH) and glutathione thiol/disulfide (GSSG) were measured in third trimester maternal plasma samples, and 8-oxo-deoxyguanine (8-OHdG) in maternal DNA samples. ASD-related outcomes were assessed via (1) Social Responsiveness Scale (SRS) raw total scores and (2) according to best estimate clinical diagnosis following clinical evaluation, Autism Diagnostic Observation Schedule score, and the Mullen Scales of Early Learning-Early Learning Composite score; groups included typically developing (TD, n=74), atypical development but not meeting criteria for ASD (non-TD, n=49); and ASD (n=30). Associations between the ratio of GSH:GSSG, as a measure of oxidative balance, and 8-OHdG, as a measure of oxidative damage to DNA, and SRS scores were examined using quantile regression, which allows for an exposure-outcome relationship to differ across percentiles of continuous outcomes. Increases in the level of GSH:GSSG are indicative of decreases in OS. Conversely, as levels of 8-OHdG increase so does OS. Secondly, we conducted linear regression analyses for comparison. Associations between OS biomarkers and categorical diagnoses were examined via logistic regression modeling the probability of ASD or non-TD compared to TD. All adjusted analyses included the covariates child's sex, maternal age, maternal race/ethnicity, and pre-pregnancy body mass index.

**Results:** In quantile regression analyses, there was some suggestion of minor increases in SRS scores with increasing GSH:GSSG ratio for mid-level quantiles of SRS only, but overall, strong associations were not observed with either measure of OS (Figure 1). Results were broadly consistent for SRS raw total scores using adjusted linear regression models (GSH:GSSG  $\beta$ : 2.00, 95% CI: -0.02, 4.01; 8OHdG  $\beta$ : 0.02 95% CI: -0.68, 0.71). Analyses examining associations with categorical outcomes suggested a marginal, but non-significant protective association for antioxidant balance and ASD according to the GSH:GSSG ratio (Table 1 - adjOR: 0.82, 95% CI: 0.66, 1.04), as well as with non-TD (adjOR: 0.90, 95% CI: 0.75, 1.08).

**Conclusions:** Overall, results from this high familial risk cohort do not support a strong relationship between markers of OS in the third trimester and ASD-related outcomes, though we did observe a marginal protective association between greater antioxidant balance (more GSH:GSSG) and categorical ASD-related outcomes. Our modest and null findings could relate to the timing of our measurement, given that OS changes over the course of pregnancy, or may relate to our study's high familial risk nature. Future work should consider these and other markers of OS, at other time points, and in additional, non-high-risk populations.

**510.056 (Virtual Poster)** Factors Predicting Timing of Referral, Diagnosis, and Intervention Use for Toddlers after a Positive Autism Screen in Primary Care

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**Background:** Despite clear evidence that autism spectrum disorder (ASD) can be reliably diagnosed at 18 months of age and early intervention leads to better outcomes, the median age of ASD diagnosis remains at 51 months. Universal screening with the Modified Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F) leads to earlier age of diagnosis. However, cultural and language barriers play important roles in creating disparities in receiving timely referrals for diagnostic evaluations and treatments among underserved groups, diminishing the clinical benefit of early screening.

**Objectives:** The aim of this study was to better understand whether demographic factors and/or presence of a priori providers' or caregivers' ASD and developmental concerns are correlated with different lengths of time between receiving a positive M-CHAT-R/F screening during a well-child visit and being referred for an evaluation, completing a diagnostic evaluation and initiating relevant intervention services. We sought to identify the key barriers that families face when seeking referrals, evaluations and treatments. Given that the COVID-19 pandemic occurred during the data collection period, its impact on the probability and timing of evaluations and interventions was also evaluated.

**Methods:** Retrospective analysis of Duke University Health System (DUHS) electronic health record (EHR) data was conducted by a medical student and two clinical psychologists on 213 children who had screened positive on the MCHAT-R/F during a well-child visit and/or had a documented EHR ASD diagnosis, regardless of M-CHAT-R/F score. Interrater reliability was tested and found to be adequate prior to analyses.

**Results:** Hispanic families experienced longer delays in receiving a referral for an ASD evaluation ( $p < 0.05$ ), completing a diagnostic evaluation ( $p < 0.05$ ) and initiating speech ( $p < 0.05$ ) and occupational services ( $p < 0.05$ ) compared to non-Hispanic families. White families were more likely to receive occupational therapy ( $p < 0.05$ ) and received the therapy earlier ( $p < 0.05$ ) than Black families. ASD and/or developmental concerns observed by caregivers and/or providers during the 18-24 months age period, documented in the EHR, were associated with an increased chance of being referred for an ASD evaluation, completing an evaluation, receiving an ASD diagnosis and initiating intervention services. The COVID-19 pandemic decreased the chance of receiving a referral and completing an ASD evaluation while increasing the time it took to receive an ASD diagnosis.

**Conclusions:** These results indicate that racial and ethnic background, as well as the presence of a provider or caregiver concern, play a role in the timeliness with which families receive referrals, evaluations and initiate interventions. These results suggest that attentive listening to caregivers' concerns and a better understanding of cultural barriers that influence referral timing and service initiation may help Hispanic and Black children receive more optimal care. Efforts to improve communication means between patients and providers through increased availability of patient portals in non-English languages and tailored educational resources could improve access to services, allowing children from diverse backgrounds to benefit fully from universal screenings and leading to better outcomes.

**510.057 (Virtual Poster)** Is There an Association between Maternal Nativity with Trajectories of Autism Symptoms and Adaptive Functioning?

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**Background:**

Although autism is highly heritable, evidence suggests its aetiology is multifactorial, including genetic and environmental factors that interact in complex ways over development. Maternal nativity or immigration status has previously been proposed as a risk factor as it may relate to adversity in country of origin, socioeconomic disadvantage, and barriers to healthcare, which in turn are robust predictors of poorer health outcomes in mothers and their children. Existing literature has focused on whether immigration status is related to an increased prevalence of autism. In this study we build on previous work by examining whether maternal nativity is associated with overall level and with change over time in autism symptoms and adaptive functioning in childhood.

**Objectives:**

To examine whether maternal nativity is associated with autism symptoms and adaptive behaviour, assessing both level and developmental course measured from preschool to late childhood.

**Methods:**

Participants were 380 children from the Pathways in ASD sample, an inception longitudinal cohort of autistic children based in Canada. Maternal nativity (“Canada-born” or “Born outside Canada”) was self-reported at time of recruitment (within 4 months of preschool diagnosis) or 6 months afterwards. To assess trajectories of autism symptoms and adaptive behaviour, the present analyses used Autism Diagnostic Observation Schedule (ADOS) and Vineland Adaptive Behaviour Scale (VABS) measures collected at four time points when participants were between 2 and 11 years of age.

Growth curve models were used to assess association of predictors with outcomes as follows: Model 1) nativity as predictor, study site as covariate; Model 2) nativity as predictor, and study site, maternal ethnicity, income, child sex, a measure of IQ, and age at diagnosis, as covariates; Model 3) model 2 plus an interaction term between nativity and income.

### Results:

There was no association between maternal nativity and autism symptom severity level. However, nativity (being born outside of Canada) was associated with increasing growth in symptom severity over time after accounting for covariates. For adaptive behaviour, being born outside Canada was significantly associated with lower level of adaptive behaviour, but this association was removed by the inclusion of IQ and low income in the model, which were both significantly associated with lower adaptive behaviour level. Nativity was not associated with growth in adaptive behaviour.

### Conclusions:

The severity of autism symptoms seen in children of non-native mothers worsened over time compared to those in children of native mothers, suggesting these individuals may be disproportionately impacted by reduced access to support services due to factors such as socioeconomic, language, and cultural barriers. Our findings therefore highlight these populations must be high priority for targeted support and intervention to reduce the risk of health inequalities in autistic children of non-native families

**510.058 (Virtual Poster)** Prevalence of Sleeping Disorders and Patterns of Medication Use in Individuals with Neurodevelopmental Disorders Using Health Insurance Claims Data from the United States

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### Background:

Up to 80% of children with neurodevelopmental disorders (NDDs) are reported to have disrupted sleep, with detrimental effects on cognition, mood and behavior. While sleep hygiene training and behavioral interventions are recommended as first-line therapies for sleeping disorders, evidence relating to effectiveness is mixed. Available pharmacological therapies, including atypical antipsychotics, are commonly prescribed for ‘off-label’ use. The characteristics and medication use of those with NDDs and sleeping disorders has not been studied in a large cohort with a broad age range.

### Objectives:

To evaluate prevalence, characteristics and medication use of individuals with sleeping disorders and NDDs (including autism, Fragile X, Rett, Williams, Prader-Willi, Angelman and Smith-Magenis/Miller-Dieker syndromes) in the USA.

### Methods:

A cross-sectional analysis of individuals with sleeping disorders was conducted using health insurance claims data, IBM® MarketScan® Research Databases, from the USA. Individuals were included if they had observable data on the cross-sectional date of December 31<sup>st</sup>, 2018 for Multi-State Medicaid Database and December 31<sup>st</sup>, 2019 for Commercial and Medicare Databases (owing to data availability). Individuals with sleeping disorders had ≥1 ICD-10-CM codes for sleeping disorders or prescription(s) for sleep medication between 2016 and the cross-sectional date. Among those with sleeping disorders, individuals with NDDs (≥1 ICD-9/10-CM codes for NDDs on or before the cross-sectional date) were identified. No age restrictions were applied. Demographics, comorbidities and sleep medications were assessed with descriptive analyses.

### Results:

Sleeping disorders were reported in 9.3% of the total cohort (>31 million people). Of 2,970,823 individuals identified with sleeping disorders, 64,342 (2.2%; 65.6% of which were covered by Medicaid) also had a NDD, most commonly autism (61,056; 94.9%). Most of those with a sleeping disorder and NDD were aged <18 years (58.3%). Of those with a sleeping disorder and NDD, 71.7% were male versus 40.0% in the total sleeping disorder population (reflecting the expected male predominance among some NDDs). Sleep medications were more commonly prescribed to individuals with a sleeping disorder and NDD (80.9%) than to the total sleeping disorder population (71.9%). Among those with a sleeping disorder, the top five most commonly used sleep medications were: trazodone (28.9%), zolpidem (19.3%), gabapentin (17.7%), hydroxyzine (14.1%) and lorazepam (8.9%). In contrast, the top five among those with a sleeping disorder and NDD were: trazodone (32.9%), clonidine (32.4%), guanfacine (24.8%), cetirizine (19.8%) and hydroxyzine (19.4%). While most likely given over the counter to more individuals, melatonin was occasionally prescribed (2.3% of those with sleeping disorders).

### Conclusions:

In this large cohort of individuals from the USA, sleeping disorders were highly prevalent. Over 64,000 individuals with a sleeping disorder also had a NDD, most commonly autism. The pattern of sleep medication use differed in those with a sleeping disorder with and without a NDD. Among individuals with NDDs, antihistamines and adrenergic agonists were prescribed more frequently, presumably for sedating side-effects, rather than the more common sleep medications (zolpidem or benzodiazepines). These data provide insights into the characteristics of those with a NDD and sleeping disorder and into the therapeutic management of these conditions.

**510.059 (Virtual Poster) Profile of Children with ASD and Food Selectivity**

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**Background:**

Autism Spectrum disorder (ASD) is characterized by difficulties with social interactions, communication, restricted interests and preference for sameness in behavior (APA, 2021). Food selectivity, often referred to as “picky eating”, is a common problem in children with ASD and is of particular concern because of its negative impact on nutrient adequacy and family mealtimes (Bandini, et al., 2017). One recent review estimated that children with ASD have a five-fold risk of feeding problems compared to children without ASD (Sharp et al. 2013). Children with ASD are overly selective in their eating patterns; consume less varied diets with very few fruits and vegetables and is associated with inadequate nutrient intake, mealtime behavior problems and parent stress ((Ranjan & Nasser 2015; Curtin et al. 2015).

**Objectives:**

The goal of this study was to examine the association of behavior and assessment profiles of children with food selectivity in newly diagnosed children with ASD between the ages of 3 to 12 years.

**Methods:**

A chart review was conducted on 125 diagnostic evaluations conducted on children between the ages of 3 to 12 years between the years of 2015-2017 that ended with a conclusive diagnosis of ASD based on clinical data received from parent/teacher report, intake report and assessment findings. The chart review was conducted at a University based Medical center. A rating scale for Behavior Rigidity was determined from the clinical intake based on the “restricted, repetitive patterns of behavior” listed in the diagnostic criteria for ASD in the DSM-V. The authors rated behavior rigidity as No Rigidity=0; moderate rigidity= 1 (if meets 1 to 2 criteria) high rigidity=2 (if meets 3-4 criteria) and severe rigidity=3 (over 4 criteria). In a similar manner food selectivity was rated as 0=no food selectivity reported; 1= moderate selectivity reported (limited food repertoire) and 2= high selectivity reported (not more than 2 food groups). Demographic factors such as ethnicity, sex, age, urban vs rural, ratings on the Autism Diagnostic Observation Schedule-2 (ADOS-2) and adaptive scores were used in the final analysis. Frequencies, and correlations were run to explore trends and associations between food selectivity, demographic and assessment findings.

**Results:**

Frequency statistics demonstrated a trend of high reported levels of behavioral rigidity and food selectivity in children diagnosed with ASD (Rigidity: 94% reported ratings of 1 and higher; Food Selectivity: 63% reported ratings of 1 and higher). Logistic regression analyses indicated that females are more likely to have “high” food selectivity when compared with “low” and “medium” food selectivity groups combined together. Also, “high” food selectivity was observed as preference for carbohydrates and as ADOS-2 total scores increased ( $p = 0.067$ ).

**Conclusions:**

In ASD, factors contributing to the combination of high food selectivity include gender, strong preference for carbohydrates and overall higher ratings of autism including social communication behaviors on the ADOS-2. Understanding these contributing factors can assist in developing treatment plans for food selectivity. Larger samples from different locations are required for better generalization of results. This study received IRB approval prior to chart review.

**510.060 (Virtual Poster) Suicide Versus Non-Suicide Death in Autistic Individuals: A 25-Year Population-Based Matched Cohort Study in Ontario, Canada**

**M. C. Lai<sup>1,2,3,4</sup>, N. R. Saunders<sup>4</sup>, A. Huang<sup>5</sup>, A. Artani<sup>5</sup>, D. Wilton<sup>5</sup>, J. Zaheer<sup>6</sup>, S. Ameis<sup>7</sup>, H. K. Brown<sup>8</sup> and Y. Lunskey<sup>2</sup>,** (1)The Margaret and Wallace McCain Centre for Child, Youth and Family Mental Health, Centre for Addiction and Mental Health, Toronto, ON, Canada, (2)Azrieli Adult Neurodevelopmental Centre, Centre for Addiction and Mental Health, Toronto, ON, Canada, (3)Department of Psychiatry, University of Toronto, Toronto, ON, Canada, (4)The Hospital for Sick Children, Toronto, ON, Canada, (5)ICES, Toronto, ON, Canada, (6)Centre for Addiction and Mental Health, Toronto, ON, Canada, (7)The Margaret and Wallace McCain Centre for Child, Youth, & Family Mental Health, Campbell Family Mental Health Research Institute, Centre for Addiction and Mental Health, Toronto, ON, Canada, (8)Department of Health & Society, University of Toronto Scarborough, Toronto, ON, Canada

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**Background:**

Autistic people may experience increased suicide risk compared to non-autistic people, with various sizes of risk reported by 6 population-based studies in Sweden, Taiwan, United States, and Denmark. The reported risk is particularly high in females and individuals without intellectual disability (ID). Reasons for this heightened risk and the differing pattern by autism sub-populations remain unclear but may involve available health and social support (that varies by jurisdictions) and co-occurring psychiatric conditions. Identifying modifiable factors associated with suicide in autistic people offers new directions for preventative efforts.

#### Objectives:

- (1) To compare the risk of suicide death in autistic versus non-autistic people (with other causes of death treated as competing risk), stratified by sex-assigned-at-birth.
- (2) To examine if socio-demographic factors, psychiatric diagnoses, and ID explains the risks of suicide and non-suicide death.

#### Methods:

Using health administrative data housed at ICES, Ontario, Canada that included all individuals in Ontario with a physician-recorded autism diagnosis in hospital or ambulatory care health records during 1988-2018, we conducted a 1:4 autistic:non-autistic matched-cohort study (age-matched within sex). We applied cause-specific competing risk models on death by suicide versus other causes, in 334,690 individuals (17,982 autistic versus 71,928 non-autistic females; 48,956 autistic versus 195,824 non-autistic males), followed for death outcomes during 1993-2018. Hazard ratios were stratified by sex-assigned-at-birth. We ran unadjusted and adjusted models (for neighborhood income and rurality, psychiatric and ID diagnoses) to observe whether risks were attenuated after adjustment.

#### Results:

Over the 25 study-years, among autistic people the incidence of death (every 100,000 individuals) was 95 (female) and 116 (male) for suicide, and 9799 (female) and 3413 (male) for non-suicide. Among matched non-autistic people, the incidence was 46 (female) and 83 (male) for suicide, and 8114 (female) and 2591 (male) for non-suicide. The hazards were higher in autistic versus non-autistic females for suicide death (cause-specific hazard ratio, HR 1.98, 95%CI [1.11-3.56]) and non-suicide death (1.08 [1.03-1.14], as competing risk that did not alter suicide risk findings); in autistic versus non-autistic males, the hazards for suicide death were not different (1.34 [0.99-1.82]) but significantly higher for non-suicide death (1.15 [1.09-1.22]). Adjustments for neighborhood income and rurality did not alter these patterns. Adjustments for each lifetime psychiatric diagnosis including schizophrenia spectrum, anxiety or mood, substance-use, and personality disorders attenuated most HRs for suicide death to non-significant levels, with small influences on non-suicide death (except schizophrenia), for both sexes. Adjustments for the effect of ID substantially increased the HR in females for suicide death (2.35 [1.28-4.32]) but attenuated that for non-suicide death (1.02 [0.96-1.08]); the same change was observed for males for suicide death (1.62 [1.18-2.23]) and non-suicide death (1.00 [0.94-1.06]).

#### Conclusions:

In Ontario, autistic female individuals and those without ID had higher risks of death by suicide. This pattern is similar to that reported in other jurisdictions, though with smaller effect sizes. Psychiatric diagnoses accounted for increased risk of suicide death, whereas ID and schizophrenia spectrum accounted for increased non-suicide death, across sexes. Support for autistic people must consider the risk stemming from co-occurring psychiatric conditions.

#### **510.061** (Virtual Poster) Psychometric Epidemiology: Population Based Reasoning to Identify ASD Screening Tools That Are Weaker Than Publicized

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#### Background:

Increasing research shows that the diagnostic accuracy of many autism screening tools are substantially lower than expected. This is primarily driven by studies following up on false negatives (FN) allowing for greater clarity of missed cases. Many years typically pass from originally publicized diagnostic accuracy studies without follow up to more expensive follow up studies. Thus, policy groups risk promoting screening tools that do not live up to their promise. Methods are needed allowing the field to identify weaker than expected screening tool diagnostic accuracy metrics.

#### Objectives:

This study builds out a simple method suggested by Barbaro & Dissinayake (2010) using published epidemiological population estimates to identify “likely missed cases” allowing for a recalculation of ASD screener sensitivity.

#### Methods:

We applied a “pop adjusted” approach to data from recent meta-analyses of diagnostic accuracy of ASD screening tools (Olmstead, 2020, K = 24; Sanchez-Garcia et al., 2019, K = 18, to show how estimating likely missed cases impacts reported sensitivity. First, we identified ASD prevalence



rates based on the national ASD prevalence closest to the year of publication. Pop-adjusted accuracy metrics were developed for each identified study by determining the expected ASD cases within a sample dependent on the nation's prevalence, resulting in pop-adjusted TN and pop-adjusted FP metrics. Pop-adjusted sensitivity was then developed from adjusted TN and FP. For example, Chlebowski et al. (2013) reported data on 18,446 children 18 to 24 months on the M-CHAT/R. Using CDC national prevalence data estimating that 1/68 U.S. children had an ASD, we then calculated estimates of how many children with ASD might be reasonably expected in the sample:

CDC (2012):  $1/68 = x/18,446$ ;  $x \sim 271$

Compared to the 98 identified ASD cases in Chelbowski's sample (6 FN and 92 TP), pop-adjusted samples indicated ~173 likely missed cases, leading to a pop-adjusted FN of ~179 (6 originally identified) and TN ~18,096 (original 18269-173). Pop-adjusted sensitivity then drops from a reported 94% to 34%. Studies identifying more cases than indicated by pop-adjustments kept originally reported FN and TN. When studies did not report data points for FN or TP these were calculated from available data provided standard formulas. Details of the PRISMA based systematic review methodology and meta-analyses may be found in Sanchez-Garcia et al. (2019) and Olmstead (2020).

#### Results:

Initial estimates indicate that 7/18 (38.9%) of studies reported from Sanchez Garcia et al. (2019) and 6/15 (40%) of Olmstead (2020) studies had decreases in their FN rates impacting reported sensitivities. These adjustments lead to substantial drops in meta-analyzed pooled sensitivity estimates (Olmstead decreasing from ~75% to ~53%; Sanchez-Garcia et al. decreasing from ~75% to ~54%). US based studies were more likely to be impacted than non-US.

#### Conclusions:

Epidemiological population estimates may be psychometrically useful in estimating potentially missed FN ASD cases in screening studies. Formulas for hand and R-calculations will be provided. Field insights are needed to determine optimal populations estimates.

### **510.062** (Virtual Poster) The Conjoint Impact of Preterm Birth, Low Birth Weight, and Literature Implicated Covariates on Identified Autism Spectrum Disorder

S. Sanchez-Alvarez, **B. Barger** and E. Graybill, Georgia State University, Atlanta, GA

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#### Background:

Premature birth and low birth weight (LBW) are implicated in the etiology of autism spectrum disorder (ASD); however, these postnatal factors are rarely considered conjointly. Both are also implicated in the etiology of intellectual disability (ID) and developmental delays (DD) (co-morbid with ASD), which are rarely controlled for in analyses.

#### Objectives:

This study considers the relationship between premature birth and LBW, singly and conjointly, on identified ASD. Literature-derived covariates (e.g., ID and DD) are also considered.

#### Methods:

Weighted/stratified logistic regression analyses of the National Survey of Children's Health (NSCH) for the years 2016-2018 were conducted to determine the relationship between preterm birth and LBW on identified ASD. Child level covariates included: sex (female [Reference]), age (<4 [Reference], 4-8, 9-12, and  $\geq 13$  years), developmental delay (no [Reference]), ID (no [Reference]), birth order (third or greater older child [Reference], only, oldest, and second oldest child), and race/ethnicity (non-Hispanic Other [Reference], non-Hispanic White, non-Hispanic Black, and Hispanic. Family included: age of mother at birth (18-24 [Reference], 25-29, 30-34, and  $\geq 35$  years), family structure (2 parents married [Reference], 2 parents not married, single mother, and other), usual source of care (no usual source [Reference]), caretaker education level (>high school [Reference], and high school or less), primary language (non-English [Reference], and English), insurance type (private only [Reference], public only, public and private, and uninsured), personal doctor/nurse (yes, one person [Reference], yes, more than one person, and no), and family poverty ratio [FPL] (400+ poverty [Reference], <100% poverty, 100-199% poverty, and 200-399% poverty).

#### Results:

Of 102,341 available cases 2.4% had an ASD. Typical birthweight children had fewer (2.3%) ASD cases compared to low birth weight (LBW, 2.7%) and very low birth weight (VLBW, 4.7%) children; more preterm children had an ASD (4.1%) compared to non-preterm (2.1%). Bivariate analyses showed that compared to non-LBW children, greater odds of ASD were seen for LBW (OR=1.39[1.09-1.77]) and VLBW children (OR=2.13[1.28-3.54]). Odds of ASD was much higher for children with ID (OR=34.55[25.17-47.43]) or DD OR=41.87[32.55-53.84]. Smaller increased odds of ASD were also seen for Black and Hispanic children, older children, birth order, family structure, caretaker education, usual source of care, having a personal doctor or nurse, poverty level, and health insurance. Considered conjointly, preterm birth remains associated with increased odds of ASD (OR=1.96[1.38-2.78]), but LBW is not. Conjoint consideration with covariates resulted in no statistical relationship between preterm birth and lower odds for LBW (OR=0.63[0.40-0.98]) and a trend for VLBW (OR=0.50[0.22-1.11]); child gender, age, and birth order maintained associations

with small increased odds of ASD; presence of DD maintained a strong association with increased ASD odds (OR=32.49[26.10-40.43]), but ID's relationship lowered (OR=2.65[1.88-3.74]).

Conclusions:

Researchers should take care when conducting studies on the relationship between prematurity and birthweight on identified ASD. This analysis indicates that prematurity accounts for the variance of birthweight when considered conjointly. Furthermore, DD and ID should be further investigated as potential moderator/mediators impacted by prematurity and birthweight.

## Family Issues and Stakeholder Experiences

### PANEL — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES

#### 213 - Challenges and Resilience: Effects of the COVID-19 Pandemic on Autistic Individuals and Their Families across the Lifespan

**Panel Chair:** Matthew Lerner, *Psychology, Stony Brook University, Stony Brook, NY*

**Discussant:** Emily Simonoff, *King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom*

**213.001 (Panel)** COVID-19: The Important Roles of Stress, Anxiety, and Coping in Adolescents with and without Autism and Their Parents  
**B. A. Corbett<sup>1</sup>**, R. A. Muscatello<sup>1</sup>, M. E. Klemencic<sup>1</sup> and J. M. Schwartzman<sup>2</sup>, (1)*Psychiatry and Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN*, (2)*Vanderbilt University Medical Center, Palo Alto, CA*

**Background:** In the wake of COVID-19, the world has become a more uncertain, unpredictable environment – a breeding ground for stress and anxiety, especially for individuals with autism spectrum disorder (ASD) who often respond poorly to change.

**Objectives:** The objective of the study was to examine stress, coping and anxiety in a data-driven, real-time assessment of adolescents with and without ASD and their parents at the height of the COVID-19 shutdown and three months later. A robust, theoretical model in which stress response and coping are considered on three dimensions (voluntary vs. involuntary; engagement vs. disengagement; primary vs. secondary control) (Compas, 2001). Also, state (current) and trait (persistent) anxiety were measured.

**Methods:** Participants included 122 fully-characterized adolescents (ASD=61, TD=61), and their parents (96.3% mothers). Five standardized measures were administered via REDCap to ascertain stress and coping explicitly related to the COVID-19 pandemic (RSQ COVID-19-Child, Adult, Parent (about Child)) and anxiety (STAI-C, STAI-A). Four aims examined: Aim 1, Child: stress, coping and anxiety via self-reports of youth with and without ASD. Aim 2, Parent: examined stress, coping and anxiety on parents regarding their own self-reported stress and anxiety. Aim 3, Predictive: the influence of adults' self-reported stress and coping style on the perception of their child's stress and coping skills. Aim 4, Longitudinal: impact of COVID-19 longitudinally by comparing stress and coping over two time-points. For youth, Trait anxiety was compared over three time points: T0 (Pre-COVID-19), T1 (lockdown) and T2 (re-opening). Aim 5, Coping and Anxiety: the influence of coping style at T1 on trait anxiety at T2 for Child and Adult. Multivariate, univariate analyses of variance and hierarchical regression were used.

**Results:** Significant differences emerged with ASD youth endorsing more trait anxiety ( $p<.05$ ) and response to specific stressors (e.g., virus, access to healthcare) ( $F(14,91)=2.82$ ,  $p=.002$ ;  $\Lambda=0.698$ ,  $\eta^2=.302$ ). Parents of children with ASD showed higher self-reported anxiety ( $p<.05$ ), yet scores were elevated for both parent groups. ASD parents reported more stress ( $F(1,106)=22.38$ ,  $p<.001$ ,  $\eta^2=.174$ ), especially related to the virus, access to healthcare, work, and concern for the future. TD youth and their parents used more Primary and Secondary Control Coping whereas ASD youth and their parents used more Disengagement Coping. Coping Style for Child (Primary, Secondary) and Adult (Secondary) predicted trait anxiety at T2.

**Conclusions:** Results reveal striking differences in youth with ASD and their parents regarding anxiety, stress, and coping. The important role of coping style was a significant predictor of later anxiety for youth and their parents above and beyond diagnosis. Findings highlight the need for essential support, access to services, and strategies to enhance psychological and emotional well-being.

**213.002 (Panel)** Trajectories of Self-Reported Internalizing Symptoms Among Autistic and Nonautistic Youth during the COVID-19 Pandemic  
**T. C. Day<sup>1</sup>**, M. L. McNair<sup>1</sup>, D. Reicher<sup>2</sup>, A. H. Gerber<sup>1</sup> and M. D. Lerner<sup>1</sup>, (1)*Psychology, Stony Brook University, Stony Brook, NY*, (2)*Psychiatry, Stony Brook University, Stony Brook, NY*

**Background:** Autistic people experience anxiety and depression at higher rates (Hudson et al., 2019; Wijnhoven et al., 2018) and these internalizing symptoms (IS) remain elevated throughout adolescence (Gotham et al., 2015). In nonautistic children and adolescents, large increases in IS at the beginning of the COVID-19 pandemic (Racine et al., 2021) were followed by subsequent decreases in the summer and fall of 2020 (e.g., Hawes et al., 2021; Andreas & Brunborg, 2021). However, little is known about IS during the pandemic in autistic youth despite their elevated risk for depression and anxiety and the disruptions to home, school, and service access (Baweja et al., 2021).

**Objectives:** Assess the trajectories of IS in autistic and nonautistic youth during the COVID-19 pandemic. We hypothesized that (1) baseline IS will be higher in autistic youth and (2) relative to autistic youth, IS in nonautistic youth will decrease.

**Methods:** Participants included 75 autistic and nonautistic (determined via ADOS-2; Lord et al., 2012) youth (all FSIQ  $\geq 70$ ). The Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) was administered once every two weeks from June 2020 to December 2020 during the COVID-19 pandemic. Multilevel models were used to assess changes in IS.

**Results:** Fifty autistic youth ( $N_{female}=10$ ,  $M_{age}=12.9$ ,  $SD_{age}=2.59$ ,  $range=8.50-17.4$  years) and 25 nonautistic youth ( $N_{female}=14$ ,  $M_{age}=12.6$ ,  $SD_{age}=2.65$ ,  $range=8.54-16.5$  years) completed the RCADS. Baseline IS did not differ between groups ( $p=.27$ ). Average IS did not differ by group status, but an interaction between time and group emerged (Table 1; Model 3). IS did not change over time in the nonautistic group ( $B=.014$ ,  $SE=.015$ ,  $p=.35$ ) while in the autistic group, IS decreased over time ( $B=-.021$ ,  $SE=.0096$ ,  $p=.03$ ). Post-hoc analyses revealed a similar interaction between time and group for the Social Anxiety subscale ( $B=-.041$ ,  $SE=.020$ ,  $p=.04$ ) and Generalized Anxiety Disorder (GAD) subscale ( $B=-.031$ ,  $SE=.015$ ,  $p=.04$ ): in the autistic group only, GAD symptoms decreased over time ( $B=-.018$ ,  $SE=.0083$ ,  $p=.03$ ). Changes over time were not observed in the depression, OCD, panic, nor separation anxiety subscales within the autistic or nonautistic groups.

**Conclusions:** Baseline levels of IS did not differ between autistic and nonautistic youth, suggesting that all youth displayed average (non-clinical) IS by June 2020. Contrary to hypotheses, autistic youth demonstrated a *decrease* in IS, specifically in GAD and Social Anxiety, over time relative to nonautistic youth. These results reveal a potential unique source of resilience in autistic youth, which may be due to less anxiety about in-person schooling and socializing, as well as more choice in daily routines (Spain et al., 2021). More specifically, the impact of “hidden curricula” (e.g., social norms) endemic to schools may have been reduced by the pandemic (Reicher, 2020). Social distancing may normalize sitting alone during lunch, and mask wearing may reduce requirements to read facial expressions; furthermore, some autistic students prefer virtual instruction because of reductions in social obligations (Hurwitz et al., 2021). Future investigations examining for whom such adaptations (e.g., virtual instruction) are warranted as the school environment evolves in response to – and beyond – the COVID-19 pandemic.

**213.003 (Panel) A Mixed Methods Study of the Impact of COVID-19 on the Mental Health and Wellbeing, and Mental Health Service Access during COVID-19, of Autistic Adults in Australia**

**D. Hedley<sup>1</sup>, K. Denney<sup>2</sup>, M. Uljarevic<sup>3</sup>, S. M. Hayward<sup>4</sup> and M. A. Stokes<sup>5</sup>,** (1)Olga Tennison Autism Research Centre, La Trobe University OTARC, Melbourne, VIC, Australia, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, VIC, Australia, (3)School of Psychological Sciences, University of Melbourne, Stanford, CA, Australia, (4)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, QLD, Australia, (5)Deakin University, Burwood, VIC, Australia

**Background:** Recent research has highlighted the mental health impacts of the COVID-19 pandemic on people with disability, i.e., autistic people. Among negative mental health impacts are increases in depression and anxiety symptoms, and concerns about safety, security, employment, medication and food access (Oomen et al., 2021). Studies suggest that vulnerable populations, including those with disabilities, may be at increased risk of self-harm and suicidal ideation and behavior. It is therefore important to examine potential relationships between the impacts of COVID-19, mental health and wellbeing, and suicide risk in an autistic population; as well as their access to mental health services during this time.

**Objectives:** This study explored a) potential relationships between the impact of COVID-19, mental health and wellbeing, including suicide risk, in autistic adults and b) any changes to mental health care and service access as a result of COVID-19.

**Methods:** A mixed methods interview design was adopted. Quantitative data were collected during the second wave of the COVID-19 pandemic. Qualitative data were collected during the third wave. Participants were 111 autistic adults (women = 58.6%, men = 32.4%, non-binary/not disclosed = 9.0%;  $M_{age} = 42.45$ ,  $SD = 13.03$  years). COVID-19 impact was assessed with the COVID-19 Impact Scale (CIS). Mental health and wellbeing were assessed with the Personal Wellbeing Index (PWI-A) and Patient Health Questionnaire (PHQ-8). Suicidal ideation and behavior was assessed with the Suicide Behaviour Questionnaire, Revised (SBQ-R). In an interview we asked a subset of participants “Has your access to mental health care changed during the COVID-19 pandemic?”

**Results:** COVID-19 impact showed small associations with poorer personal wellbeing,  $r = -.224$ ,  $p = .023$ ,  $[-.409, -.016]$ , and higher depressive symptoms,  $r = .268$ ,  $p = .006$ ,  $[.056, .445]$ . COVID-19 impact was not significantly associated with the SBQ-R suicide risk score,  $r = .081$ ,  $p = .418$ ,  $[-.118, .264]$ . Themes from qualitative data indicated: no change of access to mental health care; no meaningful change in mental health service provision despite the introduction of new programs by the government; telehealth services are welcomed; and delays to accessing typical services.

**Conclusions:** The impact of COVID-19 is reflected in worsening mental health and wellbeing, particularly in those with predisposing conditions or vulnerabilities, such as disability or co-occurring mental health conditions. The COVID-19 pandemic was significantly associated with poorer wellbeing and higher depression symptomatology. There was no significant association between COVID-19 impact and suicide risk. Participants reported that telehealth and the introduction of government programs improved their access to mental health care; however there were also longer wait times and delays in accessing assistance.

**213.004 (Panel) Longitudinal Changes in Depression and Other Mental Health Symptoms Among Autistic Adults during the COVID-19 Pandemic**  
**S. Zheng<sup>1</sup>, J. L. Taylor<sup>2</sup>, R. Adams<sup>3</sup> and S. Bishop<sup>4</sup>,** (1)Psychiatry, University of California, San Francisco (UCSF), San Francisco, CA, (2)Vanderbilt University Medical Center, Nashville, TN, (3)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (4)University of California San Francisco, San Francisco, CA

Autistic adults are at risk for experiencing numerous stressors related to the COVID-19 pandemic, such as uncertainties/disruptions in routines and employment. Some studies on the early impact of the pandemic showed elevated COVID-19 related distress and mental health problems among autistic adults, whereas others reported no significant increases in mental health symptoms or even positive effects related to reduced social demands. As the U.S. society starts to reopen, longitudinal studies are necessary to further elucidate the long-term impact of COVID-19 related disruptions on the mental health of autistic adults.

#### Objectives:

We aim to examine (1) changes in mental health symptoms across four timepoints over 16 months (March 2020 to July 2021) and (2) the impact of anxiety, stress, and loneliness on depression in autistic adults in the context of the COVID-19 pandemic.

#### Methods:

A cohort of 315 independent autistic adults (aged 18 to 35; 48% female) were recruited in early March 2020 (baseline) for a study on mental health services. A follow-up survey was sent to the same cohort of adults in May 2020, and two additional follow-ups were sent to a subsample of 210 consented adults in March 2021 and July 2021. For each data collection, autistic adults completed online surveys including the Beck Depression Inventory-II (BDI-II), Depression Anxiety Stress Scale (DASS-21), and Asher Loneliness Questionnaire. See Table 1 for descriptive statistics of mental health symptoms over time.

#### Results:

Repeated measures ANOVA showed that at the group level, autistic adults reported statistically significant (1) decreases in depressive symptoms measured on BDI-II over time since May 2020; (2) initial decreases in anxiety levels in May 2020 that then returned to baseline; (3) decreases in loneliness in May 2020 and July 2021 compared to baseline; and (4) increases in stress levels in March and July 2021 compared to baseline. To examine the effect of changes in stress, anxiety, and loneliness on later depression, we built a multi-level model with BDI-II depressive symptoms at follow-up timepoints as the outcome variable and controlled for baseline depressive symptoms. The model identified the significant random effect of time and the time-lagged (T-1) random effect of loneliness (see Table 2 for model specification and outputs), indicating that the changes in depressive symptoms and the positive effect of the feeling of loneliness on later depressive symptoms vary significantly across individuals. In fact, the intraclass correlation for depression over time is 0.76, indicating large between-individual variances.

#### Conclusions:

Findings from our longitudinal study on mental health in autistic adults highlighted two implications: (1) Different aspects of mental health (i.e., depression, anxiety, stress, loneliness) show different patterns of changes over time in response to social-environmental events, and therefore need to be considered separately (and in relation to each other). (2) Mental health problems in autism vary greatly between individuals, reinforcing the need to consider individual differences in risk, resilience, and response to stressors. We plan to further examine how individual characteristics (e.g., employment, relationship, social experiences) might impact longitudinal changes in mental health symptoms in autistic adults.

## PANEL — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES

### 221 - Understanding the Stigmatisation of Autistic People across Contexts and Settings

**Panel Chair:** Monique Botha, *Department of Psychology, University of Stirling, Stirling, United Kingdom*

**Discussant:** Morton Ann Gernsbacher, *Department of Psychology, University of Wisconsin-Madison, Madison, WI*

**221.001 (Panel)** “I Felt like I Deserved It Because I Was Autistic”: Understanding the Impact of Interpersonal Victimization in the Lives of Autistic People

**A. Pearson<sup>1</sup>, K. Rose<sup>1</sup>, J. Rees<sup>1</sup> and S. Forster<sup>2</sup>,** (1)*Psychology, University of Sunderland, Sunderland, United Kingdom*, (2)*Social Work, University of Sunderland, Sunderland, United Kingdom*

**Background:** Autistic adults are more likely to experience interpersonal victimisation compared to non-autistic peers. Research has suggested that this heightened prevalence predicts poorer mental health outcomes, including higher prevalence of post-traumatic stress disorders. However there has been little focus on the social factors that drive heightened prevalence (i.e. stigma), and how this interacts with outcomes, and access to support and recovery.

**Objectives:** The aim of the current study was to explore experiences of interpersonal victimisation in autistic adults through the lens of the social process model of stigma. We specifically focussed on the impact of interpersonal victimisation on identity, and barriers and facilitators of support and recovery.

**Methods:** We recruited 102 autistic adults (aged 19-73) to take part in a qualitative study on their experiences of victimisation. We offered the opportunity to take part asynchronously by responding to an online survey with structured interview questions, or synchronously via a live semi-

structured interview. One hundred people took part in the asynchronous version, and 2 gave spoken interviews. We analysed the data from these interviews using reflexive thematic analysis, with a blended inductive/deductive approach. We used Frosts process model of social stigma to form the deductive coding framework, and completed inductive coding in an open and organic manner.

**Results:** We identified 4 main themes in the dataset. Theme 1, 'The usual for autism' focussed on participants perceptions that the victimisation they had experienced was normal for autistic people, and that they deserved it. Theme 2, 'Personhood: revoked' focussed on feelings of otherness, and the relationship between victimisation, masking, and autistic burnout. Theme 3, 'Unpacking the baggage' focussed on the emotional impact of victimisation, and how the participants made sense of their experiences. Theme 4, 'If you want to make an apple pie from scratch, you have to invent the universe first' identified the role of power dynamics in support-seeking, the impact of good interpersonal relationships and knowledgeable therapists on recovery, and the importance of autistic community.

**Conclusions:** The findings from this study support the importance of acknowledging the role of stigma in the interpersonal victimisation of autistic adults. Experiences of victimisation were driven by perceptions of otherness and being labelled negatively, which led participants to blame themselves. Participants responded to victimisation by masking and suppressing their identity to avoid further trauma, which led to exhaustion and burnout. The experience of victimisation often took a long time to process emotionally, but being able to make meaning out of these experiences helped participants start to recover. Recovery was further facilitated by the presence of supportive relationships and access to good quality therapy, however structural inequalities made this inaccessible to many. Our findings suggest that intervention to reduce the heightened prevalence of interpersonal victimisation in autistic adults need to focus on stigma reduction, and removing structural inequalities that prevent access to support and recovery.

#### **221.002 (Panel) Perceptions of Autistic Adults across Personal and Professional Contexts**

**K. M. DeBrabander<sup>1</sup>, D. R. Jones<sup>1</sup>, R. A. Ackerman<sup>2</sup> and N. J. Sasson<sup>1</sup>,** (1)University of Texas at Dallas, Richardson, TX, (2)The University of Texas at Dallas, Richardson, TX

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**Background:** Non-autistic (NA) adults form less favorable impressions of autistic adults and report greater reluctance to interact with them (e.g., Sasson et al., 2017) but these findings have been generated within limited and artificial scenarios (e.g., auditioning for a reality TV show) rather than reflecting the diversity of real-world contexts experienced by autistic adults.

**Objectives:** This study compares how autistic adults are perceived across broader personal (e.g., dating) and professional (e.g., job interview) contexts.

**Methods:** Twenty-one autistic and 21 NA adults, new to this study and matched on core demographic features, were filmed participating in six personal and professional contexts for 45s each: job interview, dating profile, making a friend, finding a partner for class project, discussing an interest, and auditioning for a reality TV show (i.e., the context from Sasson et al., 2017). Videos were shortened to thin-slices (10-15s) and shown to 979 NA undergraduates pseudo-randomly assigned to one context in which they rated all 42 stimulus participants. After each video, participants completed the First Impression Scale (Sasson et al., 2017), which consists of six trait items and four items assessing social interest in the stimulus participant.

**Results:** Consistent with prior research, autistic adults were rated less favorably than NA adults on all first impression items (except dominance) across contexts ( $p < .05$ ). However, significant interactions between diagnostic group and context emerged for all items ( $p < .05$ ) other than attractiveness. Post hoc analyses revealed that NA participants maintained a first impression advantage over autistic participants across contexts, but the size of this advantage varied, with autistic adults being rated more favorably in some contexts than others. They were rated as more likeable, trustworthy, and intelligent when talking about their interest than when in a job interview ( $p < .001$ ), a pattern that did not occur for NA participants. In contrast, impressions of NA but not autistic participants improved in the job interview on trust and awkwardness ( $p < .01$ ), with a trend on intelligence ( $p = .055$ ), compared to the original TV context. Autistic adults were also rated as less likely to be hired from their job interview than NA adults ( $p = .029$ ). For social interest items, autistic adults received lower ratings than NA adults across contexts, but the magnitude varied. Interest in having a conversation with NA participants varied across contexts but remained similarly low across contexts for autistic participants.

**Conclusions:** First impressions of autistic and NA adults are modulated by context. Only ratings of attractiveness did not produce an interaction between diagnosis and context, likely because higher attractiveness ratings for NA adults are not influenced by the changes elicited by context. Autistic adults were rated most favorably when discussing their interest and least favorably when interviewing for a job. In contrast, NA participants improved in the interview context on some items relative to baseline. In sum, biases against autistic social presentations appear magnified in job interview contexts and are associated with lower ratings of employability. These findings argue for more nuanced evidence concerning the environmental factors contributing to social disability and discrimination experienced by autistic adults.

#### **221.003 (Panel) Characteristics of Autistic People and Characteristics of Raters: An Investigation into Factors Contributing to Heightened Autism Stigma in South Koreans Vs Americans**

**S. Y. Kim<sup>1</sup> and K. Gillespie-Lynch<sup>2</sup>,** (1)Duksung Women's University, Seoul, Korea, Republic of (South), (2)Department of Psychology, College of Staten Island, City University of New York, Staten Island, NY

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**Background:** Previous research suggests that autism stigma is heightened in South Korea relative to the United States (US) (Kim et al., 2021). In Korea, emphasis on social norms contributes to heightened autism stigma (Kim et al., 2021). Given that internalized stigma likely contributes to the poor mental health of autistic people (Botha & Frost, 2020), there has been increasing research interest in understanding and alleviating autism stigma. However, little remains known about how specific characteristics of autism may contribute to autism stigma internationally.

**Objectives:** We aimed to 1) examine if Korean and American non-autistic people show different levels of stigma toward unlabeled vignettes depicting autistic people depending on the domains of autistic characteristics portrayed (i.e., social, non-speaking, and repetitive interests and restricted behaviors [RIRB]) and 2) identify what variables predict stigma toward autistic behaviors in each domain.

**Methods:** Two-hundred fifty-nine Koreans and 240 Americans completed online surveys. Participants read three unlabeled vignettes depicting a character exhibiting primarily: 1) social difficulties, 2) RIRB, or 3) a non-speaking person. Participants were randomly assigned to read either low or high support vignettes within each domain and to indicate their desired social distance from the character in each vignette. See Table 1 for participant information and variables measured. Repeated-measure ANCOVA was performed to examine the effect of domains and country on stigma, controlling for age and gender. Multiple regressions examined stigma toward social, non-speaking, and RIRB vignettes with variables that were correlated with stigma in each domain as predictors.

**Results:** Main effects of domains ( $F = 11.37$ ;  $p < 0.0001$ ) and country ( $F = 152.31$ ;  $p < 0.0001$ ) were observed. Koreans reported more stigma than Americans. Stigma was higher toward RIRB ( $M = 2.90$ ) than social characteristics ( $M = 2.72$ ). Stigma towards non-speaking people ( $M = 2.80$ ) did not differ from those exhibiting primarily social or RIRB characteristics. Being Korean was correlated with heightened stigma across domains, but this association disappeared in Non-speaking and RRB domains once autism knowledge, neurodiversity endorsement, contact quantity, and support needs were accounted for (Table 2). Heightened autism knowledge and neurodiversity endorsement and low support needs predicted lower stigma across all domains. High contact quantity predicted low autism stigma in Non-speaking and RRB domains. Additionally, cultural tightness, correlated with stigma in RRB domain only among Koreans ( $p = .0007$ ), predicted autism stigma in RRB domain.

**Conclusions:** RIRBs and high support needs were more stigmatized across both countries. Findings suggest that both characteristics of autistic people and individual differences of raters, including their autism knowledge and neurodiversity endorsement, exert more impact on autism stigma than nationality. Even after accounting for individual differences, Koreans reported more stigma toward a character exhibiting primarily social difficulties, suggesting the emphasis on how to *appropriately* behave in social situations is contributing to high autism stigma in South Korea. Efforts to increase autism knowledge and help people appreciate the neurodiversity movement may reduce autism stigma in both South Korea and the US.

**221.004 (Panel) Understanding Cues for Stigmatisation in the Narratives of Autism Researchers**  
**M. Botha** and E. Cage, Department of Psychology, University of Stirling, Stirling, United Kingdom

**Background:** Research about autism is particularly prolific, with at least 18,490 papers published between 2005-2014 (Sweileh et al., 2016). In 2019 and 2020 alone there were over 7,000 publications each year (Kirby & McDonald, 2021). There is a lack consensus around the nature of autism, nor how autistic people should be described. Some researchers adopt a medical perspective, which centres autism into bodies of autistic people as disorder. Others adopt a neutral embodiment perspective which focuses on autism as natural and biological, which is a difference/disability without inherently being disorder. Lastly, some researchers adopt a social model which focuses on the role of society and environments in disabling autistic people. Autism research has been criticised for othering autistic people (Michael, 2021) and for research-based violence (Botha, 2021). Participatory methods are increasing and might challenge these othering notions. To our knowledge, there have not been investigations into the views held by autism researchers.

**Objectives:** First we analysed the different narratives being used by autism researchers and whether they contained stigmatising cues. Second, we analysed whether variables such narratives (medical or otherwise) or participatory methods predicted stigma cues while controlling for other connections to autistic people or length of experience in research.

**Methods:** In total, 172 autism researchers took part. Most were female (72.8%), in the UK (36.4%) or USA (33%), 19% were autistic autism researchers. Researchers came from a range of disciplines and career stages with on average 8.56 years' experience. They completed an online mixed methods survey, answering five qualitative questions, where they had to describe autism, autistic people, the cause of autism, the main goal of autism research, and the main aim of their own research. Quantitative questions recorded information on experience, language preferences, connections with autistic people (familial and non-familial), and experiences of participatory research. We used content analysis to analyse researchers' qualitative responses.

**Results:** We coded 55.8% ( $n = 96$ ) of the accounts as medical, 32.6% ( $n = 56$ ) as neutral embodied, and 11.6% ( $n = 20$ ) as social model narratives. In 59.9% of researchers answers there was at least one stigmatising cue. We used hierarchical binary logistic regression to identify whether narrative or participatory methods predicted stigmatising cues, while controlling for length of research career, familial and non-familial connections to autistic people. Narrative significantly predicted the odds of stigmatising cues with both the embodied ( $\text{Exp}(B) = .16$ ) and social ( $\text{Exp}(B) = .06$ ) perspectives predicting lower odds of stigmatising cues ( $ps < .001$ ). Greater participatory research methods predicted significantly lower odds of stigmatising cues ( $\text{Exp}(B) = .60$ ,  $p = .03$ ). Neither familial nor non-familial connections predicted cues for stigmatisation once degree of participation or perspective were included in the model.

**Conclusions:** Medical narratives are still predominant, but not exclusively how researchers characterise autism. Participatory methods predicted significantly lower odds of stigmatising cues in researchers accounts and may be particularly important in reducing the stigmatising or othering accounts of autistic people.

## ORAL SESSION - 4A — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES

### 304 - Autistic Experiences

### 304.001 (Oral) Autistic and Non-Autistic Stakeholder Participation in Autism Research

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**Background:** Participatory research is a framework for approaching inquiry such that those who would traditionally be research participants become partners in the research process (Cornwall & Jewkes, 1995). There have been increasing calls for participatory autism research, but little is known about the strategies researchers use and their perceptions of involvement.

**Objectives:** The objective of this study was to understand participatory autism research better. Specifically, we asked (1) what strategies do investigators use, (2) what barriers do they face, and (3) what do they see as the importance of involvement? We also asked if there were differences in involvement between autistic and non-autistic stakeholders (such as parents, educators, and clinicians).

**Methods:** This study is a fully mixed sequential equal status design (Leech & Onwuegbuzie, 2009) in which we first asked participants to complete a survey, and then a subsample was interviewed. Corresponding authors who had published in autism-focused journals from 2015–2019 were emailed an invitation to participate in a survey (n=2,722). Of these, 215 participated in the survey, and 21 of these participants also agreed to one-hour-long interviews. The authors, three of whom identify as autistic, developed the survey and interview protocol. We analyzed both qualitative and quantitative data descriptively. Paired samples t-tests were used to identify statistical differences between autistic and non-autistic stakeholder groups. The qualitative data was structurally coded (Saldaña, 2016) to expand and provide detail into the quantitative findings and guide additional analysis.

**Results:** The tables summarize the results of the analysis. In general, there was infrequent use of the participatory research approaches. Participants were more likely to have an advisory board and present research to non-autistic stakeholders. The quote in Table 1 highlights an approach we did not ask in the survey—how community building can foster participatory research. Participants moderately endorsed each of the barriers to research, with “not being sure how to engage stakeholders” and “questioning how stakeholders may enhance research” having the least agreement. A lack of incentives and confidence with engagement seemed to be more significant barriers for autistic stakeholder participation, whereas not being sure how their participation could enhance research was a greater barrier for non-autistic stakeholders. The quote in Table 2 highlights the connection between barriers to involvement (e.g. funding) and the importance of involvement (e.g. balancing power). In terms of the importance of involvement, there was moderate endorsement of each item. In general, the scores on importance were higher for autistic stakeholders. The quote in Table 3 provides a detailed example of how stakeholder involvement enhanced the research process.

**Conclusions:** This research indicates that stakeholder engagement in autism research does have support; however, attempts to engage stakeholders are lagging behind. There were many similarities between different stakeholder groups; however, a difference seems to be more support for how the participation of autistic stakeholders is important for research.

### 304.002 (Oral) The Experiences and Perceptions of Professional Autistic Actors in Film and on Television

M. Dean<sup>1</sup> and A. Nordahl-Hansen<sup>2</sup>, (1)Education, 2013, Camarillo, CA, (2)Faculty of Education, Østfold University College, Halden, Norway

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Background:

Film and television portrayals of autism can simulate personal experiences for people who have otherwise not had direct substantive contact with autistic individuals—people form perceptions of autism based on the characters they observe on the screen (Nordahl-Hansen et al., 2018). Given the recent upsurge in autistic portrayals in film and on television, it is important to understand the involvement of autistic stakeholders in the development of autistic characters, and the extent to which these groups value autistic representations.

Objectives:

We sought to examine the experiences and perceptions of professional autistic actors who have played autistic characters in film and on television.

Methods:

This study uses Interpretative Phenomenological Analysis (IPA) (Smith et al., 1999), in which professional autistic actors participated in interviews and discussed their professional opportunities and work experiences as autistic actors in film and on television. Participants also described their perceptions of autistic characters. Ethical approval was granted by the University's Institutional Review Board prior to the start of recruitment.

Autistic community engagement was built into the study design; autism stakeholders, including community members, and parent- and self-advocates helped to develop the interview protocol and procedures, and assisted in recruitment efforts. Per community endorsement, actors were sent the interview questions prior to the scheduled appointment, and were given the choice to participate in the interview via Zoom, phone, chat, or email. All actors chose the Zoom format.

Nine autistic actors (6 male; 3 female) participated in the study. Participants played autistic characters in film or on television, and roles included guest stars, recurring guest stars, and voiceover actors on television, and leading and supporting roles in film. Actors were in or were eligible to join the Screen Actors Guild. Participant ages ranged from 16 to 34 years. Actors identified as Caucasian (n=5), mixed race (n=2), Asian (n=1), and Latinx (n=1).

The interviews followed an in-depth, semi-structured format, with open-ended questions related to employment/workplace experiences on film and television sets, autistic identity, and autistic representations. Interviews were recorded via zoom and transcribed verbatim. An inductive coding process was used to become familiar with the data, generate initial codes, and collate codes into themes (Braun & Clarke, 2006).

#### Results:

Four key themes emerged from the data analysis: Opportunities for autistic actors, employment accommodations, when and when not to disclose, and representations promote awareness but more nuance is needed.

#### Conclusions:

Production companies' targeted efforts to promote authentic casting have helped to increase employment opportunities for autistic actors. Affiliation with autism-specific acting studios, disability resource centers, and representation by agents and managers who specialize in representing actors with disabilities helps autistic actors access and take advantage of these opportunities. If necessary, for authentic casting, actors are willing to disclose autism, but worry that type-casting will limit opportunities to play non-autistic characters. Actors recognized that autism is a spectrum and they therefore could not relate to every autistic character. Actors had negative perceptions of "over-the-top" portrayals, and appreciated nuanced portrayals.

#### **304.003** (Oral) Understanding the Research Priorities and Perspectives of Autistic Female and Nonbinary People

**O. C. Putnam<sup>1</sup>, M. Swisher<sup>2</sup>, T. A. Niblack<sup>3</sup>, C. M. Perry<sup>4</sup> and C. Harrop<sup>1</sup>,** (1)Department of Allied Health Sciences, University of North Carolina - Chapel Hill, Chapel Hill, NC, (2)The University of North Carolina - Chapel Hill, Chapel Hill, NC, (3)University of North Carolina at Chapel Hill, Chapel Hill, NC, (4)Department of Allied Health Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC

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**Background:** Currently there is a disconnect between the funding and research priorities of the autism community and the funding priorities and decisions made by government and other funding agencies (den Houting et al., 2020; Pellicano et al., 2014). Further, stakeholders commonly surveyed within the autism community, such as parents, may have conflicting priorities to autistic individuals themselves (Frazier et al., 2018). In the United States, little work has been done to evaluate the priorities of autistic adults. Further, the voices of female and non-binary autistic individuals have been under-represented in this work, despite reporting different life experiences to males (Bargiela et al., 2016; Cridland et al., 2014; Sedgewick et al., 2019). Considering these experiences and priorities when developing new research is critical.

**Objectives:** To understand the research priorities of a sample of autistic adults, with an overrepresentation of female and nonbinary participants.

**Methods:** 52 autistic adults (29 female, 12 nonbinary, 11 male; 46 formally diagnosed, 6 seeking diagnosis; Mean age =31 years (range 16-70); Mean age of diagnosis =23 years (range 3-67)) completed an online survey. Participants were asked to rank the seven research questions included in the Interagency Autism Coordinating Committee Strategic Plan (IACC; October 2017). Weighted ranks of the questions were calculated. Additionally, participants were asked to respond to the free-response question, "What topics do you think should be investigated by researchers?". Themes were pulled from the written responses using content analysis.

**Results:** IACC questions related to services, infrastructure, and adulthood were ranked the highest while questions related to recognizing autism, interventions, biology, and causes were ranked lowest (Table 1). High-ranked IACC priorities, such as services and supports, were reflected in the written priorities of participants. A content analysis of free-response answers (Figure 1) revealed that participants were most interested in seeing research related to "Inclusivity" (N = 32), "Autism Phenotype" (N = 29), "Services/Supports" (N = 27), "Co-Occurring Conditions" (N = 21), "Recognition/Diagnosis" (N = 14), "Training/Education" (N = 11), and "Treatments/Interventions" (N = 7). Values that emerged throughout the free-response questions included valuing neurodiversity in society, education, and research, and researching autism for the purpose of understanding and support rather than for seeking a "cure". Additionally, participants promoted the value of including autistic perspectives in the shaping of research and treatment practices and in creating infrastructure.

**Conclusions:** While written research priorities overlapped to some degree with the current strategic plan questions, participants placed more of an emphasis on autism acceptance, support and services, and lifespan issues. Our results align with those of previous studies surveying autistic adults (Benevides et al., 2020; Pellicano et al., 2014) and contribute to the scaffolding of future research questions that best reflect the values and priorities of the autistic community. Importantly, the oversampling of female and nonbinary adults in the current study provided insight into priorities that may not emerge from typical predominantly male sample, such as an earlier identification of females, eating disorders, and knowing how autism presents in female and nonbinary people.

#### **304.004** (Oral) Implicit Attitudes Towards Autism in the British Press

**T. Karaminis<sup>1</sup>, U. Maden-Weinberger<sup>2</sup>, G. Beattie<sup>2</sup> and C. Gabrielatos<sup>2</sup>,** (1)Department of Psychology, Edge Hill University, Ormskirk, United Kingdom, (2)Edge Hill University, Ormskirk, United Kingdom

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**Background:** Feeling accepted is crucial for the successful integration of autistic people in education, work, and society and has a significant impact on their mental health. Autism acceptance also becomes increasingly important as our understanding of the condition shifts from clinical-based models towards neurodiversity-based models. But how accepting is society towards autism and autistic people? One way to address this question is through the lens of the press. The press reflects and constructs public views. The language used to portray autism in the press can reveal implicit attitudes, perceptions, and stereotypes and offer insight into the acceptance of autism and autistic people.



**Objectives:** This study aims to investigate how the British Press uses language to describe autism using a corpus-linguistics and critical-discourse-analysis methodological framework (corpus-based CDA). It also aims to examine changes in the representation of autism over time and differences between individual newspapers, for example, in the style of reporting (tabloids vs. broadsheet) or political orientation (left vs. right).

**Methods:** We created a corpus with newspaper articles relevant to autism by querying the ProQuest Newsletter Database for 2011 - 2020. The corpus included articles from paper and online editions of ten national newspapers. After preprocessing and duplicate removal, the final corpus consisted of around 24,000 autism-related articles (1 million sentences; 19 million words). We used the corpus-based CDA framework to construct emergent representations of the terms autism and autistic. Firstly, we performed measurements and statistical calculations to identify collocates of "autism" and "autistic" (words associated with these terms strongly and reliably and thus reflecting some of their meaning). Subsequently, we examined collocates within the grammatical constructions and the semantics contexts in which they occurred. Finally, we examined the attitudes that the lexicogrammatical patterns expressed in a given context.

**Results:** The number of articles referring to autism increased, on average, by 15% per year between 2011 and 2020 with considerable differences in this upward trend between individual newspapers. As a result, in 2020, 1 in 100 articles referred to autism in the Independent (left-leaning broadsheet), but only 1 in 1000 in Sun/Express/Mirror (tabloids). The emergent definitions of autism suggested that autism is portrayed more frequently as a disorder or disability than a difference. Autism is usually described with negative language, and is listed together with comorbid neurodevelopmental and physical and mental health conditions. Autistic individuals are spoken about and lack agency in the described actions. For example, children are portrayed as attributes of their mothers, who might take actions to improve their child's life or create a more inclusive world. Finally, there is a strong male bias in the representation of autism as most stories refer to males rather than other genders. This gender bias has declined slowly over the years.

**Conclusions:** Our results suggest a trend of increasing newsworthiness and coverage of autism in the British press. Autism, however, is often portrayed using negative language and with a strong male-gender bias in its coverage. These representations might hinder public awareness and acceptance of autism and neurodiversity.

## ORAL SESSION - 11B — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES

### 323 - Family Systems

**323.001** (Oral) Financial Hardship in Families of Children with Autism Spectrum Disorders: A Report from the r-Kids Study  
**F. Lynch<sup>1</sup>, J. Dickerson<sup>1</sup>, J. Bulkley<sup>1</sup>, E. Fombonne<sup>2</sup>, L. A. Croen<sup>3</sup>, Y. Daida<sup>4</sup>, B. Hatch<sup>5</sup> and A. Varga<sup>1</sup>,** (1)Kaiser Permanente Center for Health Research, Portland, OR, (2)Department of Psychiatry, Oregon Health & Science University, Portland, OR, (3)Division of Research, Kaiser Permanente Division of Research, Oakland, CA, (4)Kaiser Permanente Center for Integrated Health Care Research, Honolulu, HI, (5)Oregon Health & Science University, Portland, OR

#### Background:

Many families of children with autism (ASD) experience financial distress or hardship related to their child's ASD. However, most prior studies examined limited aspects of financial distress or relied on parent-reported diagnoses of ASD. Studies also lacked control groups of children without ASD that would allow for comparisons of financial difficulty for families of children with other chronic health conditions, or those without a significant condition.

#### Objectives:

The objectives of this analysis are to extend previous work by examining a more comprehensive model of financial hardship in families of children with ASD, and to compare these patterns to two independent control groups: families of children with Asthma, and families of children without either of these health conditions (Control). In addition, we examined other correlates of financial hardship such as family structure (e.g., single parent households), and severity of ASD.

#### Methods:

Data come from the recently completed r-Kids study which recruited parents of children from three large integrated health systems and several safety net clinics in the US. Children were randomly selected from electronic health records to identify children between 3 and 16.5 years with diagnoses of ASD, Asthma, or Control. Children with Asthma and Control children were matched to the ASD group distribution on age and sex. Parents were then invited to participate, and a total of 1,461 parents joined the study, (564 ASD, 468 Asthma 429 Control) and completed on-line or telephone surveys. The survey was comprised of the Family Economic Impact Inventory (measuring financial hardship impacts of caring for a child's health), and instruments measuring demographics, insurance status, and symptom severity for children with ASD or asthma. All materials were provided in English and Spanish. Financial hardship outcomes, defined as material conditions (e.g., medical debt), psychological response (e.g., distress due to costs of care), and coping behaviors (e.g., delaying care due to cost), were calculated as annual measures and were compared between groups using a variety of multivariable regression methods. Models were fit separately for each outcome. We applied a two-sided  $\alpha=0.05$  for all inferential tests.

#### Results:

Children were between the ages of 3 and 16.5 years old, predominantly male (79%) because comparison groups were matched by age and sex to ASD children. The sample was ethnically diverse (43% non-Hispanic white; 21% Hispanic; 35% non-Hispanic Asian, Black, Native Hawaiian, or other race/ethnicity). Families of children with ASD were significantly more likely to experience at least one type of financial hardship compared to the control group (OR: 5.38,  $p < .001$ ) and asthma group (OR: 2.88,  $p < .001$ ). Families of children with ASD were also significantly more likely to have greater hardship in all three domains of financial hardship (material conditions psychological response, and coping behaviors).

#### Conclusions:

Families of children with ASD experience significant financial hardship related to their child's condition. Public and health insurance policies to help mitigate these impacts could aid families in managing care for children with ASD.

### **323.002** (Oral) Attitudes and Behaviors Related to COVID-19 Vaccines Among Parents of Children with ASD and Autistic Adults

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**Background:** Previous research suggests heightened vaccine hesitancy among parents of children with autism spectrum disorder (ASD) relative to the general population (Chang & Kochel, 2020). Considering evidence that individuals with ASD are at increased risk to be hospitalized with COVID-19 (Karpur et al., 2021), it is important to understand specific attitudes and behaviors related to COVID-19 vaccines in the ASD community.

**Objectives:** To explore attitudes and behaviors related to COVID-19 vaccines among parents of children with ASD and autistic adults.

**Methods:** Participants were 135 members of the ASD community (99 parents of children with ASD and 36 autistic adults) who responded to the third and fourth time points of a larger longitudinal study on the experiences of individuals with ASD during the pandemic (Table 1). All participants lived in the state of Arizona. Participants responded to a series of questions measuring their attitudes and behaviors related to COVID-19 vaccines in the spring (April/May) and summer (August/September) of 2021.

**Results:** Table 2 reports participants' household vaccination status, plans for vaccinating children, and descriptive statistics for Likert scales measuring attitudes and beliefs about COVID-19 vaccines. Wilcoxon signed rank tests indicated that participants in both samples were significantly more likely to indicate that they believed the vaccine was safe for adults and children in the summer compared to the spring. Parents were significantly less likely to indicate that they were concerned about long-term effects of COVID-19 vaccines in the summer compared to the spring. Ratings related to perceived effectiveness and adverse effects for children did not change significantly over time.

Parents of older children were more likely than parents of younger children to indicate that they believed that COVID-19 vaccines are safe for adults (Spring:  $\rho = 0.21$ ,  $p = .04$ ; Summer:  $\rho = 0.18$ ,  $p = .08$ ) and children (Spring:  $\rho = 0.27$ ,  $p = .01$ ; Summer:  $\rho = 0.24$ ,  $p = .02$ ) and were less likely to indicate concerns about their children experiencing adverse effects from COVID-19 vaccines (Spring:  $\rho = -0.24$ ,  $p = .02$ ; Summer:  $\rho = -0.23$ ,  $p = .02$ ). Parent age was negatively associated with concerns about children experiencing adverse effects (Summer:  $\rho = -.20$ ,  $p = .05$ ).

**Conclusions:** Percentages of the parent and autistic adult samples reporting that all eligible members of their household were fully vaccinated was consistent with or higher than the general population of Arizona (AZDHS.gov). Attitudes and beliefs related to COVID-19 vaccines became more positive over time in both groups. Despite this, a sizable minority of participants reported that no one in their household plans to receive a COVID-19 vaccination and that they do not plan to vaccinate any of their children. Although promising that vaccine uptake appears consistent with the general population, this convenience sample may not generalize to the wider ASD community. Additional research and continued education and outreach efforts are necessary to better understand and reduce vaccine hesitancy in the ASD community.

### **323.003** (Oral) Examining Indicators of Psychosocial Risk and Resilience in Parents of Autistic Children

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#### Background:

There is evidence that parents of autistic children experience increased levels of stress, even in comparison to parents of children with other neurodevelopmental disabilities (Estes et al., 2009), which has been previously attributed to behavioral challenges associated with autism spectrum disorder (ASD; Lyons et al., 2010). Less attention has been given to other possible contributors to stress in this population, such as the contribution of children's adaptive behavior. Additionally, little is known regarding potential protective factors that may ameliorate the experience of stress among parents of autistic children.

#### Objectives:

The present study aims to determine the relationship between autistic children's clinical characteristics and indicators of their parents' psychosocial risk and resilience.

## Methods:

Participants included a sample of 263 autistic children (77.9% males, 68.6% white) aged between 1 and 16 years ( $Mage = 7.37$ ;  $SD = 3.92$ ), as well as their biological mothers ( $Mage = 40.64$ ;  $SD = 7.014$ ) and fathers ( $Mage = 42.88$ ;  $SD = 7.74$ ). Data were collected as part of a cross-sectional study that involved one wave of data collection from SPARK participants. Parents completed self-report measures of mental health (Patient Health Questionnaire-9 [PHQ-9; Spitzer et al., 1999], General Anxiety Disorder-7 [GAD-7; Spitzer et al., 2006]) as well as resilience and wellbeing (Caregiver Strain Questionnaire [CGSQ; Brannan et al., 1997]; Well Being Scale [WBS; <https://www.radc.rush.edu/docs/var/overview.htm?category=Well-being>], Barkley Deficits in Executive Functioning Scale Short Form [BDEFS; Barkley, 2011]). Additionally, data were collected on several child clinical factors, including the Repetitive Behaviors Scale – Revised (RBS-R; Bodfish et al., 2000) and the Vineland Adaptive Behavioral Scales (VABS; Sparrow et al., 1984).

## Results:

Parents in this sample endorse high levels of mental health concerns, with 61.2% of mothers and 55.1% of fathers at clinical risk for a depressive disorder. Children's repetitive behaviors (RBS-R) were found to correlate with risk for depressive disorders (PHQ-9) among mothers ( $r = .215$ ,  $p = <.001$ ), as well as risk for anxiety disorders (GAD-7) among both mothers ( $r = .207$ ,  $p = <.001$ ) and fathers ( $r = .132$ ,  $p = <.05$ ). An even stronger relationship was found between children's adaptive behavior (VABS) and parents' daily strain (CGSQ), with greater impairment in adaptive behavior associated with greater daily strain for both mothers ( $r = -.327$ ,  $p = <.001$ ) and fathers ( $r = -.332$ ,  $p = <.001$ ). Conversely, parents' executive functioning (EF) skills emerged as possible protective factors against mental health risks; specifically, stronger parent self-reported inhibition and emotion regulation skills were associated with greater parent wellbeing (see Table 1 and Table 2).

## Conclusions:

The current study leveraged a large sample of autistic children and their biological parents to examine the relationship between children's clinical characteristics and parent's mental wellbeing. Results indicate that, although parents of autistic children do experience high rates of internalizing mental health concerns that relate to child adaptive functioning and RRBs, parent EF may act as a protective factor against adverse mental health. These findings indicate a need to further examine resilience factors and ensure appropriate and targeted supports are available for parents of autistic children.

### **323.004 (Oral)** Influence of Siblings on Teacher-Reported Trajectories of Challenging Behaviors in Autism

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**Background:** Individuals with autism spectrum disorder (ASD) frequently exhibit challenging behaviors throughout the lifespan, especially from childhood through early adulthood (Lecavalier, 2006). Untreated challenging behaviors can have pervasive effects, with notable impacts on social functioning, academic achievement, psychiatric outcomes, and quality of life (Kim, 2000). Challenging behaviors have been shown to change over time as a function of various individual-level factors (e.g., cognitive ability). Much of this research, however, has relied upon parent-report and no study to date has examined the influence of broader family-level factors, such as siblings, on these trajectories despite the important role that siblings play in the lives and development of individuals with ASD.

**Objectives:** This study aimed to examine trajectories of teacher-reported challenging behaviors (i.e., hyperactivity, irritability, social withdrawal), and predictors of patterns of behaviors including the presence of a sibling and the sibling diagnostic profile, from ages 9-22 among individuals with ASD or non-spectrum delays.

**Methods:** Participants included 165 individuals with ASD or non-spectrum developmental disorders from an ongoing longitudinal study from childhood through adulthood. Teachers completed the Aberrant Behavior Checklist (ABC; Aman, 1986) across 20 timepoints (ages 9-22) to assess participants' challenging behaviors. Change in ABC hyperactivity, irritability, and social withdrawal scores was examined using multilevel models. Presence of siblings and sibling diagnostic profiles were examined as predictors of initial level (i.e., intercept) and change (i.e., slope) in ABC scores, controlling for relevant demographic factors (i.e., autism severity, IQ, caregiver education).

**Results:** Multilevel models revealed that participants showed marginal improvement in hyperactivity symptoms ( $B = -0.32$ ,  $p = 0.09$ ), non-significant improvement in irritability ( $B = -0.17$ ,  $p = 0.32$ ), and negligible change in social withdrawal ( $B = -0.06$ ,  $p = 0.70$ ) from ages 9-22 per teacher-report. Compared to those without siblings, participants with siblings had significantly lower levels of hyperactivity at age 9 ( $B = -5.50$ ,  $p = 0.04$ ), though experienced less improvement in hyperactivity across time ( $B = 1.18$ ,  $p = 0.01$ ). Among participants with siblings, those with closest-age siblings with behavioral disorders showed significant increases in hyperactivity ( $B = 0.83$ ,  $p = 0.02$ ) and irritability ( $B = 0.66$ ,  $p = 0.04$ ) over time compared to a decline in participants with siblings without behavioral disorders; notably, both groups demonstrated similar levels of hyperactivity and irritability at age 9 ( $p > 0.05$ ).

**Conclusions:** Findings extend our understanding of challenging behavior trajectories by focusing on teacher perspectives and examining effects of siblings. Teachers provide unique insight into how these behaviors manifest in ASD across varied situations and contexts outside of those observed by parents (e.g., classroom, hallway, recess). In keeping with expectations for a general positive influence of siblings, individuals with ASD with siblings presented with fewer hyperactivity symptoms in childhood, though, potentially as a result, seem to have less room for improvement over time than individuals with ASD without siblings. Additionally, given that siblings often serve as behavioral models for individuals with ASD (Shivers, 2015), it is not surprising that individuals with ASD who have siblings with behavioral disorders experienced greater challenges across time

in hyperactivity and irritability. Findings highlight the importance of providing behavioral support to multiple children within the same family (with/without ASD) who struggle to regulate their behavior and emotions.

## POSTER SESSION — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES

### 411 - Family Issues and Stakeholder Experiences I

**411.085** (Poster) A Systematic Review of Social Support for Siblings of Children with Neurodevelopmental Disorders

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**Background:** Siblings of children with neurodevelopmental disorders are at risk of various negative emotional and behavioral outcomes, including increases in internalizing problems such as anxiety and depression symptoms. Differences in sibling outcomes have been found across studies, with siblings of children with autism spectrum disorder found to be more at risk for negative psychosocial functioning compared to siblings of children with Down syndrome and other developmental and intellectual disabilities. Social support is an important protective factor for siblings of children with neurodevelopmental disorders such as autism spectrum disorders. **Objectives:** This review investigates the level of social support received by siblings of children with neurodevelopmental disorders, explores associated variables, and examines measurement instruments used to study social support in this population. **Methods:** A pre-registered systematic review was conducted (CRD42020207686). We searched PsycINFO, MEDLINE, Web of Science, and Scopus for articles on social support and siblings of children with neurodevelopmental disorders. **Results:** Fifteen articles were included. Thirteen studies were descriptive. Two studies investigated sibling social support after an intervention. The mean level of social support across sibling diagnostic groups were found to be 76% of the maximum scores, indicating moderately high support. Multiple variables were found to be negatively related to social support (e.g., sibling depression, loneliness, and stress). Variables that were positively related to social support included prosocial behavior, total competence (academic, social and in activities), problem-focused coping and family quality of life. Potential moderators of the relationship between social support and psychosocial adjustment variables included type of sibling disorder (diagnostic group), the source of social support, and perceived importance and amounts of social support. Overall, support for siblings of children with autism tended to be lower than for siblings of children with other disorders. Seven different measures of social support were used across the 15 studies, measuring different types of support and from various sources. The reliability and validity of these measurement instruments varied considerably. **Conclusions:** Lower levels of social support have been linked to more negative psychosocial adjustment among siblings of children with autism spectrum disorders and other neurodevelopmental disorders. Future research is encouraged to further investigate ways to increase social support for siblings to improve outcomes.

**411.086** (Poster) Associations Among Parent Emotion Regulation, Parent Stress, and Child Behavior Problems

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#### Background:

Literature to date suggests that parents of children with ASD are likely to experience heightened stress and rely more on maladaptive emotion regulation strategies to handle stress and negative emotion, compared with parents of other neurodevelopmental disabilities. Parent stress and child challenging behaviors in ASD have a strong association both concurrently and longitudinally. However, less is known about how parent emotion regulation is related to challenging behaviors in children diagnosed with ASD. Because people with poorer emotion regulation often handle stress in a negative manner, poor emotion regulation may heighten the association between parent stress and behavior problems in ASD.

#### Objectives:

The current study seeks to explore relationships between these parent stress, parent emotion regulation, and child behavior problems in families with ASD, and it seeks to answer the following questions:

1. Are there significant relationships between parent emotion regulation, parent stress, and child behavior challenges among parents of children with ASD?
2. Does parent emotion regulation predict child behavior problems in ASD; if so, does parent emotion regulation moderate the relationship between parent stress and child behavior problems?

#### Methods:

Participants were mothers ( $N = 49$ ) of school-aged children [ $M(SD)$  child age: 7.9 (1.68), 71.4% males] with ASD who were recruited for a study examining family patterns in ASD. Participants supplied demographic information and completed the Difficulties with Emotion Regulation—Short Form, The Parental Stress Scale, The Child Adjustment and Parent Efficacy Scale—Developmental Disabilities (behavior problems subscale), and the Social Communication Questionnaire. All variables were entered into a bivariate correlation matrix to address aim 1. For aim 2, a 2-step hierarchical regression model was constructed to predict whether control variables (child age, gender, and ASD symptoms), parent stress, and parent emotion regulation predicted child behavior problems. All variables were entered into step 1. In step 2, an interaction term between parent stress and parent emotion regulation was added.

## Results:

The mean age of mothers in the sample was 40.36 (SD=6.3) years. Of the participants, 67.3% were white, 34.7% were employed full time, and 74% were college educated. **Aim 1.** Parent emotion regulation was significantly related to parent stress ( $r = .65, p < .001$ ) and child behavior problems ( $r = .59, p < .001$ ), and behavior problems were significantly related to parent stress ( $r = .53, p < .001$ ). **Aim 2.** In step 1, parent emotion regulation significantly predicted behavior problems ( $b = .41, p = .02$ ), while parent stress approached significance ( $b = .31, p = .07$ ). The control variables and interaction term were nonsignificant, and the model explained a significant proportion of variance [ $F(4, 37) = 7.55, R^2 = 46\%, p < .001$ ].

## Conclusions:

The present study demonstrates that how a parent regulates themselves when faced with stress and negative emotion may be more influential on child behavior than their stress level alone. The moderating effect of emotion regulation was not observed in this cross-sectional study. Given its theoretical importance to parent-child relationships, future research examining the reciprocal relationship between parent emotion regulation and child challenging behaviors is warranted.

### **411.087 (Poster)** Associations between Caregiver Depression and Social Support Among Diverse Caregivers of Children with Autism

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**Background:** Research has suggested that mothers of children with autism spectrum disorder (ASD) are increasingly at risk for mental health problems like stress and depression. Risk factors that increase the likelihood of maternal depression include SES, access to social support, child disability status, and child challenging behaviors. There is moderate research showing that social support buffers the effects of stress on parents of children with ASD, but fewer have examined its effect on maternal depression, particularly the types of social support (formal, informal, family) that is more helpful to parents. In addition, most studies examining social support utilize White, English-speaking caregivers with high education and SES, the extent to which studies utilize Latinx/Hispanic caregivers with varied English-speaking abilities, SES, and education are relatively under-investigated.

**Objectives:** This study examines the types of social supports that are viewed as most helpful in an ethnically and linguistically diverse sample of caregivers of young children with developmental delay (DD) or ASD. We examine if perceived helpfulness varies by ethnicity (Latinx, non-Latinx) and if social support is associated with caregiver depression ratings.

**Methods:** This sample consists of 130 caregivers and their preschool children (3-5yrs) who have a diagnosis of ASD or DD who were participating in an ongoing longitudinal study examining the effects of stress-reduction and parenting interventions to improve child and parent outcomes. All measures for the present study were collected as part of the baseline assessment. Social support was measured using Family Support Scale (FSS) and depression was measured using the Center for Epidemiological Studies-Depression (CES-D). Demographics were self-reported. We used descriptive statistics and a one-way ANOVA to test our research questions.

**Results:** About two-thirds (62.3%) of the sample identified as Hispanic/Latinx (43% Spanish-speaking at home). Approximately half of the sample reported an annual family income of \$40,000 or lower, with more than half (53.9%) receiving a high school education or less. 40% of children had an ASD diagnosis. Families rated formal supports as most helpful ( $M = 2.36$ ), and informal supports as least helpful ( $M = 1.43$ ). Based on ethnicity, Latinx/Hispanic caregivers rated formal supports as more helpful ( $p < .05$ ) when compared to non-Latinx. In addition, higher family social support ratings were associated with lower depression scores.

**Conclusions:** Our results suggest that families overall are finding formal supports (i.e., physicians, other professional helpers) to be more helpful than informal (co-worker, parent groups) and family supports (parents, spouse), which is inconsistent with the larger literature on social support. In terms of caregiver depression, family supports in particular, were associated with lower depression scores. These results suggest that both family and formal supports are useful to caregivers of young children with ASD/DD, possibly through different processes. Perhaps given the age of the children in the current study, formal support is especially beneficial to families so that they can be connected to services and information for their newly diagnosed children. Future studies could inform how to improve caregivers' solicitation for supports, in addition to intervention studies that target malleable factors related to caregiver depression.

### **411.088 (Poster)** Autism Community Priorities in Diverse Low-Resource Settings: A Country-Wide Scoping Exercise in India

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**Background:** While most research on autism and other neurodevelopmental conditions takes place in high-income countries, the majority of autistic individuals and their families live in low and middle-income countries. The priorities of and challenges faced by the autism community in these countries need to be systematically investigated in order to chart an informed course of action for research, services, and policy. While over 20 studies have been conducted in other countries to map the priorities of the autism community, there has been no such systematic assessment in the South Asian region.

**Objectives:** To map the landscape of priorities of the Indian autism community on skills, intervention, and research in a nationwide sample.

**Methods:** A mixed-methods approach was used for this study. The first phase used an online survey to rank individual priorities in each of three sections: skills, interventions, and research. In the second phase, follow-up interviews were conducted with a subset of the respondents, who were chosen through stratified random selection based on demographic variables and support needs. Both the questionnaire and the interview schedule were prepared in English, Hindi, and Bengali to allow for wider participation.

**Results:** In all, 280 participants (comprising autistic adults and parents of autistic children) completed the study. Within the list of skills, self-help skills were given the highest priority and believed to be crucial for the development of independence. Skills required to support the family and participate in family activities constituted the second-highest priority. Within interventions, Speech and Language Therapy was identified as the top priority. This result echoes similar findings reported by a nationwide survey of parents of autistic children in North America. The second priority was identified to be mental health counselling. Interestingly, follow-up interviews revealed that most parents cited mental health counselling as one of the top priorities for themselves, rather than for their autistic children. They reported that it can help them better understand and respond to their children's needs. Within research, there was consensus that the primary priority was to recognise the most effective ways to support people with autism, reflecting similar findings reported in a recent study on research priorities in Australian parents. Surprisingly, research on gender and ASD was accorded the lowest priority by the current sample. Overall, all respondents demonstrated a positive attitude towards research and considered it to be a vehicle for bettering the lives of autistic individuals.

**Conclusions:** The study highlights the key priority of the community in making autistic individuals independent. Consequently, interventions and skills linked to this priority were identified to be more important. The study also points to a need to equip caregivers through training and support. Service providers must keep these priorities in mind while designing learning and living programmes for autistic individuals. Furthermore, this study corroborates findings from similar exercises in other countries, which suggest that the goal of autism research should be to guide and lead the development of various services necessary for the well-being of autistic individuals.

**411.089 (Poster)** Autistic People Don't like Music – an International Survey on Community Opinions of Autistic Portrayals on Film and TV  
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**Background:** Autistic portrayals in TV-series and movies are important sources shaping the public perception of autism. Concerns have been raised that, although these portrayals contribute to increased awareness about autism, they may also be stereotypical and homogeneous in nature (Dean & Nordahl-Hansen, 2021).

**Objectives:** To investigate attitudes towards portrayals of autistic people in TV-series and movies in the autistic community compared with other groups.

**Methods:** This is, to our knowledge, the largest survey ever on this topic consisting of  $n=2119$  participants from 90 countries. Autistic adults ( $n=798$ ,  $M_{age}=30.3$ ,  $SD=10.2$ , 48% female), family and friends of autistic people ( $n=652$ ,  $M_{age}=35.5$ ,  $SD=11.0$ , 58% female), professionals and students within an autism-relevant field ( $n=486$ ,  $M_{age}=36.0$ ,  $SD=10.1$ , 79% female) and individuals who had not met any autistic people in person ( $n=183$ ,  $M_{age}=30.1$ ,  $SD=10.2$ , 42% female) responded to a survey about their opinions of seven portrayals (*Atypical*, *The Bridge*, *The Good Doctor*, *The Big Bang Theory*, *Community*, *Rain Man*, and *Music*) of autistic people in films and TV-series, and how to improve them. The questionnaire contained a 7-item scale ( $\alpha=.83$ ) capturing attitudes towards autistic portrayals in general and a 5-item scale ( $\alpha=.76$  to  $.86$ ) capturing attitudes towards specific TV and film characters. Data were analyzed using descriptives and analysis of variance (ANOVA) with Bonferroni post-hoc tests.

**Results:** The autistic portrayal in the movie *Music* was disliked by autistic people, whereas the autistic portrayal in the TV-series *Community* was the most favored and were viewed as positive. A significant difference was found between participant groups' attitude towards autistic portrayals in general ( $F(3, 2115) = 68.326$ ,  $p<.001$ ). Autistic people held more negative opinions of autistic portrayals than the other groups (all  $p$ -values  $<.001$ , Hedges  $g = -.56$  to  $-.72$ ). For the TV-series *Community*, there was also a significant difference between groups ( $F(3, 780) = 7.709$ ,  $p<.001$ ). Autistic people were more positive about the autistic portrayal in *Community* compared with family and friends ( $p=.016$ , Hedges  $g = .25$ ) and professionals and students ( $p<.001$ , Hedges  $g = .48$ ). There was also a significant difference for the film *Music* ( $F(3, 269) = 16.829$ ,  $p<.001$ ). Autistic people were more negative about *Music* compared to family and friends ( $p<.001$ , Hedges  $g = -.84$ ) and professionals and students ( $p<.001$ , Hedges  $g = -1.30$ ). Of the total sample, over 91% of the total sample recommended *Community*, compared to 91% not recommending *Music*. Participants strongly disagreed to statements about *Music* promoting positive awareness of autism (74.1%), promoting understanding of autism (74.1%). Over 65% strongly agreed *Music* was a stereotypical portrayal of autism.

**Conclusions:** The results show the autistic community has a clear negative stance on attitudes toward movies like *Music* that tend to portray autism in a stereotypical manner. Conversely, autistic persons rate *Community* as more favorable than other groups, possibly due to a more multifaceted, and less prototypical alignment to diagnostic symptom criteria (Nordahl-Hansen et al., 2017).

**411.090 (Poster)** Autistic Women Portrayed on Instagram #Fann #Actuallyautistic #Letsputafaceonthatasd  
**M. Stevens<sup>1</sup> and E. M. Blijd-Hoogewys<sup>2</sup>,** (1)Miranda Stevens Photography, Breda, Netherlands, (2)INTER-PSY, Groningen, Netherlands

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## **Background:**

There is still a lot unknown about female autism. There are still many misunderstandings, among practitioners as well as among autistic women themselves and their network. The Female Autism Network of the Netherlands (FANN) tries to change times by sharing honest and open stories of

autistic girls and women in an easy-accessible way, via Instagram. This is done, among other things, with photos accompanied by interviews, often portraying a perspective of personal recovery.

Personal recovery has been defined as ‘a deeply personal, unique process of changing one’s attitudes, values, feelings, goals, skills and/or roles . . . a way of living a satisfying, hopeful and contributing life even with the limitations caused by illness’ (Anthony, 1993). A systematic review showed that there are five major recovery processes involved in personal recovery from mental health: connectedness, hope and optimism about the future, identity, meaning in life, and empowerment (known as CHIME; Leamy et al., 2011).

### Objectives:

To get an understanding of how autistic girls and women cope with their autism.

### Methods:

In a period of 8 months, 43 autistic females ( $n = 12$  girls;  $M_{\text{age}} = 12.24$ ,  $SD = 4.20$  years) ( $n = 31$  women;  $M_{\text{age}} = 36$ ,  $SD = 9.28$  years;  $M_{\text{age of ASD diagnosis}} = 30.95$ ,  $SD = 10.45$ ; 33% with a romantic relation; 21% with children) were portrayed on FANN Instagram, by a photograph and an interview (see Figure 1). The pictures were taken by a female autistic photographer. The interviews were based on four questions answered in writing by the autistic female at stake: (1) describe yourself briefly, (2) describe the impact of autism on your life, (3) what are you proud of in your life? and (4) what kind of tips do you have for autistic peers? We analyzed the interviews using Qualitative content analysis.

### Results:

Based on what autistic females portrayed spontaneously in their stories (no hearing back protocol was applied), their love for animals was mentioned often, most pronounced in children (42% in women, 83% in girls). Most common hobbies were being creative (37%), music (23%), writing (19%), nature (14%), and sports (14%). Most common negative impact of autism was the experienced sensory overload (58%) and being overtired (49%). For women with a later autism diagnosis, not knowing this diagnosis before has led to both physical and mental problems, and lost identity. However, having autism also led to more perseverance (35%). Most common mentioned tips for autistic peers were (1) stay true to yourself (65%), and (2) dare to ask for help (16%). Reactions of Instagram followers are overwhelmingly supportive.

### Conclusions:

The results paint a picture of female autism, where sensory problems and being overtired is mentioned regularly by autistic females. The posts give other autistic females a way to experience connectedness, hope and optimism about the future, and gives them examples of an autistic identity, different meanings in life, and empowerment (CHIME). They show a way to personal recovery, showcasing their troubles but also their perseverance and staying true to themselves.

### 411.091 (Poster) Social Inclusion and Autism in Mainstream Secondary Education. What Is Needed?

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### Background:

Children do not solely attend school to learn math and grammar, but also to meet friends, play, and socialize, which are important interactions to reach optimal social development by adulthood. A so-called ‘sense of belonging’ is key for social wellbeing, but also crucial for children to stay motivated for school (Korpershoek et al., 2020). Conversely, thwarted social interactions often lead to school absenteeism (Gubbels et al., 2018).

Since the introduction of the Dutch Appropriate Education Act in 2014, attempts have been made to include pupils with special needs in mainstream secondary education, including autistic pupils. However, this has been only partially successful. Schools seem to have focused mainly on the educational needs of these pupils and less on their sense of belonging. To make meaningful changes, the perspective of autistic pupils is key.

### Objectives:

The aim was to get a deeper understanding to what extent young autistic people, within mainstream secondary schools, experience a sense of belonging and what, according to them, is needed for amelioration.

### Methods:

We conducted three focus groups ( $N = 12$ ) with autistic (former) mainstream education pupils (age = 13-19 years). All levels of education were represented. Two focus groups were online; the third was at a mental health care facility. Each lasted 50 to 60 minutes and was audiotaped. Verbatim transcripts were analyzed using Thematic analysis (Braun & Clarke, 2006).

## Results:

Autistic pupils reported to have little contact with their fellow students, to not belong, and to experience uncomfortable loneliness. Being alone made them stand out in a negative way. Most pupils had accepted to be without a friend at school and made no more effort. They retained from small talk. Breaks were considered extra difficult due to busy environments - with too many students in crowded hallways (bumping into each other, loudly chatting away), poor access to their school locker, too few seats in the canteen, too few quiet zones, and bad acoustics - all leading to sensory overload, fatigue, and stress. Many avoided breaks by retreating in classrooms or by skipping school all together.

## Conclusions:

Sense of belonging and social inclusion is a basic human right, also for autistic pupils in mainstream education, but this requires active policies from schools. Both schools and designers need to be educated as to the particular requirements and capacities of all users in order to be able to produce inclusive environments. Our study shows that the actual physical (built) school environment should indeed be examined and adapted. Creating more calm and less crowded spaces in schools are a precondition for autistic teens to enter, let alone participate. Only without chronic fatigue or stress at school, other interventions to improve their social inclusion can be successful. Further research within our project is aimed at obtaining deeper understanding of what a sense of belonging means for autistic pupils and those around them, and how to achieve this while addressing different aspects in the physical (built), social, and cultural environment.

**411.092 (Poster)** Black Families' Experiences of Autism Diagnosis: Preliminary Parent Feedback to Inform Culturally Competent Care  
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**Background:** Black families face significant barriers in receiving a timely diagnosis of autism spectrum disorder (ASD). Lack of knowledge of ASD, distrust of health systems, and racial bias on the part of healthcare professionals all contribute to diagnostic delays (Constantino et al. 2020). Deliberate evaluation of structural racism within current ASD screening models must occur in order to address race-based diagnostic care disparities for Black families. To better understand Black families' ASD diagnostic journeys, we surveyed diagnostic experiences and the potential impact of race/ethnicity on the diagnostic process for 400 Black caregivers of children with ASD.

**Objectives:** We surveyed 400 caregivers of Black children with ASD about their experiences with the ASD diagnostic process and the potential impact of racial and ethnic identity on this process.

**Methods:** 400 families of children with ASD (mean age: 71 months, 323 male) were recruited from the Simons Foundation SPARK cohort Research Match program. Individuals were eligible if they were data consented for SPARK, were the parent or guardian of a child with ASD aged 8 years and under, and the parent and child self-identified as Black or African American (including multiracial families). The SPARK research team sent invitation emails in batches until our recruitment goal of 400 was reached. Respondents completed the survey with their eldest child with ASD in mind.

**Results:** Primary areas of interest were first concerns and perceptions of race/ethnicity on the diagnostic process. Caregivers' first concerns (Table 1) included speech (87.5%), social skills (61.3%), behavior (57.8%), and motor skills (34.8%). Most children were diagnosed after age 2 years, with 34.4% of children not diagnosed until age 3-5 years. Almost a third of families (28%) reported that race/ethnicity had an impact on their care. Although most caregivers (82.3%) did not feel that cultural differences between them and their providers impacted the diagnostic process, some (16.3%) indicated that cultural differences did play a role. (Table 2). When asked what would have made the diagnostic process easier, 51% of caregivers said receiving an evaluation sooner; 42% said professionals listening to their concerns sooner; and 36.8% said receiving more support from family (Table 2).

**Conclusions:** Survey responses provide insight into caregivers' primary pre-diagnosis concerns and ideas for improved care. Given that a substantial minority of respondents reported that race/ethnicity impacted the diagnostic experience, it remains critically important to consider diverse viewpoints and parenting experiences when developing new models of developmental screening. Caregivers provided detailed qualitative feedback that future research will examine to support creation of culturally competent screening tools.

**411.093 (Poster)** Building Capacity for Inclusive Informal STEM Learning Opportunities for People with ASD  
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## Background:

Individuals with Autism Spectrum Disorder (ASD) are more likely to be unemployed compared to their neurotypical peers. Of adults with ASD who participated in the National Longitudinal Transition Study-2, 42% reported they had never been employed (Roux et al., 2015). Those who had been employed primarily worked part-time/low-income jobs.

While approximately 60% of individuals with ASD do not have an intellectual disability (Baio et al., 2018), only 44% of autistic adults pursue post-secondary education (Newman et al., 2011). When pursuing higher education, individuals with ASD enroll in Science, Technology, Engineering,



Math (STEM) majors more commonly than their peers, regardless of disability status (Wei et al., 2013). There is an increasing demand for STEM professionals in the workforce (Olson & Riordan, 2012) and individuals with ASD are an untapped resource.

### **Objectives:**

We conducted a survey to learn about families' experiences visiting museums and informal STEM education environments (ISE) to determine how ISEs can better promote inclusive learning opportunities for individuals with ASD.

### **Methods:**

Survey data was collected from parents of children (ages 11-18) with ASD that visited an ISE between 2016-2019 (n=69). The survey focused on ISE inclusivity, the level of engagement at ISEs, the effect ISE experiences had on their child, and whether these experiences strengthened their child's interest in STEM. These questions used a 1 (strongly disagree) to 5 (strongly agree) Likert scale. Parents also reflected on memorable experiences while visiting ISEs and provided suggestions for improving visits for autistic individuals.

### **Results:**

When reflecting upon interactions with staff/patrons at ISEs, 33% of families said that their child had a negative experience. Further, only 16% of parents strongly agreed that an ISE staff member engaged with their child in a manner that encouraged discovery and learning. After visiting a museum, only 7% of parents strongly agreed that their child had developed a new interest in a STEM topic. 25% of respondents expressed that hands-on activities helped provide opportunities for inclusion and learning.

Helpful accommodations (e.g. sensory packs, noise-canceling headphones, re-entry into the museums) were reported by 9% of respondents. Some parents suggested additional accommodations; 25% of families requested quiet areas/calm-down rooms for children to decompress and 12% requested alternative entry options (such as purchasing tickets online to avoid their child having a meltdown while waiting to gain entry).

### **Conclusions:**

This research shows how ISEs can improve visits for individuals with ASD. Adding accommodations might increase the number of autistic patrons, but accommodations will not ensure that the individual feels included and engaged. Our goal is for neurodiverse individuals to feel valued, accepted, and included when visiting ISEs to strengthen their interest in STEM and, ultimately, gain employment within the field.

This research helped develop ASD-informed training that fosters inclusive STEM learning environments for neurodiverse individuals. Currently, four museums are receiving this training, and it has been developed in a way that can be replicated across the country.

### **411.094 (Poster) COVID-19 Vaccine Hesitancy in the Autism Community**

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Background: SPARK (Simons Foundation Powering Autism Research for Knowledge) is the largest research cohort of individuals with autism and their family members, with more than 100,000 individuals with autism enrolled. SPARK surveyed participants at six time-points over the course of the COVID-19 pandemic to investigate the impact of the pandemic and to better understand COVID-19 vaccine acceptance and hesitancy in the autism community.

Objectives: To describe the attitudes toward COVID-19 vaccines, and to report the factors that correlate with COVID-19 vaccine hesitancy.

Methods: 9,249 caregivers and guardians of individuals with autism responded to an initial survey sent by email in March, 2020. Subsequently, all individuals who initially responded were sent follow-up surveys at 5 different time-points from April, 2020 to July, 2021. In November, 2020 and March, 2021, participants were asked whether or not they intended to receive the COVID-19 vaccine when it became available, and if they intended for others in their household to receive it. They were also asked whether or not anyone in their household had received the vaccine in March, 2021 and July, 2021. Analyses were conducted to determine variables associated with vaccine hesitancy and refusal. Variables included sex, autism diagnosis, geography, income, previous beliefs towards vaccines, COVID-19 positivity, practicing COVID-19 safety measures, and genetic diagnoses related to autism. All analyses were performed using R Statistical Software.

Results: We found the highest levels of vaccine hesitancy in November, 2020 prior to the COVID-19 vaccine being approved by the FDA, with 60% of participants indicating that they were unsure or would not receive the vaccine. Over time, hesitancy dropped to 26% by March, 2021. In the most recent survey performed in July, 2021, only 15% of respondents reported that no members of their household had received the COVID-19 vaccine, compared to the national average of 25% of adults living in fully unvaccinated households (Hamel et al 2021). We found that having a lower income, living in more rural settings, and having a previous COVID-positive case within a household were significantly associated with vaccine hesitancy. The factors that correlated most strongly with vaccine refusal were not practicing COVID-19 safety measures (p<.001) and previous endorsement (asked at registration in SPARK) of the belief that vaccines caused their child's autism (p<.001). Variables that did not show a significant association with vaccine hesitancy included: sex, autism diagnosis, and having a genetic diagnosis related to autism.

Conclusions: We found that vaccine hesitancy was highest prior to COVID-19 vaccines being approved by the FDA and before they were widely available in the United States. Over the spring of 2021, vaccine hesitancy dropped to 15% among our survey respondents. We found that previous beliefs on the role of vaccines in a family member's autism were strongly correlated with current COVID vaccine refusal. Data collected from the national SPARK cohort can help inform strategies to address vaccine hesitancy.

**411.095 (Poster)** Caregiver Depression during the COVID-19 Pandemic: A Study on Latino Families of Children with Autism and Developmental Disabilities

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Background: The COVID-19 pandemic has dramatically changed the world and everybody's life. Minoritized families of children with autism and developmental disabilities (DD) were impacted to a greater extent because of multiple disadvantages pre-pandemic and additional caregiving responsibilities. As part of a larger research that investigates health and health behaviors among Latino families, we examined how the COVID-19 pandemic affected maternal caregivers' mental health. The results will inform policy and practices to better support families of children with autism and DD amid these times with heightened uncertainties.

Objectives: We aimed to learn 1) the prevalence of depression among Latina caregivers of children with autism and DD, 2) what were the individual, family, and socioeconomic factors associated with maternal depression, and 3) practical strategies to support these families.

Methods: Data collection was performed across two study sites in two urban cities in Texas and Illinois, respectively. Participants were 68 maternal caregivers of 75 children (some families have more than one child with autism and DD). From July 2020 to September 2021, trained research assistants interviewed families via three separate phone or video calls over a period of 4–6 weeks, with each interview lasting 60–75 mins. Demographic, quantitative, and qualitative data were collected via a set of standardized measures and open-ended questions that assessed caregiver-child dyads' health and health behaviors. The main outcome examined in this abstract was maternal depression, as assessed by the Center for Epidemiological Studies Depression Scale (CES-D). Bivariate regressions were run to determine what factors were associated with maternal depression (CES-D) scores.

Results: On average, maternal caregivers were 43.9 years old. They were mostly married/living with partner (82%), foreign-born (82%), and had an annual household income of <\$35,000 (59%). The children were on average 11.3 years old, mostly boys (72%), born in the US (92%), and had a primary diagnosis of autism/Asperger syndrome (75%). Sixty percent of the families experienced at least one negative economic change during the pandemic, while only 40% received any kinds of COVID-19 financial assistance from the government. Bivariate analyses indicated that, 1) Thirty-seven percent of the maternal caregivers were at risk of having depression (CES-D scores  $\geq 16$ ); 2) Annual household income ( $F=3.71, p<.001$ ), whether the family received any COVID-19 financial assistance ( $F=3.28, P=.001$ ), food security ( $F=2.56, p=.01$ ), and perceived support from a significant other ( $F=2.18, P=.04$ ) were associated with maternal depression (CES-D) scores.

Conclusions: The findings of this study indicated that, 1) low-resourced Latino families of children with autism and DD were hit hard especially economically during the pandemic, and 2) financial difficulties were a major contributor to elevated depression among maternal caregivers. Policy and practices should provide tangible measures of support for these families which may include access to food bank/pantry, direct financial assistance, assistance with finding employment, and so on.

**411.096 (Poster)** Caregiver Perspectives on Barriers and Facilitators to Primary Healthcare Encounters for Autistic Adults

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Background: Primary care is associated with greater access to healthcare services, improved health outcomes, cost savings, and mitigation of the negative impact of socioeconomic factors on health. Autistic adults experience barriers to utilization and high-quality primary care, reporting heightened stress, decreased satisfaction, and increased unmet physical and mental healthcare needs. The need to minimize existing barriers and identify strategies to facilitate successful healthcare encounters for consumers and primary care providers (PCPs) is increasingly important as autistic adults represent a growing segment of society. Currently, little research exists examining primary healthcare interventions for this population.

Objectives: The purpose of this study was to elucidate the barriers and facilitators to primary care health encounters for autistic adults, in order to inform the development of new or improve existing interventions.

Methods: We conducted interviews with caregivers of autistic adults living in Los Angeles (n=21) and Philadelphia (n=11). This data represents a subset of a larger study which conducted interviews/focus groups with autistic adults (n=34), caregivers of autistic adults (n=32), and PCPs treating autistic adults (n=14) in Los Angeles and Philadelphia. Caregiver interviews lasted an average of 34 minutes and were transcribed verbatim. Thematic analysis using a grounded theory approach was employed to describe barriers and facilitators to primary care health encounters. This project included a meaningful percentage of underserved and diverse populations, specifically Latino and African American participants.

Results: Sixteen themes or subthemes emerged from the interviews and clustered broadly into two categories — barriers and facilitators to care. Reported **barriers to primary care encounters** for autistic adults included: (1) *communication difficulties* that resulted in misunderstandings between patients and PCPs; (2) *PCP's lack of autism-specific knowledge* which impeded the receipt of patient-centered care; (3) *sensory overstimulation* from the physical environment that led to anxiety and emotional dysregulation; and (4) the *caregiver burden* which described the amplified stress and anxiety due to experiences with navigating the medical system, care coordination, and managing challenging behaviors exhibited by their adult child with autism. **Facilitators to improve care** included tailored accommodations for autistic adults; these differing strategies were

implemented by: (1) *PCPs* who aimed to improve experience by employing time modifications (e.g., reduction of time in waiting room, increase in one-on-one time with the patient), using alternative equipment, and affording greater autonomy to the autistic adult during medical encounters; (2) *caregivers* who utilized pre-visit discussions to describe the impending healthcare encounter to the adult with autism, and strategically scheduled appointments to minimize discomfort and anxiety while waiting; and (3) *autistic adults* who used distraction techniques such as technology (e.g., iPad, phone, television) and targeted strategies to remove noxious sensory stimuli during healthcare encounters (e.g., removal of examination table paper, dimming lights, use of headphones).

**Conclusions:** This study describes perceived barriers to successful care as well as strategies to facilitate positive primary care health encounters for autistic adults, as reported by their caregivers. Findings have the potential to provide a blueprint for the development of client-centered interventions to improve the quality of primary healthcare services for this population.

**411.097 (Poster) Caregiver Perspectives on Reading Instruction for Elementary School-Aged Children with Autism Due to the COVID-19 Educational Disruption**

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**Background:**

Children with autism commonly demonstrate atypical reading development (McIntyre et al., 2017) and receive services in general and special education settings. The COVID-19 pandemic caused massive disruption to the US education system, and emerging data highlights the stress placed on families when schools shut down that may be linked to the increased time spent providing services that an educator typically would provide (Manning et al., 2020). Learning from the primary caregivers who have been closely involved in their elementary-aged student's education during COVID-19 will help researchers and educators understand more about literacy learning at 3 timepoints (TPs): before, during, and after the COVID-19 educational disruption.

**Objectives:**

To examine whether the following changed over 3 TPs: 1) quantity, frequency, effectiveness of caregiver home reading instruction; 2) caregiver satisfaction with access to special education (SPED) resources; 3) caregiver belief that their child made progress in reading achievement; 4) caregiver belief that their child's reading instruction needs were being met.

**Methods:**

Primary caregivers in the US of an elementary-aged autistic child were eligible to participate in this online survey study. Participants completed questions on demographics, Individualized Educational Plan (IEP) reading goals, and caregiver reading support and perceptions. There are three reporting time periods: TP1, 5/2019-3/2020; TP2, 3/2020-8/2020, TP3, 8/2020-5/2021.

**Results:**

Current analyses discuss 40 initial participants (with 400 participants expected by late 2021). Initial participants reflect a diverse sample of mostly male children (77%) in grades K-5<sup>th</sup>. 60% of households are non-White or mixed-race; 48% qualify for free or reduced-price lunch; a language other than English is spoken in 30% of the homes. Approximately 70% of the sample had IEP goals for reading at all 3 TPs.

Wilcoxon signed-rank tests were used for all analyses:

OBJ1: The number of caregivers providing reading instruction at home did not change significantly from TP1 to TP2 ( $Z=-1.89, p=.06$ ) or TP2 to TP3 ( $Z=-.38, p=.70$ ). Also, the frequency of the reading instruction did not change significantly from TP1 to TP2 ( $Z=-1.22, p=.22$ ) or TP2 to TP3 ( $Z=-.30, p=.76$ ). However, while caregiver perception of their effectiveness did not change significantly from TP1 to TP2 ( $Z=-1.63, p=.10$ ), it did increase significantly from TP2 to TP3 ( $Z=-1.93, p=.05$ ).

OBJ2: Caregiver satisfaction with access to SPED services decreased significantly from TP1 to TP2 ( $Z=-2.85, p=.004$ ), then increased significantly from TP2 to TP3 ( $Z=-2.85, p=.004$ ).

OBJ3: Caregiver belief that their child was making general progress in their reading achievement decreased significantly from TP1 to TP2 ( $Z=-3.07, p=.002$ ), then increased significantly from TP2 to TP3 ( $Z=-3.51, p<.001$ ).

OBJ4: Caregiver belief that their child's reading instruction needs were being met decreased significantly from TP1 to TP2 ( $Z=-3.11, p=.002$ ), then increased significantly from TP2 to TP3 ( $Z=-3.71, p<.001$ ).

**Conclusions:**

About half of the caregivers provided frequent reading instruction at home, which did not change significantly across time, but their sense of effectiveness grew significantly by TP3. The COVID-19 educational disruption significantly negatively impacted perceptions of access to SPED

services, meeting student reading instructional needs, and student progress in reading achievement. Analyses of the complete dataset will reveal more lessons learned about caregivers' role in supporting reading.

**411.098 (Poster)** Characterizing Family Social Support from Adolescence through Young Adulthood in Autism

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**Background:** A strong social support system can bolster family functioning and promote a host of positive parent and child outcomes. For families of autistic youth, social support is a particularly important resource, as it can ameliorate the high level of stress placed on these families and support parent well-being (Boyd, 2002; Marsack & Samuel, 2017; Smith et al., 2011). A dearth of studies, however, have considered the multidimensional nature of social support (e.g., Bromley et al., 2004) to understand which sources of social support are most helpful and frequently utilized. Additionally, there are few longitudinal studies of family functioning in autism; no study to date has explored changes in family support from adolescence into young adulthood.

**Objectives:** In families of autistic adolescents, this study aims to 1) characterize helpfulness and utilization of multiple sources of social support, 2) explore trajectories of social support from adolescence into young adulthood, and 3) examine autism severity and cognitive ability as predictors of social support trajectories.

**Methods:** A sample of 128 autistic adolescents (Age  $M=16.17$ ;  $SD=1.25$ ) were drawn from an ongoing longitudinal study. Social support was measured at six time points (TPs) from adolescence through young adulthood using a modified version of the Family Support Scale (FSS; Bromley et al., 2004; Dunst et al., 1988). FSS subscales include Family, Friends, Community, and Professional support; reporters rate the helpfulness and frequency of utilization. Development appropriate standardized IQ measures indexed cognitive ability and the ADOS Calibrated Severity Score captured autism severity.

**Results:** At TP1, Professional support was rated as the most helpful but second most utilized, Friends and Family were the second most helpful but the most utilized, and the least helpful and utilized was Community support. Level of helpfulness and utilization were positively correlated within each type of support (Table 1). Multilevel modeling in *Mplus* revealed that, controlling for parent education, helpfulness of Family ( $B=-0.02$ ,  $p=0.10$ ) and Friend ( $B=-0.02$ ,  $p=0.12$ ) support did not change across adolescence to young adulthood, while Community ( $B=-0.05$ ,  $p<0.01$ ), Professional ( $B=-0.07$ ,  $p<0.001$ ), and Overall ( $B=-0.04$ ,  $p<0.001$ ) support demonstrated significant declines. Utilization of all social support sources significantly declined across time. Cognitive ability and autism symptoms were not related to the level or trajectory of helpfulness of social support, and only cognitive ability was negatively related to the intercept of utilization of Professional support ( $B=-0.01$ ,  $p<0.01$ ).

**Conclusions:** These findings provide the first longitudinal characterization of family social support across adolescence to young adulthood among families of autistic youth. Declines were identified in the helpfulness of Professional and Community support, as well as the frequency of utilization of all types of social support during this time period, independent of adolescent cognitive ability and autism severity. Given the importance of social support for well-being, these declines highlight the need to bolster accessibility of social support during the transition from adolescence into young adulthood for families of autistic youth. Future research should explore how social support changes into later adulthood and the consequences of declining social support for aging autistic adults and their families.

**411.099 (Poster)** Comparison of Psychological Functioning and Parental Burnout in Heterosexual and Same-Sex Parents of Children with ASD

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**Background:** Previous research has shown that parents of children with autism spectrum disorder (ASD) often report high levels of psychological distress (Hastings et al., 2005; Hayes & Watson, 2012; Lai et al., 2015). Additionally, stress levels are known to be high among LGBTQ+ parents (Goldberg, 2010). Although one study found no differences in levels of stress between heterosexual and same-sex parents of typically developing (TD) children (Farr et al., 2010), no study to date has examined potential differences in psychological functioning in parents of children with ASD. The current study aims to expand on previous findings through examining psychological distress and parental burnout amongst heterosexual and same-sex parents of children diagnosed with ASD.

**Objectives:** The current study aimed to understand differences in parental stress, depression, anxiety, and burnout during the COVID-19 pandemic between parents of children with ASD in heterosexual relationships and parents of children with ASD in same-sex relationships.

**Methods:** A total of 81 parents of children diagnosed with ASD (ages 4 to 16) were included in analyses. Fifty-one parents were in heterosexual marriages/relationships (33 females and 18 males). Thirty parents were in same-sex marriages/relationships (19 male, 11 female). Parents provided sociodemographic information and completed the *Depression, Anxiety, and Stress Scale – 21* (Lovibond & Lovibond, 1995) and *Parental Burnout Assessment* (Roskam et al., 2018). These measures were collected in the context of a larger study exploring differences in psychological functioning between parents of TD children and parents of children with ASD.

**Results:** Independent-samples *t*-tests revealed significant differences in parental depression, parental anxiety, and parental burnout between parents in heterosexual relationships and parents in same-sex relationships,  $p$ 's  $< .05$ . Parents in same-sex relationships ( $M = 14.90$ ,  $SD = 1.88$ ) reported significantly more depression compared to parents in heterosexual relationships ( $M = 11.92$ ,  $SD = 5.59$ ),  $t(79) = -2.33$ ,  $p = .023$ ,  $d = -.535$ . Parents in same-sex relationships ( $M = 14.17$ ,  $SD = 5.35$ ) also reported significantly more anxiety compared to parents in heterosexual relationships ( $M = 11.47$ ,  $SD = 5.71$ ),  $t(79) = -2.10$ ,  $p = .039$ ,  $d = -.0483$ . Similarly, parents in same-sex relationships ( $M = 74.80$ ,  $SD = 37.96$ ) reported significantly more

burnout compared to parents in heterosexual relationships ( $M = 55.69$ ,  $SD = 38.58$ ),  $t(79) = -2.14$ ,  $p = .035$ ,  $d = -.491$ . Furthermore, parents in same-sex relationships reported significantly higher burnout on three of the four subscales: Contrast in Parental Self, Feelings of Being Fed Up, and Emotional Distancing,  $p$ 's  $< .05$ ; however, there were no significant differences in Exhaustion in Parenting Role  $p = .109$ . Additionally, no significant differences were found in parental stress,  $p = .109$ .

**Conclusions:** Our findings suggest a greater need for future investigation in the psychological functioning and burnout in LGBTQ+-identifying parents of children with ASD, and more generally, developmental disabilities, as this would allow clinicians to assess what interventions may be beneficial in treating mental health symptoms and increasing caregiver quality of life.

**411.100 (Poster)** Computer-Assisted Heart Rate Variability Biofeedback As a Method of Stress Reduction for Parents of Children with Autism: A Pilot Study

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**Background:** Despite their success, treatment adherence and satisfaction with currently existing methods of relaxation training or mindfulness-based stress management techniques for reducing stress and anxiety in parents and caregivers of children with autism (ASD) remain low. These methods are often time consuming to learn and practice, require a trained or licensed professional for instruction, and typically rely on less objective measurements. Recent technological advancements have led to the development and miniaturization of a user-friendly and inexpensive biofeedback training device that relies on a cardiovascular biomarker, heart rate variability (HRV-HRVBF), to quickly identify and control the physiological mechanisms commonly associated with feelings of stress and anxiety.

**Objectives:** To 1) assess the practicality and usefulness of HRVBF for a parent of a child with ASD 2) determine the effect of HRVBF on parental self-reported symptoms of state anxiety 3) to compare observed behaviors associated with maternal affect, interest, stress, and communication, and 4) child affect and compliance during a structured interaction before and after use of HRVBF.

**Methods:** A single parent-child with autism dyad was recruited and selected for this study. The dyad was observed during a "stressful or challenging" interaction chosen by the mother for approximately 17 sessions: alternating between baseline and intervention conditions every 3-5 sessions. The mother was instructed to use the HRVBF device immediately before interacting with her child for 5-minutes prior to each of the intervention sessions and to refrain from using it during baseline sessions. Self-reported and observational measures of stress and changes in maternal and child behavior with and without HRVBF, as well as the social validity and feasibility of using the device were collected and assessed using a variety of measures.

**Results:** Self-reported symptoms of anxiety and stress were lower when using the device ( $M=49.6$ ;  $M=53.5$ ) than without ( $M=35.6$ ;  $M=36$ ). Likewise, behaviors associated with maternal affect and maternal states of relaxation were observed more during sessions with the device than without. Changes in maternal communication style, child affect, and child compliance remained inconclusive or more indicative of change across time. Results from the social validity questionnaire strongly supported the use of- and experience with HRVBF by the participating mother.

**Conclusions:** The current study expands on our understanding of the use of HRVBF as a stress management tool, by incorporating a relatively new, underrepresented member from the population of parents of children with ASD who are more prone to experiencing relatively high feelings of parental stress and anxiety. This study is unique in that it demonstrates potential of a more practical and feasible proxy or supplement to- relaxation training and a more objective measurement of physiological symptoms associated with these outcomes. Although the sample size is limited, the methods and results of this study extensively demonstrate some of the positive behavior changes, as well as the self-reported feelings of decreased stress and anxiety, and overall satisfaction, in the selected mother when using HRVBF during an otherwise stressful and challenging interaction.

**411.101 (Poster)** Coping and Well-Being Associations Among Parents of Autistic Adolescents and Young Adults with and without Intellectual Disability

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## **Background:**

Parent well-being, despite its link to many family outcomes (such as child well-being), is an understudied component of the family system. Most existing literature examines the higher rates of negative outcomes (e.g., poor mental health and high stress) among parents of children with autism spectrum disorder (ASD), and reports on parenting during early childhood; few studies have explored broader positive aspects of parent well-being (e.g., purpose in life or self-acceptance), or outcomes of parents of autistic adolescents and adults. Furthermore, although approximately 40 percent of people with ASD have co-occurring intellectual disability (ID), few studies have examined whether ID plays a role in connections among parent well-being and factors that may foster well-being (i.e., coping strategies).

## **Objectives:**

To 1) examine links between parent well-being and parent coping style in parents of adolescents/young adults with ASD and 2) examine the effect of child intellectual disability status on parent well-being and coping.

## **Methods:**

101 parents were drawn from an ongoing longitudinal study of ASD. Parent measures were collected when their adolescent was roughly age 18 ( $M = 17.85$  years;  $SD = 1.31$  years). Parent well-being and coping were measured via self-report on the Scales of Psychological Well-being (SPWB) and the Brief Coping Orientation to Problems Experienced Inventory (Brief COPE), respectively. The SPWB yields scores for total well-being, purpose in life, self-acceptance, and personal growth. The current analyses include three Brief COPE subscales: active-, emotion-, and avoidance-focused coping. Adolescent nonverbal IQ, assessed at age 9 with standardized developmentally appropriate tests, was used to classify the samples as with ID (child IQ < 70) or without ID (child IQ  $\geq$  70). Pearson correlations were used to examine the association between parents' SPWB scores and COPE scores across all parents and within each ID group (i.e., with or without ID).

## Results:

Across all parents, higher levels of problem-focused coping were significantly associated with greater purpose in life, self-acceptance, personal growth, and total well-being scores (Table 1). For emotion-focused coping, significant positive associations emerged with purpose in life and personal growth, but not self-acceptance. Avoidant coping was not significantly related to well-being. Examining these associations within each ID group revealed similar links between well-being and problem-focused coping (Table 1). Emotion-focused coping, however, appeared to be more strongly linked with well-being for parents of autistic adolescents with ID than those without (Table 1).

## Conclusions:

These findings provide preliminary evidence that greater use of certain parent coping strategies (i.e., problem- and emotion-focused) have important implications for promoting positive well-being in parents of adolescents/young adults with ASD. Results also suggest that coping-well-being associations may vary based on child intellectual disability status, such that emotion-coping may be a more powerful strategy for supporting parent well-being among parents of children with ID.

Parent well-being is tightly intertwined with other family system subunits, including child well-being. These results highlight the critical need to bolster parents' capacity to use adaptive coping strategies to foster healthy and happy families of autistic adolescents/young adults. Follow-up analyses will include longitudinal exploration of parent coping-well-being relations.

### 411.102 (Poster) Differences in Parent Perceptions of and Family Experiences with Autism Among Vaccine Hesitant and Non-Hesitant Parents of Children with ASD in the SPARK Cohort

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**Background:** Despite the public-health benefits of vaccines, a growing number of families are vaccine-hesitant (i.e., have concerns about vaccines that may lead to vaccination delay/refusal). Parents of children with autism spectrum disorder (ASD) are particularly at risk, as up to 40% of parents of children diagnosed with ASD believe that vaccines played a role in their child's condition (Sahni et al., 2020). Several factors have been associated with both vaccine hesitancy (e.g., beliefs about ASD etiology, demographics) and parents' beliefs in vaccines as a cause of ASD (e.g., child's history of skill loss, child's language level). However, less is known about how parents' attributions regarding their child's ASD and their personal or family adjustment to the ASD diagnosis may influence vaccine hesitancy.

**Objectives:** To examine associations between parents' attributions about ASD, parents' personal and family adjustment to the ASD diagnosis, and vaccine hesitancy within the SPARK (Simons Foundation Powering Autism Research for Knowledge) national cohort.

**Methods:** A total of 39,461 SPARK families were invited via email (4/10/19—6/8/19) to participate in a study about families' ASD-related attributions, personal or family support and stress, and perceptions about vaccination. 8,118 (20.6%) participants submitted complete data on the *Parent Attitudes about Childhood Vaccines* (PACV; measure of vaccine hesitancy), the *Revised Illness Perception Questionnaire-ASD* (IPQ-R-ASD; parental attributions about ASD), and the *Family Adjustment Measure* (FAM; personal and family adjustment for parents of children with ASD). The average age of participants (92% mothers) was 42.6 years ( $SD=8.6$ ) and that of their children was 11.9 years ( $SD=6.3$ ).

**Results:** 1,766/8,118 (21.8%) participants in this sample were vaccine hesitant (PACV score  $\geq 50$ ). Compared to non-hesitant parents, vaccine hesitant parents (VHPs) had significantly higher scores on the IPQ-R-ASD's Identity, Consequences, Timeline-Cyclical, and Emotional Representations subscales, and significantly lower scores on the Timeline Acute/Chronic, Treatment Control, and Illness Coherence subscales (all  $p < 0.001$ ; Cohen's  $d$  ranged from 0.10—0.45). Likewise, VHPs had significantly higher scores on the FAM's Parental Distress subscale and significantly lower scores on the Family Based Support, Social Support, and Positive Coping Skills subscales compared to non-hesitant parents (all  $p < 0.001$ ; Cohen's  $d$  ranged from 0.16—0.38). Data are being merged with the most recent SPARK-dataset release for subsequent analyses to identify parents' internal experiences and/or perceptions as potential predictors of vaccine hesitancy in parents of children with ASD.

**Conclusions:** Perceptions about ASD and experiences of personal and family support and stress differ significantly between VHPs and non-hesitant parents. Compared with non-hesitant parents, VHPs associate more behaviors with ASD, perceive more negative consequences of ASD, report less understanding of the diagnosis, and report higher stress and less support. Taken together, these findings suggest that vaccine hesitancy could indicate a subgroup of parents who may require more clinical attention and support (i.e., parent- or family-focused intervention) than parents who are not vaccine hesitant.

### 411.103 (Poster) Do Cultural Adaptations Matter? Comparison of Socially Valid Measurements during Caregiver Training of Children with Autism

**Background:** For families of children with autism spectrum disorder (ASD), caregiver training has the power to positively impact the child's development and the family's quality of life. With training, caregivers can learn how to implement strategies to successfully increase adaptive skills in their child with ASD. Nevertheless, culturally and linguistically diverse (CLD) families face unique challenges when attempting to access services that match their culture and language. Furthermore, the scarcity of appropriate practices when serving CLD families and the shortage of bilingual therapists in the United States add to the limitations of providing culturally adapted services. To reduce this disparity, it is essential to better understand the impact of current practices, when there is a mismatch between the family and training language, and when training has been linguistically adapted.

**Objectives:** The purpose of this pilot study was to evaluate the effects of implementing caregiver training with and without linguistic adaptations to Latino caregivers of children with ASD. Specifically, we wanted to capture the social validity measures of caregivers' behaviors (*personalismo*, involvement, indices of happiness, and acceptability) when Latino caregivers with limited English proficiency receive training in English versus Spanish.

**Methods:** Four low-income Latino mothers from the United States and Honduras participated in this pilot study. An alternating treatments design embedded with a concurrent delayed multiple probe design was conducted to investigate the relative effects of language on instruction, using English versus Spanish and teaching caregivers, via Telehealth, two different skills: (a) matching to sample and (b) motor imitation during play.

**Results:** Results indicated that CLD families can benefit from training regardless of the language mismatch and that, with training, caregivers can positively impact their child's skill acquisition. However, training that has been culturally adapted to match the family language was easier to learn and more comfortable for caregivers. Also, mothers were more involved during training sessions that were culturally adapted. For instance, caregivers shared more personal information — "*personalismo*"—asked more questions, and showed more indices of happiness (e.g., laughing). Treatment gains were maintained during two-week and one-month follow-ups.

**Conclusions:** Caregiver training for CLD families can increase the caregiver's ability to teach their child with ASD new skills. Nevertheless, culturally adapted training showed a higher level of caregiver involvement and happiness, demonstrating that caregiver training that adapts to the families' native language may increase the families' well-being in a timely, efficient manner.

#### **411.104 (Poster)** Elucidating the Perspectives of Autistic Youth about Their Healthcare Experiences

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**Background:** Co-occurring medical and psychiatric conditions are prevalent among autistic individuals, and promote increased service use within this population.<sup>1,2</sup> However, autistic individuals and their caregivers report lower satisfaction with healthcare service delivery, citing needs that are incompatible with the healthcare environment.<sup>3,4</sup> Additionally, health professionals report feeling unprepared to meet the unique needs of autistic individuals in healthcare settings.<sup>5</sup> Prior studies have described the general healthcare experiences of autistic adults<sup>6</sup>, but there is little known about health seeking and service use experiences of autistic youth.

**Objectives:** This study aimed to qualitatively describe and better understand the healthcare experiences of autistic youth receiving services at a large, urban, safety net hospital in New England.

**Methods:** We conducted four 90-minute, virtual focus groups with autistic youth between January-November 2021. Each focus group included seven participants, ages 11 to 25 years. Youth and young adult participants were not separated due to the cohesive group dynamic that has been established as most of them knew each other prior to the focus group through a teen mentoring program. Group discussions were led by the fifth author using a semi-structured group interview guide that inquired about participants' positive and negative healthcare experiences, desired accommodations during healthcare visits, and recommendations for what providers should know about autism. Audio recordings of focus groups were transcribed and verified by two research assistants. Data are being analyzed using inductive coding techniques. Three trained researchers developed qualitative memos from two transcripts to identify high-level topics that emerged from focus groups. Consensus discussions with the research team were used to generate initial codes for the codebook based on these memos and knowledge of the focus group content. Transcripts will be double-coded by two independent coders. Consensus discussion will be used to resolve any coding discrepancies, with a third coder serving as a tie breaker. Themes will be identified through a close reading of the coded data, using a thematic content approach. All analysis will be completed in Nvivo.

**Results:** At the time of submission, we have developed the consensus codebook and are in the process of coding transcripts in NVivo. Preliminary themes include: (1) Patient appreciation for providers willing to listen to their needs and frustrations with past healthcare experiences; (2) Variation in patient preferences regarding involvement in healthcare decision-making and service delivery format (e.g., telehealth vs. in-person); (3) Environmental stimuli particularly the waiting room (e.g., smells, crowds, loud sounds), are deterrents of health services use.

**Conclusions:** The type and level of specific support that autistic youth need vary across individuals. However, participants largely agreed on environmental barriers and factors that facilitate and hinder patient-provider relationships. Our findings to date support previous research that suggest the need to individualize care, disseminate individualized patient needs to all members of their care team, and increase provider knowledge about this unique patient population.

**411.105 (Poster)** Examining the Experiences of Autistic and Non-Autistic Adolescents in a Teen Mentoring Program during the COVID-19 Pandemic: A Qualitative Focus Group Study

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**Background:** Social distancing policies are critical, but have also created disruptions to the lives of many children and families.<sup>1</sup> Disruptions in routine can be particularly difficult for autistic individuals, especially when compounded with the loss of access to much needed services and supports.<sup>2</sup> Our program has run a unique teen mentoring program since 2015, which involves monthly social events for autistic and non-autistic adolescents. Due to the COVID-19 pandemic, the teen mentoring program activities shifted to virtual formats to adhere with social distancing rules.

**Objectives:** This study aims to examine the perspectives of autistic and non-autistic adolescents, as well as caregivers, about their experiences participating in a teen mentoring program and maintaining social connections during the pandemic.

**Methods:** Three focus groups were conducted with seven autistic and three non-autistic adolescents ages 13-18 (7 males, 2 females, 1 non-binary). In addition, two focus groups with nine caregivers were conducted, seven of whom have an autistic child. Focus groups were audio recorded, transcribed, and verified by two research assistants. Guiding questions focused on eliciting responses about adolescents' experiences during COVID-19 in terms of adjusting to virtual formats for activities and staying connected with friends. Qualitative data are being analyzed using inductive coding as the study is exploratory in nature. We conducted qualitative memoing on two transcripts to identify high-level topics to serve as codes in the initial codebook, which was developed through consensus. Qualitative analysis is being conducted in NVivo, where each transcript is coded by two independent coders out of a team of three coders. All three coders meet to review and reach consensus in the coding, and the third coder serves as a tie breaker if the two coders disagreed. Thematic content analysis will be performed based on a close reading of the data.

**Results:** The teen mentoring program participants indicated mixed feelings about participating in virtual and in-person activities during a pandemic, which ranged from excitement to anxiety. Positive feelings about virtual settings included improved accessibility and skills (e.g., better time management, increased independence). Negative feelings about participating in virtual activities included limitations in opportunities for social interactions. Additionally, caregivers underscored routine disruption as a challenge when shifting to virtual format. Participants identified coping strategies to address challenges in virtual activities, including forming pods of individuals with similar interests and staying connected with others via social media.

**Conclusions:** The teen mentoring program participants indicated benefits and disadvantages associated with the shift to virtual activities. However, participants and caregivers agreed that the teen mentoring program monthly events, virtually or in-person, had positive effects to their social skills and relationships. Findings highlighted the importance of maintaining social connections and adapting services to ensure continuity of access, whenever possible.

**411.106 (Poster)** Evaluating Maternal Communicative Behaviors in Latina Mothers of Young Children with ASD in Low-Resource Households  
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**Background:**

Research has consistently found that the quality and quantity of adult speech that children experience can positively impact their language, communication, and social development (Greenwood et al., 2018; Weisleder & Fernald, 2013). In low-resource households, the quality of early dyadic communication (mother-child), specifically fluency and connectedness, were strong predictors of expressive language in typically developing children one year later (Hirsh-Pasek et al., 2015). However, little research to date has focused on maternal communicative behaviors directed towards children with ASD from diverse racial/ethnic and socioeconomic backgrounds. Understanding maternal communication patterns in racial/ethnic minority families is important as it can impact interventions and supports. We set to explore how Latina mothers from low-resource households communicate with their children with ASD during a semi-naturalistic play interaction.

**Objectives:**

The goal of this exploratory study is to evaluate maternal communicative behaviors during a play interaction and to identify child and maternal factors that are associated with greater quality behaviors.

**Methods:**

Latina mothers and young children (18 months through 6 years) with ASD were recruited as part of a larger intervention study implemented in low-resource households in the United States. For low-resource status, families met one of the following criteria: Medicaid as insurance provider, caregiver has a high school or lower education, or household income of  $\leq 200\%$  of the federal poverty level. Child and caregiver data included the Mullen Scales of Early Learning (MSEL), Vineland Adaptive Behavior Scales-3 (VABS-3), child challenging behavior, family empowerment, and parenting stress. Mothers completed a 15-minute play interaction with their child at home using a curated toy box. The toy box included developmentally appropriate items (e.g., animal figures, blocks, bubbles, Little People ® figures, puzzles, vehicles). Coding of maternal communicative behaviors will follow established coding protocols (Conway et al., 2018; Hirsh-Pasek et al., 2015) for the following: directives,



praise, missed opportunities, expansions, imitations, responsive questions, supportive directives, labels, fluency, and connectedness. Coding will be completed by Latina, bilingual (English/Spanish) researchers.

#### Results:

We present results for 11 mother-child dyads who participated in the study prior to COVID-19. Children were about 4.00 years old ( $SD = 1.79$ ), mostly male (63.6%), and communicated in verbal language (63.6%). They had a mean MSEL Early Learning Composite score of 58.90 ( $SD = 15.53$ ), and mean VABS-3 Adaptive Behavior Composite score of 65.64 ( $SD = 10.52$ ). Mothers were on average 35.18 years old ( $SD = 5.67$ ), mostly foreign-born (81.8%), and mostly bilingual (English/Spanish, 63.6%). Preliminary analyses finds that caregiver age was positively associated with parenting stress,  $r(10) = 0.67, p = 0.024$ . We will examine if child (e.g., challenging behavior) and maternal (e.g., parenting stress) factors are associated with maternal communicative behaviors using Pearson correlation analyses.

#### Conclusions:

This exploratory study will evaluate how Latina caregivers communicate with their children with ASD during a play interaction. We will further identify how child and family factors are associated with these behaviors. These findings will inform parenting support programs to enhance the language and communication trajectories of young children with ASD from racially/ethnically and socioeconomically diverse backgrounds.

#### **411.107 (Poster)** En Español Se Siente Mas Bonito: Parent Perspective of Bilingual Language Development and Service Support for Autistic Children

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Background: Bilingualism is a growing phenomena among neurotypical and neurodiverse children alike. However, for children with disabilities, such as Autism Spectrum Disorder (ASD), both professionals and clinicians alike have perpetuated the belief that early bilingual instruction may cause further language delays in populations with already impaired communication. Recent studies are beginning to highlight a potential benefit in the preverbal communication, expressive vocabulary, and executive functions of bilingual children (Valicenti-McDermott et al. 2013; Iarocci et al. 2017; Lim et al. 2018). However, 90% of developmental psychology research is conducted on white, U.S., middle class families known as the W.E.I.R.D. population (Mistry, Contreras, & Dutta, 2013). Consequently, families from differing cultural and environmental contexts may be overlooked in these studies.

Objectives: The study aimed to explore and document the parenting practices in Spanish-speaking families that support their Autistic child's cognitive and bilingual development. The study also documented if bilingualism has been supported/promoted by service providers and parental perceptions towards the importance of bilingualism.

Methods: This study employed a two-phase, community-based participatory research (CBPR) qualitative design to accomplish the validation of research materials, recruitment, and analysis. As the research team made contact with community groups and stakeholders, they practiced *confianza*, *familismo*, and *personalismo*. Phase I consisted of a focus group (5 participants) where research materials were presented such as the research flyer, interview protocol, and feedback was received in order to ensure the questions were culturally sensitive, relevant, and appropriate within the community. Phase II consisted of two rounds of qualitative interviews with 5-6 participants who were Spanish-speaking parents of bilingual autistic youth between the ages of 5-12. The interview protocol was adapted from previous focus groups protocol to reflect the focus on language, family dynamics, and support for bilingualism.

Results: Participants included 1 Male and 5 Females, all parents of at least one bilingual autistic youth. Parent's mean age was 43 ( $SD = 4.42$ ) and mean age when youth were diagnosed was 3.33 ( $SD = 1.39$ ). The average median household income was \$41,999 ( $SD = \$35,637$ ). All participants were Latinx and identified as immigrants from either Mexico or Guatemala. Four out of five parents endorsed the importance of bilingualism but all five parents promoted dual language learning for their autistic child. Three out of five parents explicitly sought support for the promotion of bilingualism through in-home services which resulted in delayed service delivery and long wait times.

Conclusions: The growing number of bilinguals with ASD calls for extensive research on second language development, parental support for successful bilingual development, and culturally sensitive and competent services for immigrant populations.

#### **411.108 (Poster)** Understanding the Impact of the COVID-19 Pandemic on Autistic Children and Their Families: Results from an Online Survey Developed By Project Steer Stakeholders

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Background: Approaching stakeholders as engaged collaborators in research represents a challenging, yet critical, shift to better align autism research with the values, goals and needs of stakeholder communities. Project STEER (Stakeholders Engaging in Early Intervention Research) brings together autistic adults, parents of children with autism, community-based service providers, and autism early intervention researchers to support this shift. The COVID-19 pandemic offered a unique opportunity to partner with Project STEER stakeholders to learn more about the impact of the pandemic on children with autism and their families.

**Objectives:** The goal of this study was to co-develop an online survey with Project STEER focused on better understanding the impact of the COVID-19 pandemic on autistic children and their families.

**Methods:** Project STEER used a Participatory Action Research approach to develop an online survey consisting of questions that were identified by stakeholders as being of greatest importance to the autism community during this time.

**Results:** The survey was completed by 106 families of children with autism ages 1 to 11. Two percent of the sample identified as American Indian/Alaskan Native, 2% as Asian, 15% as Black, 2% as Hispanic, Latinx or Spanish, 1% Native Hawaiian, 2% as Middle Eastern or North African, 69% as White, and 7% as another race or preferred not to say. Most children's therapeutic and educational services were paused only briefly and then resumed either in person or via telehealth; only 14% of children experienced the complete discontinuation of a service during the pandemic. Interestingly, pandemic-related changes in children's services were experienced as mostly or completely negative for just 17% of children and 23% of parents—suggesting that a majority of families viewed these changes as neutral or positive. Twenty-one percent of parents report that their changes in household responsibilities during the pandemic were mostly or completely negative, with 38% feeling that their personal needs are not currently being met. Between 40% and 47% of children with autism experienced increases in aggression/disruptive behavior, anxiety, moodiness and sadness during the pandemic. Parents report developing a better understanding of their child's skills and behavior (62%) and improvements in the parent-child relationship (74%) during the pandemic. Parents also report spending more quality time (69%) with their child with autism as a result of the pandemic.

**Conclusions:** Although the pandemic caused many changes in services for children and their families, these data indicate that many children's academic and therapeutic needs were largely being met. However, parents themselves have experienced significant stress and unmet needs during this time. Many parents also reported increases in their children's experiences of aggression, anxiety, moodiness, and attention challenges during the pandemic. There have been longstanding calls for better mental health services and resources for children with ASD. The pandemic may have further increased the need for such services. Importantly, while the pandemic has been an unpredictable and stressful time for most, parents do report some positive impacts including developing a better understanding of their child and increases in the amount of quality time spent together.

**411.109 (Poster)** Family Echo: All Teach, All Learn Model to Build Family Knowledge and Ability to Care for Children with Autism  
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#### Background:

From navigating a diagnosis to learning about new therapies, parents and caregivers of children with developmental disabilities, including autism need an immense amount of knowledge and support to provide best care to their loved ones. However, that information can often be difficult to access.

Project ECHO (Extension for Community Healthcare Outcomes) has proven successful as a learning framework for health care professionals to engage in best practice learning for application to patient and clinic practices. Learning is facilitated through evidence-based didactics, case-based discussion, and mentorship from a group of multi-disciplinary subject matter experts (HUB).

Family ECHO adapts the Project ECHO model to build an “all teach, all learn” environment where families, rather than health care professionals, are the targeted audience (SPOKES). The Family ECHO framework is able to connect families and HUB experts to share best practices and identify novel and emerging practices developing within the health care community.

#### Objectives:

- Describe the process of adapting the Project ECHO framework to families of children with autism
- Review initial outcomes related to changes in family autism knowledge, perceived caregiving competence, access to resources on specific topics related to autism.
- Demonstrate the reach of the program

#### Methods:

Family ECHO employs a 60-minute structure that includes a didactic, facilitated case-based discussion, and a pathway to resources, supports, and clinical service when needed. The traditional ECHO model elicits a case to discuss from participants. In Family ECHO, participants are families and caregivers of patients with autism; therefore, we modify the case presentation component to have HUB team members present a case vignette to ensure protection of protected health information. Data on the number of attendees and their locations are collected, in addition to an evaluation survey collected after the Family ECHO series.

#### Results:

In 2020, 430 attendees yielded 1507 attendances across 26 Family ECHO sessions. Participants came from Michigan, Kentucky, South Carolina, West Virginia and the US Virgin Island. Within Ohio, the primary audience, participants came from 79 out of 88 total counties.

Data from the evaluation survey (126 responses from 430 participants invited) indicates the topics offered are in line with the needs reported by participants of the series:

| Topic                                  | % of Families Endorsing Topic Was Topic Covered in FAMILY ECHO |     |
|--|--|-----|
| Irritability and Challenging Behaviors | 86%  | Yes |
| Behavior Management                    | 85%  | Yes |
| Family Support                         | 83%  | Yes |
| Anxiety                                | 74%  | Yes |
| Parenting                              | 60%  | Yes |
| ADHD                                   | 56%  | Yes |

Overall, attendees reported high satisfaction with the program (89% reporting being satisfied or very satisfied). 91% of participants reported participation in Family ECHO improved their knowledge and ability to care for children with developmental disabilities including autism.

Conclusions:

To our knowledge, Family ECHO is the first application of the Project ECHO framework to directly support families. We have successfully developed and launched a series structure including case presentation, outcome measures and didactic presentations and have enrolled participants from across many regions. Response from participants regarding topics for learning are in line with data collected by partner organizations.

#### **411.110 (Poster)** Family Experiences of Children with Autism Spectrum Disorder in Indian Context: A Parental Survey

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Background: There is a dearth of tools assessing the parental measures and family life of Children with Autism Spectrum Disorder (ASD). Autism Family Experience Questionnaire (AFEQ) is a recent tool developed to assess parental priorities for outcomes of an early intervention and the impact of intervention on family experience of parents of children with ASD. AFEQ has known validity and reliability measures (Leadbitter et al., 2018).

Objectives: Our study aimed to adapt, validate the scale, and evaluate the parent-generated measure of family outcomes using the adapted AFEQ scale in the Indian context.

Methods: Permission was sought from the authors to adapt and validate the AFEQ to Indian context. The original tool was then checked for social and cultural suitability to Indian context by giving to three experienced professionals (one psychiatrist and two clinical psychologists) for content validation. A 4-point likert scale was used to rate the parameters such as 4- retain, 3-retain with minor changes, 2-retain with major changes, and 1- exclude. After incorporating modifications based on experts inputs, the adapted questionnaire was provided to 90 parents of children with ASD (age range of 3-10 years). The adapted questionnaire (like original) contained 48 items and was scored on a 5-point Likert scale: 1 to 5, where 1 indicated always and 5 indicated never. There are 4 subdomains in the questionnaire such as (1) experience of being a parent of a child with autism; (2) family life, (3) child development, and (4) child symptoms. Parents filled in the questionnaire forms, that were collected on the same day and the scores were computed.

Results: Results of content validation showed scale validity index of 0.83 indicating acceptable content validity. Minor modifications such as rephrasing of certain items (viz., 2,10,14,15,16, 18, 23, 29, 30, 32) were done as per the suggestions from the experts. We compared the parental ratings of the adapted AFEQ scale with the available norms from the original AFEQ scale. The parent ratings of the adapted AFEQ scale revealed comparable scores with the original version of the scale(see Table 1). Scores on child development and overall AFEQ was slightly lower in our study, indicating positive outcome. The scores on parent section in our data, however, revealed little higher scores or relatively lower outcome. While, the scores on family and child symptoms were similar.

Conclusions: Our study results indicate that the family outcomes in children with ASD were similar to existing reports in the literature, suggesting comparable quality of life. Findings of the study, therefore, provide support for the use of AFEQ for assessment of parental priorities for key outcomes of intervention in children with ASD and their family. The adapted version of AFEQ questionnaire provides a simple to administer and ready tool for research and clinical use.

#### **411.111 (Poster)** Family Perspectives on Behavioral Health Hospitalizations for Children with Autism Spectrum Disorder

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Background: Estimates suggest children with Autism Spectrum Disorder (ASD) are six times more likely to be hospitalized for behavioral health needs (e.g., aggression, self-injury, and tantrums) and incur 12.4 times greater hospitalization costs than for typically-developing children.<sup>1,2</sup> Given implications for health care systems, research on effective service delivery is critical yet very limited. Research has primarily been limited to emergency centers and outpatient hospital departments, with limited perspectives of families elicited. Among existing research, families have identified staff training and communication, knowledge of their children's behavioral and communication needs, and recognizing parental expertise as key components in service delivery, offering important implications for future training and practice.<sup>3,4</sup>

**Objectives:** The purpose of this qualitative descriptive study was to investigate family experiences with care received during behavioral health hospitalizations for children with ASD.

**Methods:** Primary caregivers of children with ASD and behavioral health needs admitted to a large pediatric hospital were purposefully recruited. Twelve total parents participated across two focus groups (six parents each). A semi-structured interview guide was utilized to elicit perspectives on children's needs and experiences with admission, personnel, and services. Data were transcribed and coded for major themes using an interpretive description approach.<sup>5</sup> Rigor was established through audit trails, saturation, member checks, reflexivity, and rich descriptions.

**Results:** Emerging themes highlighted the complexity of behavioral health hospitalizations in relation to: 1) needs of the child and 2) family experiences and variables. For the child, factors such as communication, sensory, and safety needs existed at the center of the family's experience. For the family, experiences comprised of factors such as advocacy, information-sharing with healthcare personnel, planning ahead, feelings of value or being heard by personnel, caregiver fatigue, and experiences with personal stressors during hospitalizations. Families also expressed significant variability in positive and negative experiences.

**Conclusions:** This research demonstrates the complexity of hospitalizations for children with ASD and variability in family experiences, as informed by the needs of the child and family variables. In line with current calls for research, findings point to implications for design of personnel training and development of practices to best meet the unique needs of children with ASD and families during hospitalizations. In turn, this offers the potential for improved personnel satisfaction, safety during hospital admissions, caregiver well-being, and overall outcomes for children with ASD and their families.

#### **411.112 (Poster) How Do Autistic Individuals Conceptualise and Experience Uncertainty?**

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##### **Background:**

Autistic people are more likely to suffer from anxiety than their non-autistic peers (van Steensel et al., 2011) and considerable evidence implicates Intolerance of Uncertainty as a central risk factor in anxiety in autism (e.g. Maisel et al., 2016). While previous qualitative work has contributed to identifying intolerance of uncertainty as a significant source of anxiety in autism (e.g. Rodgers et al., 2018 and Hodgson et al., 2016), there has, however, been little research on what *uncertainty itself* means exactly for autistic people and/or what types of uncertainties might be particularly anxiety provoking.

##### **Objectives:**

This qualitative interview study sought to refine the construct of uncertainty by discerning what types of uncertainties might be problematic for autistic people, thereby informing better mental health practices and helping autistic people manage anxiety in their everyday life.

##### **Methods:**

The sample consisted of 15 adults (5 women), between 24 and 71 years of age with no additional learning or language impairment. Semi-structured interviews, lasting from half an hour to just over an hour, were carried out online via Zoom, to probe participants' understanding and experiences of uncertainty and possible links to feelings of anxiety. Grounded theory was applied to transcripts of the interviews, broadly following Charmaz' constructivist epistemology (Charmaz, 2014). As such, the analysis involved interaction with and interpretation of the data through successive levels of analysis, involving memo-writing, coding and the gradual construction of a theory.

Analysis was conducted in NVivo 12 Pro (QSR International Pty Ltd. (2018) NVivo (Version 12), <https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home> ). The initial coding was done line-by-line, and the codes were then modified as the different themes were formed and questioned with each new reading. Eventually, theoretical saturation was reached, whereby the model fit the data as interpreted and no new meaning could be drawn out. The resulting theory and construct were then shared with the participants in the form of a summary of the analysis and findings for participant validation.

##### **Results:**

The main theme that recurred in people's narrative was that 'uncertainty' was 'not knowing'. This 'not knowing' however, was not always experienced as anxiety provoking. Rather, 'not knowing' became a source of anxiety only when it felt difficult to plan for, or control. The process of managing uncertainty became a process of containment: i.e., reducing the uncertainty by gathering information or planning, or simply avoiding situations where the uncertainty was likely to be unmanageable.

##### **Conclusions:**

The resulting theory that was derived from the data was that uncertainty has three different levels, ranging from the certainty of what is 'known', through the relatively manageable uncertainty of the 'known unknown', to the anxiety provoking 'unknown unknown', which is difficult to avoid or manage through planning or information gathering. The diagram illustrates this theory, which distinguishes between three different levels of

'knowing' or 'not knowing'.

**411.113 (Poster)** How Does Stigma Towards Autism Compare to Other Clinical Conditions?

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**Background:**

Although stigma towards autism has been well documented (Someki et al., 2018), less is known about how it compares to other stigmatized disabilities. Schizophrenia, a highly stigmatized condition (Angermeyer & Matshinger, 2003) also characterized by social disability but with other distinguishing features, may offer a useful contrast. Previous comparisons (Jensen et al., 2015; Sasson & Morrison, 2019) report that autism may be viewed more favorably than schizophrenia, but the underlying volitional thoughts contributing to these differences is unclear.

**Objectives:** The present study examines this question with a qualitative approach, allowing for a nuanced understanding of stigma towards different diagnostic labels.

**Methods:**

As part of a larger study, 533 undergraduates were randomly assigned to complete an open-ended question regarding their thoughts about, and exposure to, one of eight diagnostic labels: four related to autism (autism, autistic, autism spectrum disorder, or Asperger's), two to schizophrenia (schizophrenia or schizophrenic), and two to an unspecified clinical condition (clinical diagnosis or clinical disorder). Participants were asked "What do you think of when you hear the word(s) [label]?" A thematic analysis was conducted. Responses were aggregated and themes were identified and coded based on the six-step approach to thematic analysis outlined by Braun and Clarke (2006). This process examines response patterns, generating initial codes that are further refined and organized into themes based on the shared narrative they convey.

**Results:**

Because quantitative analysis revealed no significant differences of diagnostic label within clinical conditions, labels were aggregated into broader categories (autism, schizophrenia, and general clinical condition) for analysis. Patterns in initial codes differed across diagnostic labels. The greatest variability was found for autism, with 88 initial codes generated and the most frequently occurring code (poor social abilities) occurring in only 15% of responses. Responses to schizophrenia showed greater cohesion, with "psychotic symptoms" occurring in 38% of responses out of the 86 codes produced. General clinical condition generated 62 initial codes, with high cohesion: the most frequent code (reference to brain or behavioral conditions) occurred in 63% of responses.

The identified themes and subthemes (figure 1) contained some overlap across conditions, but also important distinctions. Excerpts from participant responses, to be included at the conference, further illuminate differences in how these conditions are perceived.

**Conclusions:**

Stigma and beliefs about autism differ from those directed toward other clinical conditions. Descriptions of autism were less cohesive across responses, suggesting that knowledge, understanding, and perceptions of autism are highly variable. Whereas attitudes toward autism (patronizing, exclusionary, and accepting) and schizophrenia (fear, prejudice, and empathy) were wide-ranging, the general clinical condition did not elicit detectable attitudes. This distinction highlights the centrality of a specific clinical identity for the development of stigma. Finally, participants reported many misconceptions about autism and schizophrenia, with uncommon features such as savant syndrome and violence perceived as core characteristics of the conditions. The detailed accounts produced by this study may aid in the development of targeted programs to improve attitudes toward autism and schizophrenia.

**411.114 (Poster)** Implementing Virtual Reality Technology for Autistic Students: Teacher's Perspective on Success Factors and Challenges.

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**Background:** Virtual Reality (VR) is a term describing technology able to display artificial environments with visual and auditory stimuli, in which the user can interact. VR has shown to be an acceptable technological tool for autistic individuals (Dechsling et al., 2020). Caregivers and professionals call for accessible technological tools supporting and educating autistic individuals (Putnam, 2019). However, when implementing technology it is also important to include the teachers and school personnel (Donovan et al., 2014). The teacher's opinions and praxis are among the most important factors in succeeding with the implementation of information and communication technology in schools (e.g., Storz & Hoffman, 2013). Furthermore, the implementation is an important feature when considering treatment integrity.

**Objectives:** The aim for this study is to investigate teachers and school personnel's opinions on success factors, possible pitfalls, and challenges when implementing VR-technology for autistic students.

**Methods:** A total of 13 participants consisting of teachers, team leaders, special educators, and teaching students were interviewed. Eight participants were interviewed individually while the remaining five were interviewed as a group. We follow the qualitative thematic analysis (TA) approach as suggested by Braun and Clarke (2006), and their clarifications on reflexive TA in Braun and Clarke (2020).

**Results:** The thematic analysis resulted in themes on knowledge, network, attitudes, and technological aspects. The main findings are that (1) knowledge and sufficient training for the teachers are essential in order to utilize such tools, (2) a professional network surrounding the users (i.e., teachers and students) make sure good cooperation with developers and other users, (3) there are positive attitudes among school personnel to implement VR-tools, which they also consider a success factor, (4) technological aspects such as quality, user-friendliness, easy-to-use soft- and hardware, software updates, and flexibility is important in order to get school personnel to use the technology. In the group interview, there was a discussion whether VR could be of disturbance to other educational activities.

**Conclusions:** As various studies have looked into autistic individuals and other stakeholders' views on VR-tools (e.g., Bauer et al., 2021; Dechsling et al., 2020; Putnam et al., 2019), this study focuses on the teacher's perspective on factors related to implementation. Teachers and school personnel consider VR to be a positive pedagogical tool that can supplement traditional educational practice. Furthermore, they emphasize thorough preparations and training for the teachers, a functioning network, and easy-to-use flexible VR-technology with good quality in order to succeed with the implementation in schools and for autistic students. School personnel training, a high sense involvement and ease of use of the VR-tool is crucial for successful implementation of VR-interventions for autistic students in school.

**411.115 (Poster)** Improving Provider and Family Experiences with Telehealth Services for Children with Autism and Developmental Disabilities  
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**Background:** Although research supports telehealth as a feasible tool to increase access to clinical services, there are still challenges with work flows and subsequent delivery of and/or receipt of care. This is particularly true for clinics that rely heavily on standardized, in-person assessments and behavioral observations, such as diagnostic programs for autism spectrum disorder (ASD) and related conditions. We previously reported on providers' and parents' experiences with the abrupt transition to telehealth services because of COVID-19 at a tertiary ASD/developmental center in a large metropolitan area and identified the following areas in need of improvement: technological issues, lack of family preparedness and communication, additional in-person and testing time needed by providers, and limitations of remote care. To address these needs, we developed a telehealth guide with text and pictures to consolidate all instructions, visit-preparedness information, technological resources, and contacts that was distributed to families at the time their appointments were scheduled.

**Objectives:** To evaluate pre-post telehealth-guide experiences with telehealth services from both caregiver and provider perspectives at a tertiary ASD/developmental center in a large metropolitan area.

**Methods:** The telehealth guide was distributed to all families scheduled for a telehealth visit. REDCap surveys were developed separately for caregivers and providers; these were sent via email with a request to complete the form with a given appointment in mind. Providers were emailed a survey link for every third visit, and surveys were distributed to all families regardless of whether the visit was completed, attempted, or no-showed. Post-survey distribution spanned three months (10/12/2020-1/29/2021). Pre-post guide surveys contained 10 items with Likert-type ratings to describe participants' agreement with various statements about their telehealth-visit experience (5 = strongly agree, 0 = strongly disagree). Survey responses were analyzed separately for caregivers and providers.

**Results:** A total of 108/827(13.1%) pre-guide and 74/512 (14.5%) post-guide caregiver surveys were returned; 161/829 (19.4%) pre-guide and 76/512 (14.8%) post-guide provider surveys were returned. Independent samples t-test revealed significant improvements in pre-post guide caregiver experiences in the following five areas: preparedness for visit,  $F=10.959(180)$ ,  $p = 0.001$ ; receiving helpful information from the provider,  $F=7.517(180)$ ,  $p = 0.007$ ; understanding the plan of care,  $F=11.319(180)$ ,  $p < 0.001$ ; equipment working well,  $F=26.120(180)$ ,  $p < 0.001$ ; and overall experience with the visit,  $F=6.620(180)$ ,  $p = 0.011$ . Cohen's  $d$  effect sizes ranged from 0.787 to 0.984. Comparable provider data and qualitative analyses of parent and provider post-guide open-ended feedback are underway.

**Conclusions:** Providing families with written and pictorial information prior to telehealth visits may foster more positive experiences with telehealth. Results from providers will further elucidate utility of the guide. The nature of this QI study design and the dynamic context in which the guide was introduced limit definitive conclusions. Nevertheless, given the permanency of telehealth services, it is valuable to develop and evaluate supports that facilitate this form of clinical care.

**411.116 (Poster)** Investigating Autistic Adults' Preferences for the Social Model of Disability and Identity-First Terminology  
**T. Q. Boucher<sup>1</sup>, N. E. Scheerer<sup>2</sup>, P. Hood<sup>1</sup>, V. Ly<sup>1</sup>, H. Aime<sup>1</sup> and G. Iarocci<sup>1</sup>,** (1)Psychology, Simon Fraser University, Burnaby, BC, Canada, (2)Psychology, Western University, London, ON, Canada

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**Background:** Many autistic adults have advocated for autism to be viewed under the social model of disability, which states a person is disabled by their environment and its physical, social, and attitudinal barriers (Anderson-Chavarria, 2021). The medical model of disability is the dominant model for autism (Graby, 2016), where disability is seen as an individual problem caused by abnormalities, impairments, or deficits in one's body and/or brain. The medical model of disability is often viewed as stigmatizing by autistic individuals in that it over-pathologizes autistic traits (Woods, 2017). The medical model adopts person-first language, while the social model adopts identity first-language. Although previous research has indicated that autistic individuals prefer identity-first language, it is unclear how this preference relates to views about autism and autistic identity.

**Objectives:** Determine the model of disability that autistic adults prefer and how this relates to their views of autism.

**Methods:** Sixty autistic adults (33 women, 10 men, 10 non-binary/two-spirit/agender/gender-diverse, 7 non-disclosed;  $M_{age}=37.07$ ,  $SD=10.85$ ) were recruited through social media and completed the online study. The study was created by autistic and non-autistic researchers in consultation with eight autistic community members who provided input on question content, design, and accessibility. Participants completed the Autism-Spectrum Quotient (Baron-Cohen et al., 2001) and survey questions designed with autistic consultants. Using a slider from 0 to 100, participants indicated how much they agree with the medical and social model of disability, willingness to spend time with other autistic people, pride in being autistic, whether autism gives more challenges or strengths, the extent to which their challenges are due to autism or external barriers, and how much they would change about their autism. Definitions of the medical and social models of disability from Shakespeare (2006) were provided. Participants rated their preference for person-first and identity-first language on a 5-point Likert scale.

**Results:** Participants had an average AQ score of 37.20 ( $SD=7.26$ ). Thirty-three participants gave the social model of disability a rating of 100 (mean=75,  $SD=20.40$ ); no participants endorsed a preference for the medical model. Spearman correlations identified a positive relationship between preference for the social model of disability with participants' autistic pride, willingness to spend time with other autistic people, and the external attribution of the challenges they experience, and negatively with the desire to change anything about their autism (see Table 1). Preference for the social model of disability was negatively correlated with preference for person-first language and positively correlated with identity-first language.

**Conclusions:** There was a clear preference for the social model of disability in autistic participants. This preference is related to their sense of autistic pride, external attribution of challenges they experience, and endorsement of identity-first terminology to describe autism. These findings have implications for clinical practice; considering the high rates of loneliness and co-occurring mental health difficulties experienced by autistic individuals, it is critical that mental health professionals seek ways to cultivate connections and wellbeing in autistic clients. It may be that approaching care through the social model may represent one way that this can be achieved.

#### **411.117 (Poster) Language Interactions Among Bilingual Families and Their Children with ASD**

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##### **Background:**

Home language interactions are among the strongest predictors of young children's language and cognitive development. For multilingual families who rear neurodiverse children and who may be minoritized for their language use, limited research examines families' daily language interactions. Strong evidence exists for bilingual families to use their multilingual interactional resources to support their children's language development (Bialystok & Craik, 2010). Yet, children's language background is not always reported as an interacting factor, in developmental and intervention research (Byers-Heinlein et al., 2019; Huerta et al., 2021), reinforcing a pervasive deficit perspective favoring middle-class, monolingual language and cultural practices (Castro, et. al., 2021; Kay-Raining Bird et al., 2012). Developmentally appropriate, linguistically diverse, and culturally responsive early interventions that support the language diversity, the educational expectations, and the cultural practices of bilingual families and their autistic children are needed (Cohen et. al., 2020; DuBay et al., 2018; Stahmer et al., 2019).

**Objectives:** This study aimed to characterize the daily language practices of monolingual and bilingual Mexican heritage families and their autistic children.

##### **Methods:**

Six Mexican heritage, bilingual, families from low-income backgrounds, who reared an autistic child video recorded their language interactions during daily routines with their child over 10 days. See Table 1 for demographic information. There were 18 hours and 56 minutes of recordings from 171 videos (i.e. average length per video: 6.61 minutes). Video recordings were analyzed by activity settings, who was present during these activities, and the language used in the activities.

##### **Results:**

Families filmed an average of 34.2 videos over ten days (Range = 9-71). The most prevalent activity was adaptive caregiving (e.g., eating, preparing/serving food, brushing teeth, getting ready for school, asking questions about the child's school day) (70% of the activities;  $N=121$ ). Across all families, videos captured the target child 95% of the time ( $N=163$ ). The mother appeared in 50% of all videos ( $N= 85$ ). Siblings appeared in 47% of all videos ( $N=81$ ). Although all families reported Spanish as their primary language, three families recorded primarily Spanish interactions, whereas the other three recorded primarily in English (See table 2).

##### **Conclusions:**

Study families used English and Spanish during adaptive caregiving tasks throughout their day. Even though all study families reported being Spanish dominant, three families video recorded their interactions in English. It is possible that Spanish dominant families who video-recorded in English may have believed that they should be speaking English. Historically, families have been counselled away from using their dominant language for ASD interventions to "eliminate confusion" (Kay-Raining Bird, et al., 2012). Previous studies have shown that Latinx families accept the use of English only interventions despite initial resistance (Cioé-Peña, 2020). Few fathers were present during everyday language interactions. It is possible that families adhered to traditional gender roles and fathers were the sole breadwinners for their families. Targeted ASD interventions should be integrated into routine caregiving activities; mothers should be included in the implementation of ASD interventions, and these

interventions should be delivered in both English and Spanish.

**411.118 (Poster) Maternal Autism: Is Wellbeing Related to Autistic Camouflaging?**

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**Background:** Recent findings indicate that autistic mothers (including non-binary parents) may face additional challenges compared to their non-autistic counterparts (McDonnell & DeLucia, 2021). These challenges may present as difficulties maintaining social support, wellbeing, and ability to cope (Pohl *et al.* 2020). Autistic camouflaging is a social coping strategy which involves hiding autistic traits and altering behaviour to appear socially acceptable (Hull *et al.* 2017). Yet, this protective strategy may compromise effective communication with healthcare professionals. For instance, 80% of autistic mothers report fear of judgement if they disclose a formal or suspected diagnosis of autism and 40% report rarely or never disclosing their diagnosis (Pohl *et al.* 2020). Additionally, camouflaging has been shown to be implicated with mental wellbeing (Raymaker *et al.* 2020), which is impacted in autistic mothers (Acar, Slowinska, & Anns, 2021).

**Objectives:** The objective of this study was to investigate the possible link between autistic camouflaging and wellbeing in autistic and non-autistic mothers. Specifically, we expect to find that higher camouflaging scores will predict higher concurrent adverse wellbeing in autistic but not non-autistic individuals.

**Methods:** To date, 273 mothers and non-binary parents completed an online survey, self-reporting demographic information and autistic traits using the Social Responsiveness Scale-2, Revised Edition (SRS-2; Constantino & Gruber, 2012) (see Table 1). Group inclusion criteria for three groups was i) ASC: those who reported an autism diagnosis and scored above the t-score cut-off of 60 on the SRS-2; ii) SDA: those who self-diagnosed as autistic and also scored above 60 on the SRS-2; iii) Non-ASC: those who reported no formal or self-diagnosis of autism and who scored below 60 on the SRS-2. Participants completed the Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull *et al.* 2019) and the Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995).

**Results:** Mean scores on the DASS-21 and the CAT-Q were significantly higher in the autistic groups than the non-autistic group (DASS-21:  $F(2,270) = 29.04, p < .001$ ; CAT-Q:  $F(2,270) = 159.98, p < .001$ ). A significant correlation between mean scores on each measure was found in the ASC and SDA group, but not the non-ASC group. Regression analyses showed that CAT-Q scores could significantly predict concurrent DASS-21 scores in both autistic groups (ASC:  $F(1,120) = 4.72, p = .032$ ; SDA:  $F(1,92) = 31.35, p < .001$ ), but not in the non-ASC group ( $F(1,55) = 1.25, p = .268$ ). Most of the variance in the data was explained in the SDA group (SDA: 25.4%; ASC: 3.8%).

**Conclusions:** Our study confirms a link between autistic camouflaging and depression, anxiety, and stress in autistic mothers, both diagnosed and self-diagnosed. Both camouflaging and threat to wellbeing were also greater amongst autistic mothers. Taken together, these findings indicate a unique parenting experience in autism which could serve as important information to healthcare professionals to tailor specific support needs for this population.

**411.119 (Poster) Mental Health and Loneliness in Mothers of Autistic Children and Mothers of Children with Fragile X Syndrome during the COVID-19 Pandemic: Associations with Caregiver Burden and Social Support**

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**Background:** The COVID-19 pandemic brought about many stressful changes. Caregivers of autistic children worried about their child being out of school, were unable to receive interventions, and became more stressed (Soares *et al.*, 2021). These disruptions are also predictors of caregiver mental health (McMorris *et al.*, 2021). Mothers of children with other disabilities, such as fragile X syndrome (FXS), experienced similar struggles during the pandemic. Characterizing pandemic-related hardships, and their impact on maternal mental health and well-being, is important for developing family supports.

**Objectives:**

The questions the study addressed are as follows:

1. During the COVID-19 pandemic, did mothers of autistic children, mothers of children with FXS, and mothers of typically developing (TD) children differ in depression and anxiety symptoms, loneliness, social support, perceived decline in mental health due to the pandemic, and increased caregiver responsibilities due to the pandemic?
2. Did caregiver burden and social support during the pandemic predict mental health and well-being across mothers of children with autism, FXS, or TD?

**Methods:** Participants were mothers of autistic children ( $n=39$ ), mothers of children with FXS ( $n=54$ ), and mothers of TD children ( $n=57$ ). The mean age of the mothers was 45 years, with similar ages across groups ( $p=.420$ ). Data collection spanned 8/2020-10/2021 during the COVID-19 pandemic. Mothers completed questionnaires tapping loneliness (UCLA Loneliness Scale), anxiety (Beck Anxiety Inventory), depression symptoms (Beck Depression Inventory-II), and social support (Duke Social Support Scale). Participants also indicated on a 7-point scale how true the following statements were: "The COVID-19 pandemic has impacted my psychological health negatively" and "The COVID-19 pandemic has increased my caregiving responsibilities". A series of general linear models were conducted to test group differences. A multivariate model was used with



caregiving burden, diagnosis, and their interaction as predictors of loneliness, anxiety, depression, and decline in mental health (model 1) and then added social support as another predictor (model 2).

#### Results:

Mothers of autistic children reported higher levels of loneliness compared to both mothers of children with FXS and TD ( $p's < .015$ ). They also reported higher depression symptoms ( $p = .002$ ) and lower social support ( $p < .001$ ) compared to mothers with TD children, however, they did not differ from mothers of children with FXS on those measures ( $p's > .053$ ). In all groups, increased caregiving responsibilities during COVID-19 was associated with self-reported decline in mental health ( $p < .0001$ ), increased anxiety symptoms ( $p = .018$ ), and loneliness ( $p = .028$ ). In mothers of autistic children, increased caregiving responsibilities also predicted depression ( $p = .041$ ). When social support was added into the model it was a strong predictor for all outcome variables except for anxiety, regardless of group (all  $p's < .021$ ); more social support was associated with better mental health and well-being.

#### Conclusions:

Regardless of child's diagnosis, increased caregiving burden negatively impacted mothers' mental health and well-being during the pandemic, with social support playing a protective role. However, mothers of autistic children reported significantly lower levels of social support. Future research could look at barriers to access to social support for mothers of autistic children and potential interventions and resources, such as telehealth therapies, that could be helpful.

**411.120 (Poster)** Mental Health of Mothers and Fathers of Autistic Children during the COVID-19 Pandemic  
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**Background:** Parents of autistic children generally experience increased levels of stress and mental health problems compared to parents of children without a disability. Families were affected by the COVID-19 pandemic as parents adopted new roles, such as teacher, while continuing to balance their roles as employees, parents, and spouses. Indeed, COVID-19 stressors have been connected to high parental stress in families of neurotypical children (Brown et al., 2020). Parents of autistic children face additional stressors as their child's therapy services were shut down.

**Objectives:** This longitudinal study examined the extent to which pandemic-related experiences within the family, such as increased parental responsibility, were related to mental health outcomes for mothers and fathers of autistic children from April to October 2020.

**Methods:** This study is part of a larger, longitudinal study of families of children with ASD that started prior to the COVID-19 pandemic. Parents were contacted to complete an online survey three times (April, July, and October 2020); 93 families completed at least one survey. The surveys assessed parenting experiences during the pandemic as well as stress, anxiety, and depression.

**Results:** A series of paired t-tests were conducted to examine differences between mothers and fathers at each time point. At each time point, mothers reported significantly greater parenting responsibilities, anxiety, depression, and stress compared to fathers. Separate hierarchical linear models were performed to examine changes from April to October 2020. For mothers, there were no significant changes across time for any of the variables. Mothers consistently reported above average levels of anxiety, stress, and depression. Fathers generally reported below average levels of depression and stress, and these remained consistent over time. Levels of anxiety, however, were slightly above average, but decreased across time.

**Conclusions:** Our results suggest that mothers were more adversely impacted during the COVID-19 pandemic compared to fathers. Mothers reported significantly more parenting responsibilities, and these remained elevated even as lockdowns eased and schools reopened in our community. Mothers' levels of anxiety, depression, and stress were higher than normed averages and they remained elevated throughout the study. Fathers were less impacted by the pandemic; however, their levels of anxiety significantly declined as lockdowns eased. In the community, by the end of the study (October 2020) all businesses had resumed nearly normal operations and schools were reopened. It appears fathers were benefiting from these changes, whereas mothers were not. The findings have implications for the development of services directed to families of children with ASD. For example, focusing on parent mental health and assisting with parenting responsibilities (e.g., remote respite care) may benefit both parents and their children.

**411.121 (Poster)** Now What?: First Actions Taken By Parents after an Autism Diagnosis.  
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**Background:** Parent reactions to their child receiving an autism diagnosis can be positive depending on their own background and the effectiveness of the provider's delivery of the information. Nonetheless, many parents often feel alone in navigating resources post-diagnosis.

**Objectives:** To examine the first actions taken by parents immediately following an autism diagnosis feedback session with their provider. Understanding how parents receive and process information from the feedback session will inform providers' approaches for delivering an autism diagnosis to families. Results from this study can be used to optimize supportive and psychoeducational resources for families.

**Methods:** Parents of children diagnosed with an autism spectrum disorder within the previous three years were recruited from autism-related service organizations and community groups around the United States to complete a survey regarding the feedback session where their child's diagnosis was

disclosed to them. 189 children with an autism spectrum diagnosis were included in the study (145 male) with an age range from 1 to 28 years old (mean = 4 years old). 90.5% of survey respondents identified as the mother of the child. Parents were asked to describe the first thing they did following the diagnosis, to help their child and/or to help themselves.

**Results:** Five parents indicated that they did nothing different following the diagnosis. The remaining 184 answers fell into or blended across several broad themes including: a) seeking additional information about the diagnosis; b) starting the process of seeking services for their child; c) taking steps to support their child at home; d) processing their own thoughts and feelings; e) seeking support for themselves as parents. Overall, 41% of parents report seeking informal social support first, with 73% accessing informal social support at some point. Approximately 72% of parents eventually accessed information on websites that they found on their own, while only 50% accessed information on websites recommended by their provider. Many families reported that the first thing they did after leaving the session was to cry, then went and did another initial task, such as seeking services for their child or support for themselves. Often many of these tasks were initiated at about the same time. About half of parents stated that the first thing they remember doing was seeking services for their child. Many families noted that the first thing they did to help their child was at home such as implementing new strategies into their daily routines including schedules and/or rewards.

**Conclusions:** Many parents are likely to seek out information on their own and would benefit from direction from their providers about reliable sources of information that address their child's needs. Additionally, providers should incorporate emotional support for parents in their feedback plan. Tailored recommendations during the feedback session, specific to the needs of each child and family, provide a solid foundation for parents to build on after hearing the diagnosis.

**411.122 (Poster)** Parent Perceptions about the Academic, Literacy, Social, and Behavioral Development of School-Age Children with Autism during COVID-19: A Latent Profile Analysis

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**Background:** The COVID-19 pandemic disrupted educational services for children across the United States, with emerging evidence highlighting the loss of clinical and educational services and supports for school-age children with autism spectrum disorder (ASD). The effects of the pandemic on learning and development in children with ASD is just now being understood, and approaches are needed to examine such impacts in broad academic development, areas of common challenge for children with ASD (e.g., literacy skills like reading and writing), social, and behavioral development.

**Objectives:** To examine latent profiles of parent perceptions about their child's academic, literacy, social, and behavioral development as measured in reference to three timepoints (TPs): 1) 2019-2020 School Year Prior to COVID-19 (5/2019-3/2020), 2) Initial COVID-19 Disruption (3/2020-8/2020), and 3) 2020-2021 School Year (8/2020-5/2021).

**Methods:** This is an online survey study that recruited participants from the Simons Foundation Powering Autism Research initiative, a national database of families and individuals with verified ASD diagnoses. Current analyses include perspectives from 350 parents and caregivers of a K-6<sup>th</sup> grade children (age=7.99[1.91], 31% non-white) with ASD (ages at pandemic onset). Participants completed questions that asked about their agreement to the statement, "I believe my child is making general progress in their [skill]", with skill representing academic, reading, and writing achievement as well as social and behavioral development. Parents rated their agreement using a Likert scale (0 = *Strongly Disagree*, 5 = *Strongly Agree*) for each skill for each TP. Latent profile analysis was used to examine for the presence of underlying, multivariate profiles based on patterns of participant responses across Likert items. Profiles were fit sequentially until model estimation failed, and selection of final models was based on theoretical support as well as multiple model fit indices.

**Results:** TP1 responses endorsed a 3-profile model: 1) *Agree/Strongly Agree Overall* (46%); 2) *Somewhat Agree/Disagree Overall* (43%); and 3) *Disagree/Strongly Disagree Overall* (11%). TP2 responses endorsed a 3-profile model: 1) *Agree Academics, Somewhat Agree Social and Behavioral* (23%); 2) *Disagree Overall* (40%); and 3) *Strongly Disagree Overall* (38%). TP3 responses endorsed a 3-profile model: 1) *Strongly Agree/Agree Academics, Somewhat Agree Social and Behavioral* (44%); 2) *Somewhat Agree/Disagree Overall* (39%); and 3) *Disagree/Strongly Disagree Overall* (17%).

**Conclusions:** Findings highlight a consistent three-profile model fitting best across all TPs. However, the profiles differed across TPs in agreement ranges and group membership. TP1 highlighted overly positive responses in general, with only 11% of responses disagreeing about their child showed general progress across items. TP2 highlighted a large drop in agreement across profiles and a much larger percentage of respondents endorsing negative perceptions. TP3 highlighted more hopeful responses similar to TP1 but with lower agreement in general more similar to TP2. Furthermore, a higher percentage of participants endorsed overall disagreement relative to TP1. Findings suggest a general negative perception to the COVID-19 educational disruption but suggest that parents were more hopeful about their child's development during the subsequent school year. Implications will be discussed in line with future research concerning academic, social, and behavioral development.

**411.123 (Poster)** Parent Stress, Emotion Dysregulation, and Depression in Parents of Children with Autism and Intellectual Disabilities during the Covid-19 Pandemic: A Mixed-Method Analysis

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Background:

Parents of children with autism spectrum disorder (ASD) have reported increased stress and anxiety during the Covid-19 pandemic (Yilmaz et al., 2021; Brown et al., 2020). Even prior to the pandemic, research suggests that mothers of youth with ASD and Down Syndrome demonstrate elevated rates of depression and parenting stress (Davis & Carter, 2008; Singer, Ethridge, & Aldana, 2002; Tekinarslan, 2013) when compared to mothers of typically-developing (TD) youth. Mothers also report more depressive symptoms than fathers (Hastings et al., 2005). Research also suggests that child behaviors may particularly increase parental stress (Hastings, 2003). Therefore, understanding factors that contribute to increased parental stress and psychopathology is especially crucial during the pandemic. Preliminary research also suggests racial/ethnic differences in family experiences during the pandemic (CDC, 2020), specifically minorities being impacted most by the health disparities (Hooper et al., 2020). It is important to contextualize these relations by identifying struggles that parents face is crucial for providing support that enhance well-being of families affected by ASD during the pandemic.

#### Objectives:

This mixed-method study assessed (1a) racial and gender differences in mental health among parents of children with developmental and intellectual disabilities (DD/ID), and (1b) the impact of child maladaptive behaviors on parent psychopathology during the Covid-19 pandemic, and (2) to qualitatively assess the main areas of struggle for parents and the potential mechanisms of supportive interventions.

#### Methods:

Forty parents (87.5% female; 60% non-white; 80% ages 35-54) of children with DD/ID (72.5% ASD; 10% Down Syndrome;  $M_{age}=11.60$ ,  $SD_{age}=5.62$ ; 77.7% male) participated in this study. Parents completed a measure of parental depression (BDI-II; Beck, 1996), parental emotion dysregulation (DERS; Gratz and Roemer, 2004), and parenting stress (PSI-4-SF; Abidin, 1995), as well as child's internalizing and externalizing behaviors (Maladaptive Behavior domain from the VABS-III; Sparrow et al., 2016). Quantitative analyses included a two-way ANOVA to examine differences in parent psychopathology by race and gender. Multiple regression examined if child maladaptive behaviors predicted parental stress, depression, and emotion dysregulation. Qualitative analyses included coding responses to open-ended questions (e.g. "What is the greatest struggle for you with your child's diagnosis during the pandemic?") to assess the perceived causes of stress and parent needs.

#### Results:

Quantitative analyses revealed an interaction between gender and race for BDI-II and DERS ( $F>4.08$ ,  $p<.05$ ) such that non-white males and white females reported higher parental BDI-II and DERS (Figures 1 & 2). Qualitative analyses revealed main areas of struggle as lack of emotional/social support, parenting needs of other children, child behaviors, and managing child's treatments.

#### Conclusions:

Our mixed-method approach indicate racial and gender differences in parental psychopathology, and identified predictors such as child maladaptive behaviors and lack of support. These findings highlight the importance of addressing emotional and behavioral problems in children with DD/ID, and considering demographic factors and other areas of perceived challenges of parents in supporting parental mental health during these challenging times.

#### **411.124 (Poster)** Parent-Reported Impact of the COVID-19 Pandemic on Autistic Traits and Mental Health Symptoms in Children and Adolescents with ASD

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**Background:** On the 11th of March 2020, the COVID-19 outbreak was officially declared a pandemic. Some groups may be identified as vulnerable; for example, children and adolescents and individuals with pre-existing mental health issues, such as autism. Simultaneously, it seems that some individuals with ASD may actually benefit from the restrictions imposed. The pandemic presents us with a unique opportunity to look at the impact of a collective major life event on children and adolescents with ASD. This will better our understanding of the possible impact other (major) life events may have, help identify risk and protective factors, and inform policies and interventions. Most early studies lack a pre-COVID-19 measurement making it more difficult to indicate the impact of COVID-19 and the restrictions that coincide with it.

**Objectives:** The aim of the current study was to examine the short-term and longer-term effects of the pandemic on children and adolescents with ASD from pre-COVID-19 to during COVID-19, with a focus on emotional and behavioral problems and autistic symptoms. In addition, we aim to identify risk and protective factors (e.g., age, gender, and IQ).

**Methods:** In collaboration with three mental healthcare institutions specialized in autism in the region of Rotterdam all families who received care in the year prior to the pandemic were invited to partake in the current study (n=200). T0 (pre-COVID-19; 03/2019-03/2020) and T1 (2<sup>nd</sup> lockdown, 01/2021-05/2021) is available on a subset of parents/caregivers of children and adolescents with ASD (N = 55). T2 (lenient/less restrictive period;

09/202112/2021) data is currently being collected to assess long-term impact. Participants completed the Child Behavior Checklist; CBCL (i.e., the Brief Problem Monitor- Parent Form; BPM-P) and the Social Responsiveness Scale (SRS-2) at T0, T1, and T2.

**Results:** Final data collection is currently ongoing. Preliminary results indicate an overall group effect with an increase in emotional and behavioral problems from T0 to T1. Interestingly, when taking gender into account, females report less anxiety and depression complaints at T1 compared to T0, while males report more anxiety and depression complaints at T1 compared to T0. No change in autistic symptoms were identified from T0 to T1 on a group level. Results regarding CBCL and SRS comparing T0 vs T1 vs T2 are expected early 2022.

**Conclusions:** The COVID-19 pandemic has a unique effect on children and adolescents with ASD. Final results regarding the short- and long-term impact of the COVID-19 pandemic with regard to autistic symptoms and on emotional behavioral problems comparing T0 vs T1 vs T2 are expected by early 2022.

**411.125 (Poster)** Parent-Sibling Communication and Mental Health in Siblings of Children with Autism Spectrum Disorder Compared with Physical Disabilities

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**Background:** Siblings of children with autism spectrum disorder (ASD) are at higher risk of mental health difficulties compared with the general population and siblings of children with other intellectual and developmental disabilities. However, it is unclear whether they are at higher risk of mental health difficulties compared with siblings of children with physical disabilities. Furthermore, open and supportive parent-sibling communication has been proposed as a protective factor for mental health difficulties in siblings of children with physical disabilities but few studies have examined the relationship between parent-sibling communication and mental health difficulties in siblings of children with ASD.

**Objectives:** To compare the levels of mental health difficulties and parent-sibling communication across siblings of children with ASD, siblings of children with physical disabilities, and typically developing (TD) controls, and to examine the relationship between parent-sibling communication and mental health difficulties in siblings of children with ASD.

**Methods:** The sample comprised siblings of children with ASD (n=47), physical disabilities (n=42), and TD controls (n=44) between 8 and 16 years of age. We used a multi-informant approach where children and their mothers and fathers reported on sibling mental health using the Strengths and Difficulties Questionnaire (SDQ) and children reported on parent-child communication using the Parent-Child Communication Scale (PCCS). Data were analyzed using analysis of variance (ANOVA) with Fisher post-hoc tests and Pearson's correlation coefficient.

**Results:** There were significant differences between the three groups in both sibling-reported internalizing and externalizing difficulties ( $p \leq .007$ ), father reported internalizing and externalizing difficulties ( $p \leq .019$ ), and mother reported internalizing and externalizing difficulties ( $p \leq .003$ ). Siblings of children with ASD had more internalizing difficulties according to both child-, mother-, and father-report ( $p \leq .006$ ; Hedges  $g = .65-.94$ ) and more externalizing difficulties according to child- and father-report ( $p \leq .008$ ; Hedges  $g = .65$ ) compared with controls. Siblings of children with ASD also reported poorer mother-sibling ( $p = .021$ , Hedges  $g = -.56$ ) and father-sibling communication ( $p < .001$ ; Hedges  $g = -.92$ ) compared with controls. There were no significant differences between siblings of children with ASD and siblings of children with physical disabilities. Mother-sibling communication correlated significantly negatively with mother-reported externalizing difficulties ( $r = -.39$ ,  $p = .020$ ) and father-reported externalizing difficulties ( $r = -.47$ ,  $p = .018$ ).

**Conclusions:** Sibling of children with ASD and siblings of children with physical disabilities seems to be at equal risk of mental health difficulties and poor parent-sibling communication. Parent-sibling communication seems not to be a general protective factor of mental health difficulties in siblings of children with ASD but rather mother-sibling communication is limited to a protective factor against externalizing difficulties. This study highlights the importance of providing supportive interventions for siblings of children with ASD and suggests that targeting parent-sibling communication may not be the most effective approach.

**411.126 (Poster)** Parent-to-Parent (P2P) As an Intervention Delivery Model: A Scoping Review

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**Background:**

Parents of children with autism have often reported feelings of isolation and increased stress after receiving their child's diagnosis. Increasing global prevalence of autism calls for increased services and supports to meet the needs of children with autism and their families. This may also indicate the need for diversifying intervention delivery models to increase contextual fit and enhance implementation effects for different populations. Many parents of children with autism have reported parent-to-parent (P2P) model to be a source of emotional support, advocacy, and knowledge related to their child's diagnosis, and practical advice.

**Objectives:**

P2P intervention model may be especially relevant in low resource settings across the world where parents of children with autism are reported to experience inequitable access to resources and evidence-based interventions (EBI). However, there have been little efforts to examine the evidence of benefits of P2P, and there is no literature synthesizing the evidence of P2P intervention model even though this could potentially be beneficial to

many families in various low-resource settings. Therefore, the purpose of this review was to scope the evidence of the use of P2P model among parents of children with autism.

## Methods:

In this review, we conducted a systematic search process by referring to the PRISMA checklist. The initial search yielded a total of 631 articles. After screening, a total of 33 articles were selected for full-text review, and 23 articles were then selected for inclusion. We then created an online coding form that included demographic information, type of study, modality and type of intervention, dosage, target outcomes, and social validity.

## Results:

Two researchers independently coded half of the 23 total articles using the online coding form, and another independent researcher coded 38% of the 23 articles for reliability. The findings revealed that in about half of the studies included mentor-mentee system where parent mentors disseminated information about EBI or advocated for the mentees. The other half of the studies included support groups to primarily provide emotional support for other parents. Social validity data across the 23 studies revealed that most parents found the mentor-mentee system and the support group to be feasible, acceptable, and effective while some parents preferred receiving support from professionals.

## Conclusions:

Given the heterogeneity of its use, P2P intervention model poses itself as an innovative intervention delivery model, which researchers may use to disseminate information about EBP and mitigate the inequitable access to EBP. As the evidence shows that parents of children with autism may benefit from a P2P model, it is crucial to examine the mechanisms to support marginalized and minoritized parents through this model. For example, parents of children with autism who live in low-resourced communities and are experiencing limited access to EBP may especially benefit from such intervention model. There are also implications for future research on adapting this intervention delivery model to disseminate EBP with minoritized and marginalized families of children with autism.

### 411.127 (Poster) Parents' Perceptions of Genetic Testing for Their Children with Autism: What Factors Make a Difference?

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**Background:** Strong evidence points to the role of genetic factors in the development of autism spectrum disorder (ASD), and genetic testing can provide insights on genetic contributions to ASD symptoms and guide subsequent medical care and family planning decisions. As such, the American College of Medical Genetics recommends genetic testing be offered to everyone with an ASD diagnosis. Yet not all families follow through on genetic-testing referrals. While reasons for poor follow-through on referrals vary (e.g., lack of insurance coverage/high costs of testing, parents' limited knowledge about processes and purposes, perceptions about the utility of genetic testing), it is unclear whether and how income and parents' perceptions of their child's ASD influence their opinions about genetic testing, which ultimately influences whether they complete recommended genetic testing.

**Objectives:** To ascertain (a) whether parents' etiological beliefs about ASD influence their perceptions of genetic testing; (b) whether parents' attributions of ASD-related symptoms influence their perceptions of genetic testing; and (c) whether differences in parents' perceptions of genetic testing (i.e., their causal beliefs of their child's ASD and their attributions of ASD-related symptoms) and income affect genetic testing completion.

**Methods:** Parents of children with ASD aged 12 years and younger were recruited from the Simons Foundation Powering Autism Research Knowledge (SPARK) Research Match (RM) program. Parents completed a series of questionnaires about their demographics, experiences with genetic testing, and the *Revised Illness Perception Questionnaire for Autism Spectrum Disorder* (IPQ-R-ASD), a measure of attributions related to ASD.

**Results:** 231 parents have completed the survey at the time of abstract submission, with data collection ongoing. Our sample is socioeconomically diverse with regard to income (e.g., 44% reported annual household income below the U.S. median). Participants were recruited using purposeful sampling, resulting in a relatively equal number of participants who did and did not complete genetic testing. Almost all (90%) parents expressed interest in genetic testing; however, only 137 (59%) reported their child actually received genetic testing after receiving a referral. Based on IPQ-R-ASD results, parents endorsed varied etiological beliefs related to their child's ASD on the Causal scale (e.g., genetics, stress at birth, will of God, vaccines), as well as several symptoms they attributed to their child's ASD on the Identity scale (e.g., behavioral dysregulation, social interaction difficulties, repetitive behaviors, withdrawal). Chi-squared tests of independence will permit exploration of relationships between (a) ASD etiological beliefs and positive/negative perceptions about genetic testing; and (b) observed symptom attribution and genetic testing perceptions. Forthcoming binomial logistic regression analyses will be conducted to model the relationship between the predictor variables (opinions about genetic testing, causal attributions, observed symptom attribution, income) and completion of genetic testing.

**Conclusions:** Results of this study will contribute novel insight into the relationship between parents' perceptions about ASD and their receptivity to genetic testing, as well as the influence socioeconomic factors may have upon differences in these relationships. Such results can inform providers' knowledge of parental decision-making regarding genetic testing, ultimately equipping them to better support families raising children with ASD.

### 411.128 (Poster) Effects of Anxiety and Social Impairment on Quality of Life in Autistic Children

## Background:

Quality of life (QoL), or an individual's subjective perception of their personal well-being across multiple domains, has been shown to be diminished for children on the autism spectrum. Greater severity of core autism symptoms is associated with reduced quality of life in both children and adults. Additionally, approximately 40% of ASD youth are affected by anxiety, which can further reduce quality of life. However, few studies have examined the impact of co-occurring psychopathology on QoL within ASD youth. Examining how autism and anxiety interact can inform targeted treatments and clinical care for an improved quality of life in autistic individuals.

## Objectives:

To examine the associations between quality of life and social impairment in children with ASD with co-occurring anxiety disorders.

## Methods:

Subjects included 82 children years 8-15 with ASD and comorbid anxiety disorders ( $M=11.45$ ,  $SD=1.79$ ; 63 boys, 19 girls). ASD diagnosis was confirmed using the ADOS-2 and ADI-R. Co-occurring psychopathology was assessed using the Anxiety Disorders Interview Schedule based on DSM-5 criteria. Quality of life was assessed using the parent report of the Pediatric Quality of Life Inventory 4.0 (PedsQL), which has excellent reliability and validity in autistic youth. The Social Responsiveness Scale Second Edition (SRS-2) was used as a measure of core ASD symptoms. The parent-report of the Multidimensional Anxiety Scale Second Edition (MASC-2) was used as a measure of anxiety symptoms. Multivariate regression models were conducted in R in which the severities of anxiety (MASC-2 total score) and ASD (SRS-2 total score) symptoms were modeled as continuous variables with QoL (PedsQL total score). Analyses controlled for age, IQ, and emotion control (Emotion Regulation Index scale, BRIEF-2). Given the developmental impacts of social functioning and emotional control on QoL, age-related effects were tested using SRS-2-by-age and MASC-2-by-age interactions.

## Results:

Significant negative correlations were found between total MASC-2 and PedsQL scores ( $r=-0.4$ ,  $p=0.00025$ ) and total SRS-2 and PedsQL scores ( $r=-0.39$ ,  $p=0.00037$ ) (**Figure 1**). Post hoc tests showed that these correlations were consistent across all PedsQL subscale domains (emotional, school, social, and physical functioning). Multivariate linear modeling analyses showed SRS-2 as a significant predictor of QoL across all domains with a significant interaction with age ( $\beta=-1.8$ ,  $t=-2.5$ ,  $p=0.01$ ). No significant interaction of age was observed between anxiety symptoms and QoL ( $\beta=0.22$ ,  $t=0.3$ ,  $p=0.76$ ). Supplemental analyses of the SRS-2-by-age interaction found that for older autistic children ( $\geq 12$  years of age), greater social impairment was associated with reduced QoL ( $p<0.0001$ ) but not for younger autistic children ( $<12$  years,  $p=0.7$ ) (**Figure 2**). Post hoc tests further showed that this interaction (SRS-2-by-age) was driven by the SRS-2 Social Communication and Interaction subscale, which measures social impairments, but not the Restricted Interests and Repetitive Behavior subscale.

## Conclusions:

These findings demonstrate that while anxiety contributed to reduced QoL across all ages in autistic children, social impairment indexed by SRS-2 contributed to reduced QoL only in older but not younger children. For older autistic children, social cognitive impairment may reduce QoL by hindering development of age-appropriate social perception abilities or by increasing awareness of social deficits.

### 411.129 (Poster) Stakeholder Opinions on Neurodiversity and Autism Intervention

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**Background:** The neurodiversity movement (NDM) is intensely controversial, a situation arguably exacerbated by confusion over its meaning. Some claim the NDM rejects all supports (e.g., Jaarsma & Welin, 2012), whereas others suggest the NDM encourages environment-focused supports and allows some individual-focused intervention (e.g., Chapman, 2021).

**Objectives:** This study aims to clarify opinions of NDM supporters and opponents, so that future debate can avoid exchanges based on false premises.

**Methods:** 501 autism stakeholders – 275 autistic adults, 159 parents (51 autistic), 75 other family members (44 autistic), 120 professionals (33 autistic), and 100 researchers (41 autistic) – completed an online survey.

NDM support was measured using 5 items (e.g., “I’m glad to be a supporter of the neurodiversity movement”) adapted from Nario-Redmond et al. (2013).

The 35-item Autism Intervention Attitudes Scale (AIAS) measured perceived appropriateness of intervention targets. Principal axis exploratory factor analysis suggested 5 factors (normalization, adaptive skills, well-being, societal reform, and supportive environments).

Participants were asked questions about whether disability-related challenges were personal or environmental (causal attributions), and whether intervention should focus on the person or the environment. Some questions were abstract (2x2 within-subjects: with/without co-occurring intellectual disability (ID), children/adults) and others followed six concrete vignettes describing specific situations (2x2 between-subjects: with/without co-occurring ID, highlighting/not highlighting environmental barriers).

Results: NDM support was elevated among autistics,  $p=.001$ , Cliff's  $\delta=.17$ .

NDM support negatively predicted endorsement of normalization, Spearman  $\rho=-.40$ , and adaptive skills goals,  $\rho=-.30$ ,  $ps<.0001$ , but was positively associated with approval of societal reform,  $\rho=.37$ , supportive environments,  $\rho=.35$ ,  $ps<.0001$ , and well-being,  $\rho=.10$ ,  $p=.02$ .

Self-identification as autistic negatively predicted support for normalization  $\delta=-.54$ , adaptive skill  $\delta=-.53$ , and wellbeing interventions,  $\delta=-.17$ , but positively predicted endorsement of supportive environments,  $\delta=.25$ ,  $ps<.0001$ . Autistic/non-autistic differences on societal reform were nonsignificant,  $p=.07$ ,  $\delta=.09$ .

In abstract questions, childhood/adulthood did not affect intervention preferences,  $p=.61$ , but participants were *less* likely to prefer person-focused interventions for autistic individuals with ID,  $p=.03$ . In concrete vignettes, ID did not influence intervention preferences,  $p=.58$ .

Respondents focused more on the environment (vs. the individual) in their *causal attributions* than in their *intervention preferences* in concrete vignettes,  $p<.0001$ , though not in abstract questions,  $p=.09$ . The magnitude of this effect grew as NDM support increased,  $p<.0001$ .

Conclusions: Autistic participants supported NDM only slightly more strongly than non-autistic respondents. Both groups were equally supportive of societal reform, but autistics more strongly opposed normalization. NDM supporters showed reduced endorsement of normalization or adaptive skills goals (i.e., changing individuals), but support for adaptive skills was higher than for normalization (see table).

Respondents viewed environment-focused interventions as relatively *more* useful for individuals with co-occurring ID, challenging the presumption that the NDM is inappropriate for people with ID.

Respondents – especially NDM supporters – appeared to believe person-focused interventions can sometimes be appropriate even when environmental barriers are the cause of challenges. This could imply greater potential for NDM supporters and opponents to find common ground on practice; however, NDM supporters' pragmatism in adopting individual solutions for societal problems suggests the enormity of social ills affecting the autism community.

#### **411.130 (Poster)** The Broader Autism Phenotype and Young Adults' Perceived Barriers to Education and Employment: The Moderating Role Parent and Sibling Dynamics

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##### **Background:**

Research highlights that young adults with autism face significant challenges in obtaining higher education (e.g., Bakker et al., 2019) and employment (e.g., Chen et al., 2015). Based on these associations, young adults with autism may perceive greater barriers to education and employment. It may be characteristics of autism that drive these patterns rather than the diagnosis itself. Parents and siblings can play an important role in helping young adults achieve successful markers of development (e.g., Jensen et al., 2018) such as education and employment. It is possible that parent and sibling relationship dynamics may mitigate or enhance the possible links between characteristics of autism and perceived barriers to education and employment.

##### **Objectives:**

The current study extends this literature and examines the link between characteristics of autism and marked by the broader autism phenotype (BAP) and young adults' perceived barriers to education and employment. Additionally, we examined how siblings may potentially mitigate or enhance these links through sibling support and perceived parental favoritism.

##### **Methods:**

Data come from 738 young adults living in the United States, surveyed via Amazon Mechanical Turk. Participants ranged between 18 and 29 years old ( $M\ age = 25.40$ ,  $SD = 2.53$ ). The sample was mostly female (57%) and Caucasian (73%). Participants reported on their own BAP characteristics using the Autism Spectrum Quotient questionnaire (Baron-Cohen et al., 2001), perceived parental favoritism, support received from a sibling, perceived barriers to education, and perceived barriers to employment.

##### **Results:**

Analysis was conducted in separate hierarchical regression models for each dependent variable: perceived barriers to education and perceived barriers to employment. In the first step we included demographics (of the parent and participating young adult), sibling structural factors (e.g., age spacing, birth order, sex composition), support received from a sibling, perceived maternal favoritism, perceived paternal favoritism, and their BAP characteristics.

Results for barriers to education and employment revealed (see Table 1) that young adults' BAP characteristics were positively associated with perceived barriers to education and employment. In both models, this effect was qualified by an interaction with maternal favoritism (see Figure 1). For young adults who believed that they were not favored by their mother, there was no association between BAP characteristics and perceived education or employment barriers. For young adults who believed they were their mothers' favorite, BAP characteristics were positively linked with perceived barriers to education ( $b = .05$ ,  $se = .01$ ,  $p < .001$ ) and employment ( $b = .06$ ,  $se = .01$ ,  $p < .001$ ).

## Conclusions:

Overall, these results suggest BAP characteristics are linked to the perception of greater barriers to education and employment. Young adults with more characteristics of autism believe that it will be harder for them to gain an education and be employed in work they would like to do. Parents may play a role in this process as the link between BAP characteristics and perceived barriers may be stronger for those who believe they are favored by their mother.

### 411.131 (Poster) The Experience of Parents of Children with Neurodevelopmental Disorder during the First Wave of COVID-19 Pandemic: Preliminary Quantitative and Qualitative Cross-Cultural Findings

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**Background:** Parenting a child with neurodevelopmental disorder (NDD) may have entailed additional challenges during the first wave of COVID-19 pandemic due to the sudden changes in family routines and the suspension of support from school and healthcare services. Although recent findings on this topic documented higher levels of parental burden, the role of culture and other potential predictors of parental stress in families of children with NDD remains poorly understood. Moreover, quantitative findings have been focused on negative aspects related to the pandemic, and little is known about potential family resilience factors associated with the experience of home confinement.

**Objectives:** The current study examined factors associated with parental stress during the first wave of pandemic in Italian, Spanish and American families of children with NDD. Specifically, we tested the predictive role of culture as well as the effect of parent, child, and contextual dimensions on parental stress. Second, for a better understanding of family adjustment we qualitatively explore parental responses about their experience of COVID-19 home confinement with their child.

**Methods:** Parents ( $N = 143$ ) of children with NDD aged from 3 to 17 years old from Italy ( $n = 85$ ) Spain ( $n = 27$ ) and United States ( $n = 31$ ) completed an online survey during the first wave of the COVID-19 pandemic. Data on sociodemographic characteristics, parental stress and mental health, child externalizing behaviors and contextual variables were collected using an online cross-sectional survey. In addition, a specific open question on parenting a child with NDD during the home confinement was qualitatively assessed through content analysis.

**Results:** Parents reported higher level of parental stress during home confinement compared to the period before COVID-19 home confinement ( $p < .05$ ) regardless of culture. No effect of culture was found in determining parental stress levels during COVID-19. By contrast, child age, parent mental health, child externalizing behaviors and pre-COVID-19 levels of parental stress emerged as significant predictors of parental stress during the pandemic. ( $p < .05$ ). Qualitative analysis showed that beyond negative aspect such as the perceived lack of support, the psychological and relational difficulties, parents also acknowledged the opportunity of spending more time with their children reporting higher parental self-efficacy and adaptive attitudes.

**Conclusions:** Our findings suggest paying great attention to families of children with NDD that undergo home confinement planning specific support intervention for parents and children. Ensuring continuity of care for children with NDD by activating telehealth interventions during period of lockdown and restrictions is of primary importance. Resilience factors in families of children with NDD should be also considered to tailor personalized intervention in case of future pandemic outbreaks.

### 411.132 (Poster) The Impact of the COVID-19 Pandemic on Caregivers of Autistic Children

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**Background:** Given the unprecedented nature of the COVID-19 pandemic, autistic individuals and their families faced a host of challenges. Caregivers adjusted to these changes while fulfilling a multitude of caretaker roles to help their children cope with the "new normal". Caregiver stress levels increased during this time as many felt they were unable to meet the overlapping needs of both work and homelife (Waite & Creswell, 2020). Due to the uncertainty of the pandemic, routines were greatly disrupted for autistic individuals and their families who tend to rely on



structured routines to adapt to unpredictability and change (Sethi et al., 2019). Therefore, familial stress and mental health concerns for both caregivers and children increased during this time (Westrupp et al., 2015).

**Objectives:** Using a qualitative approach, we explored the impact of the COVID-19 pandemic on caregivers of autistic individuals (ages 10 to 17 years). Through examining the mental health and well-being of caretakers of autistic children, we hoped to gain a greater understanding of how to effectively support vulnerable families through times of crisis.

**Methods:** A subset of caregivers drawn from the larger Project BIDD study (Bodfish et al., 2021; Jones et al., 2021) were invited to take part in a follow-up study examining the impact of the COVID-19 pandemic on families of autistic children. Caregivers were invited to participate in one of three semi-structured virtual focus group interviews conducted via Webex. Each group was led by a primary and secondary facilitator and lasted ~80 minutes. The main topics of discussion included family routine changes, caretaker roles, homelife stress, social support, and child behaviors all in context of COVID-19. Data analysis involved several rounds of coding guided by the principles of an interpretative phenomenological analysis (IPA) framework (Smith et al., 2009). Codes were organized into themes and sub-themes using NVivo 12 Software.

**Results:** A total of 11 female-identifying caregivers of autistic children participated in our virtual focus groups. While caregivers faced challenges juggling their roles and responsibilities and adapting to disrupted routines, their biggest reported stressor was a lack of external support during the pandemic. With COVID-19 safety protocols in place, most children were unable to receive outside support from their usual special education teachers, therapists, and aides. Caregivers described how their families were also isolated from the help of any relatives or close friends. Without these support systems, caregivers were left feeling overwhelmed and alone.

**Conclusions:** The COVID-19 pandemic caused caregivers of autistic children to experience an increasing amount of homelife stress. To gain a better understanding of the caregiver experience, efforts should be placed on implementing caregiver support systems and gathering information directly from the autistic community. Researchers should use the experience of this pandemic to establish prevention and interventions efforts that can be effectively executed in future crisis situations, both at global and local support levels.

**411.133 (Poster)** The Influence of Parent Experience: Investigating the Association between Parent Experiences and Parent-Reported Behaviours of Their Autistic Child

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**Background:**

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that is characterized by social communication difficulties and restricted and repetitive behavioral patterns (American Psychiatric Association, 2013). Numerous aspects associated with parenting an autistic child have been demonstrated to influence levels of burden that may contribute to parent stress, including: impaired social communication skills (Russel & McCloskey, 2016) that influence feelings of isolation between a family and their autistic child, isolation from friends and family (Gorlin et al., 2016), problem behaviours, financial requirements, and access to care (Shepherd et al., 2018). Previous research has found that parents with an autistic child report higher levels of burden, which is associated with perceived parenting self-efficacy (Weiss et al., 2016). While many studies have investigated parental stress or efficacy of those with autistic children, few have assessed the family's experience quantitatively; this has been addressed with the recent development of the Autism Family Experience Questionnaire (AFEQ; Leadbitter et al., 2017). Further, little research has addressed the association between family experience and the autistic child's developmental skills.

**Objectives:** To address this, we focused on the relationship between parental reports of their experience as a parent of an autistic child, and their report on their autistic child's development. We hypothesized that lower parental experience scores, representing a more negative perceived experience, would be associated with lower scores in parent-reported child development.

**Methods:** This study used data from the pilot phase of the *Pediatric Autism Research Cohort (PARC) Project*. The sample recruited included 91 children diagnosed with ASD (76 boys); mean age at study enrolment was 49.01 months (SD=9.23). Assessments were completed at 5 time points: Time 1 (baseline/at enrolment) and Times 2-5 at approximately 6-month intervals post-baseline.

**Results:** Data were analyzed for children who completed the AFEQ using correlation analysis, followed by a Fisher's z transformation to assess differences between timepoints. Preliminary results indicate a significant association between parental reports on their parenting experience (AFEQ1) and their child's development (AFEQ3) at time 4 and time 5 (Table 1) and a significant difference between correlations of time 3 and 4 (Table 2). No other significant differences were found.

**Conclusions:** Results suggest that there may be an association between how parents feel about their parenting experience and parent-reported development in their autistic child; however, it may not be evident until the child is slightly older and/or has carried their ASD diagnosis for more than 2 years. Further, the significant difference between time 3 and 4 may indicate an important time period in the relationship between parent's

perceived family experience and their autistic child's development, or at least their perception of this development, that requires further investigation. Results from this study will inform the full-phase PARC study following full data collection. Additionally, results may help to further understand the relationship between family experiences of having an autistic child and the autistic child's development as perceived by their parents; this understanding may be important when adapting or developing support for these families and the autistic child.

**411.134 (Poster)** The Large-Scale Shift to Telehealth Delivery in Part C Services during the Pandemic: Provider and Caregiver Perspectives  
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#### Background:

Infants and toddlers at risk for autism spectrum disorder (ASD) are eligible for early intervention (EI) through Part C of the Individuals with Disabilities Education Act (IDEA, 2004). Telehealth shows promise for increasing access to providers who specialize in ASD; however, reported barriers to telehealth include a lack of provider training in virtual service provision and poor access to reliable and high-speed internet for families (Romsetty & Adams, 2020).

The pandemic required EI programs to pivot to telehealth as a primary service model. The rapid shift without an existing blueprint to follow did not allow for an optimally planned, phased implementation approach, which may have implications for experiences and attitudes towards telehealth in EI.

#### Objectives:

This study aimed to characterize changes to EI services brought about by the transition to telehealth from the perspective of providers and caregivers of children at-risk for ASD.

#### Methods:

Providers and caregivers from three EI agencies completed a *Pandemic Telehealth Survey* created by the second and last authors. Participants were recruited from an ongoing study about EI services for children at-risk for ASD.

EI providers ( $n=39$ ) responded to open-ended questions about pandemic-related changes in child- and caregiver-specific strategies used, session content, and recommendations to improve telehealth services. Providers rated how the frequency and duration of visits, amount of time spent working with the child and the caregiver, child progress, and perceived caregiver engagement had changed. Response options were "overall increase," "overall decrease," "mixed," and "no change."

Caregivers ( $n=14$ ) responded to open-ended questions about pandemic-related changes to session interactions with providers and their child, advantages and disadvantages of telehealth, and recommendations to improve the telehealth experience. Caregivers rated how the duration of visits, topics covered, and satisfaction with and value of services had changed. Response options were "overall increase," "overall decrease," "no change," and "not sure."

Descriptive statistics were used to examine item ratings and qualitative analysis was used to examine open-ended responses. Qualitative analysis used a systematic and iterative approach of affinity diagramming (Kawakita, 1992), codebook development, and independent coding and review.

#### Results:

Many providers reported briefer (48%) and less frequent (50%) sessions, increased time spent coaching caregivers (75%), decreased time working directly with children (93%), no change in time spent addressing child goals (54%), and increases and decreases across clients regarding child progress (56%) and caregiver engagement (54%).

Most caregivers reported briefer sessions (64%), with many indicating no change in frequency (46%). The majority of caregivers indicated that discussion of daily routines increased (55%), time spent addressing therapy goals decreased (64%), observation of providers decreased (82%), and the value of services decreased (55%).

Ten themes emerged from provider responses to open-ended questions (see Table 1) and ten themes emerged from caregivers (see Table 2).

#### Conclusions:

Providers and caregivers expressed unique points of view surrounding caregiver coaching, child improvements, and the value of telehealth services. This study provides important insight into areas of need for building EI provider capacity for and improving the quality of telehealth for caregivers and children at-risk for ASD.

**411.135 (Poster)** Exploring Factors That Contribute to the Quality of Life in Mother and Fathers of Children with Autism Spectrum Disorder  
**H. Behr<sup>1</sup>, R. Hock<sup>2</sup>, B. C. Aaron<sup>3</sup> and A. Rovane<sup>4</sup>,** (1)College of Social Work, The University of South Carolina, Columbia, SC, (2)University of South Carolina, Columbia, SC, (3)College of Social Work, University of South Carolina, Columbia, SC, (4)Psychology, University of South Carolina, Columbia, SC

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**Background:** Parents of children with Autism Spectrum Disorder report significantly poorer quality of life (QoL) than the general population. To address this public health concern, it is necessary to examine malleable factors that contribute to quality of life (QoL) in this population. A potentially valuable area of inquiry is parents' style of interacting with their child and their co-parent. Researchers suggest that parents of children with ASD have greater difficulty resolving conflict, which is associated with lower couple relationship satisfaction and more frequent conflict. These findings could suggest that coparenting conflict resolution skills affect QoL for this population. Researchers found that parents with authoritarian and permissive parenting styles experienced greater stress than authoritative parents. An investigation of QoL must consider the different pathways for mothers and fathers of children with autism.

**Objectives:** This study explores whether dimensions of parenting style (laxness and over-reactivity) and coparent conflict communication contribute to QoL for mothers and fathers of children recently diagnosed with ASD.

**Methods:** Caregivers of children (ages 2-8) with a recent diagnosis of ASD were recruited from family support organizations. To be eligible, the parents were required to share parenting responsibilities with a coparent, and their child was diagnosed within the past 12 months. Mothers (n=30) and fathers (n=28) completed questionnaires about child characteristics, mental health, and family relationships. QoL was measured using the Quality of Life in Autism Questionnaire (Eapen et al., 2014). Coparent conflict resolution skills were measured with Psychological Aggression and Negotiation subscales of the Conflict Tactics Scale (Straus et al., 1996). Parenting Styles were measured using the laxness and over-reactivity subscales of the Parenting Scale (Arnold et al., 1993). Two hierarchical regression models were constructed to test whether parenting styles predicted quality of life in mothers (Model 1) and fathers (Model 2). In step 1 of each model, parenting style variables were included as predictors, controlling for child behavior. In step 2, coparenting conflict variables were added to the model.

**Results:** In Model 1, no parenting style variables significantly predicted QoL for mothers in step 1. In step 2, psychologically aggression ( $b = -.46$ ,  $p = .01$ ) and negotiation ( $b = .48$ ,  $p = .007$ ) conflict styles were significant predictors for quality of life, predicting 36.7% of overall variance in quality of life. In Model 2, no parenting style variables significantly predicted quality of life for fathers in step 1. In step 2, lax parenting style approached significance ( $b = -.35$ ,  $p = .09$ ), but no conflict styles were significant predictors for quality of life. Model 2 predicted 20.3% of overall variance.

**Conclusions:** Study findings highlight the differential relationships between parenting style, coparent conflict and QoL for mothers and fathers of children recently diagnosed with ASD. For mothers' higher QoL was associated with more use of negotiation tactics and lower use of psychological aggression during coparent conflict. In contrast, higher QoL for fathers was associated with less laxness in parenting. Future longitudinal and intervention research should explore the directionality of these relationships to inform future family-based service delivery.

**411.136 (Poster)** Exploring the Contributions of Child Challenging Behaviors and Coparenting on Stress in Mothers and Fathers of Children Diagnosed with Autism  
**B. C. Aaron<sup>1</sup>, R. Hock<sup>2</sup>, H. Behr<sup>3</sup> and A. Rovane<sup>4</sup>,** (1)College of Social Work, University of South Carolina, Columbia, SC, (2)University of South Carolina, Columbia, SC, (3)College of Social Work, The University of South Carolina, Columbia, SC, (4)Psychology, University of South Carolina, Columbia, SC

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**Background:**

Researchers have found that parents of children with ASD report high levels of stress. The stress and strain of parenting can be intensified when a child has special needs and requires more time and effort (Brobst, Clopton, & Hendrick, 2009). Parents of children with ASD experience significantly more stress than parents of children who have other neurodevelopmental disabilities; furthermore, and mothers reported more stress related to their child's temperament and behavioral characteristics than did the fathers (Grebe et al., 2021). Research on families with children with ASD indicates that partner support is associated with reduced parent stress (Boyd, 2002; Dunn et al., 2001; May et al., 2015) and lower levels of child challenging behaviors and symptoms (Hock & Ahmedani, 2012).

**Objectives:**

This study seeks to explore if child challenging behaviors contribute to strain for both mothers and fathers of children with ASD; and if coparenting quality acts as a buffer against strain for both mothers and fathers of children with ASD.

**Methods:**

*Measures*

Coparenting was measured using the coparent agreement subscale of the Coparenting Relationship Scale (Feinberg et al.). Child behavior challenges were measured using the sensory/perceptual approach and aggressiveness sub-scales of the Pervasive Developmental Disorder Behavior Inventory (Cohen & Sudhalter).

*Participants*

Caregivers of children (ages 2-8) with a recent diagnosis of ASD were recruited from family support organizations, diagnostic clinics, and pediatric offices. To be eligible, the parents were required to share parenting responsibilities with a co-parent, and their child was diagnosed within the past 12 months. Mothers (n=30) and fathers (n=28) completed questionnaires about child characteristics, mental health, and family relationships.

#### Data Analysis

Two hierarchical regression models were used to predict caregiver strain for mothers (Model 1) and fathers (Model 2). In the first step, child sensory/perceptual approach and aggressiveness were added. In the second step, coparent agreement was added to the model.

#### Results:

Separate hierarchical regression models were used to predict caregiver strain for mothers and fathers separately. In the first step, child sensory/perceptual approach and aggressiveness were added. For mothers, this model was statistically significant,  $F(2, 27)=5.084$ ,  $p=.013$ ,  $R^2_{adj}=.220$ . Coparent agreement was added in the second step, which improved the model fit,  $F(1, 26)=9.497$ ,  $p<.001$ ,  $R^2_{adj}=.458$ . Child aggressiveness contributed significantly in the first step ( $Beta=.544$ ,  $p=.024$ ), while only coparent agreement contributed significantly in the final model ( $Beta=.627$ ,  $p=.001$ ). For fathers, neither model significantly predicted caregiver strain.

#### Conclusions:

This study's findings add to previous research demonstrating that mothers' and fathers' experience of caregiving strain is influenced by different factors. Challenging behaviors are associated with strain for mothers, but not fathers. Researchers have attributed higher levels of stress to the larger role mothers historically played in daily care for children with ASD (Davis & Carter, 2008). Greater coparent agreement is associated with reduced caregiver strain for mothers, after controlling for challenging child behaviors. This finding points to the potential value of attending to the coparent relationship in ASD services such as diagnosis and parent training. Additional research is needed to understand the support needs of fathers.

#### **411.137 (Poster) Service Encounters: Service Provision and Difficulty Experienced When Attempting to Access Appropriate Treatment and Educational Services in Uruguay**

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**Background:** Even when a variety of treatment services for autistic individuals are now more widespread, caregivers are not exempt from experiencing barriers to access, especially for those that live in low- and middle-income countries like Uruguay autistic individuals oftentimes are only able to access insurance covered treatments, which are not always the most effective. It is thus imperative to understand not only type of services being provided to individuals in Uruguay, but to assess individual and contextual characteristics of those expressing difficulty accessing appropriate services for their autistic children.

**Objectives:** The present study attempts to first better understand types of services being provided to autistic individuals in Uruguay and compare them to service provision in other Latin American countries. Secondly, it tries to identify child and caregivers' characteristics and contextual factors to ascertain their effect on caregiver's endorsement of difficulty when attempting to ensure appropriate treatment and educational services.

**Methods:** The current study examines the experience of 351 caregivers of autistic individuals residing in Uruguay. Analysis included a chi-square test for association between age, functional level and type of services received. Then, a binomial logistic regression was performed to ascertain the effects of child characteristics (e.g., age, functional level, challenging behaviors), caregivers' characteristics (educational level, perceptions), and contextual factors (e.g., service payment, insurance type) on the likelihood of experiencing difficulty when attempting to access appropriate treatment and educational services for autistic children.

**Results:** In Uruguay, the service most commonly received by autistic individuals is psychomotor therapy (73.9% of the sample). When assessing predictors for likelihood of referring difficulty ensuring appropriate treatment for autistic child, the built model was statistically significant ( $X^2(27)=113.19$ ,  $p<0.001$ ). Predictors that significantly added to the model were caregiver education (primary or secondary), importance placed on accessing appropriate services, and challenging behaviors of child (aggression, daily habit difficulty, medical comorbidity, social interaction, repetitive behaviors, communication difficulties, security concerns, and sensory issues). The built model to assess predictors for difficulty ensuring appropriate educational services was statistically significant,  $X^2(22)=102.87$ ,  $p<0.001$ . Predictors that significantly added to this model were caregiver educational level (primary), importance placed on educational services, age functional level of child and child exhibiting aggression, daily habits and eating difficulties, social interaction challenges, poor safety sense.

**Conclusions:** The present study shows that the majority of services received are those financed by state institutions, regardless of their specificity for ASD and the child's specific needs. Specific treatments as well as evidence based once are available to a minority of the population due to cost limitations. Therefore, access to services in Uruguay is mediated by public health policies that offer a limited number of services for persons with ASD. The need to generate awareness and inform about evidence based interventions is crucial.

**Keywords:** ASD, Uruguay, Service Provision, Access Difficulty, Physical Therapy, Age.

**411.138 (Poster)** Baseline Parenting Stress but Not Parent Depression Predicts Growth in Parent Self-Efficacy over the Course of a Parent-Mediated Intervention

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**Background:** Research has established the important predictive role of parent self-efficacy on child development and outcomes (Albanese et al., 2019). Parent depression and parent stress have both been shown to relate to parent self-efficacy, but the causal relationships among them remain unclear (Jones & Prinz, 2005). Mothers of children on the autism spectrum are prone to higher levels of depression and stress (Baker-Ericzen et al., 2005). However, few research studies have examined predictors of change in parent self-efficacy for families of autistic children. Understanding the role of parent stress and depression on parent self-efficacy over time is important for understanding the impact of parent-mediated interventions (Wainer et al., 2017).

**Objectives:** The goal of this study is to examine the moderating effect of parent depression and stress on change in parent self-efficacy for a group of parents participating in a parent-mediated intervention.

**Methods:** Data were collected from parents of autistic children who participated in a research study examining the efficacy of a low-dose parent-mediated Naturalistic Developmental Behavioral Intervention (NDBI) delivered via telehealth. All caregivers in this study received some form of intervention, which was either self-directed or supported by a coach. Most caregivers were enrolled in additional services outside of the study. Our sample included 46 adults (37 mothers, 1 grandfather, 8 fathers). Parent stress was measured using the Parenting Stress Index-Short Form, and parent depression was assessed using the Center for Epidemiological Studies Depression Scale. Parent self-efficacy was measured using the Parenting Sense of Competence Scale. We evaluated moderators of change in parent self-efficacy using multilevel linear growth models with caregiver as the upper-level unit and trial as the lower-level unit. We hypothesized that parents with lower self-reported indicators of depression and stress at baseline would demonstrate a greater increase in parent self-efficacy over the course of a parent-mediated intervention.

**Results:** Parent depression did not significantly predict average level of self-efficacy over time, nor did it moderate the rate of change in self-efficacy over time. However, we found a significant main effect of parent stress ( $p < .001$ ) such that parents who reported higher stress levels also reported lower self-efficacy on average. There was a significant interaction between time and parent stress ( $p = .017$ ). Parents with low levels of stress (1 SD below the mean) showed no significant change in self-efficacy over time ( $p = .313$ ). Parents with high stress levels (1 SD above the mean) reported significant increases in self-efficacy over the duration of the study ( $p = .016$ ).

**Conclusions:** This research found that parent stress level significantly predicted mean levels of parent self-efficacy over the course of a low-dose NDBI, while parent depression did not. Moreover, baseline parent stress predicted rate of change in self-efficacy, such that higher-stress families reported significant increases in parent self-efficacy over time. Future research should investigate whether the improvement in parent self-efficacy among those high stressed families was a result of the intervention itself or some other factor (e.g., contact with the research team, obtaining an assessment of their child's functioning).

**411.139 (Poster)** Program Evaluation of a Cultural and Recreational Event Serving Families with Individuals on the Autism Spectrum

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**Background:** Arts-based programs can positively influence psychosocial well-being of children with physical and developmental disabilities and promote opportunities for inclusion. It is important to evaluate social inclusion strategies, as experienced by the end-user, when implementing inclusive programming. Several arts organizations in Philadelphia have implemented initiatives to offer sensory-friendly programming for over a decade. Although this has been an ongoing effort, there is still need for dissemination of the evaluation outcomes of such programs. The Sensory-friendly Community Concert by the Philadelphia Orchestra, organized and executed in partnership with the Eagles Autism Challenge, is a recent initiative to create inclusive recreation and arts. The second annual event occurred in early 2020 and offered a free orchestra concert paired with a family fun event for families with individuals on the autism spectrum and other developmental disabilities; more than 1200 individuals attended.

**Objectives:** To describe and analyze the barriers and facilitators for social inclusion in the design and implementation of a sensory-friendly community concert, based on attendee's experiences.

**Methods:** A survey containing 7 mandatory multiple-option items (demographics and satisfaction with specific aspects of the event), and 6 optional open-ended question items (barriers and facilitators), was administered to concert attendees during the event. Demographic data was collected for sample characterization. Answers to the open-ended questions were categorized, as coded by two investigators. Descriptive statistics were conducted for all variables.

**Results:** A total of 79 responses were collected for the mandatory satisfaction questions, and 39 respondents completed the optional, open-ended barriers/facilitators questions. All participants were >18 years old, 74.7% were female, and 49.53% were parents/family member of individuals with a disability, 26.58% were health professionals, and 8.85% were individuals with a disability. Participants' overall assessment of the event was "Fantastic" or "Really good" (91.1%), and 96.2% responded "Agree" or "Strongly agree" when asked if the event providing a safe, accepting environment for their family. When utilized, respondents agreed that the sensory kit provided (45.6%), the quiet space in the back of the room (51.9%), and the sensory break room (49.4%) fit their families' needs, with 35.4%, 7.6%, and 36.7% indicating they did not utilize those

accommodations, respectively. The most common motivators to attend the event were the opportunity to experience music/cultural programming and factors related to people/community (i.e., having a family member on the autism spectrum, or attending with members of their autism support group). The most frequently endorsed facilitators were factors related to facilities/location. Barriers were not identified for this event; barriers reported for similar events were related to challenges inherent to the individual's disability (e.g., sensory sensitivity). Participants endorsed a sense of community, exposure to music/culture, and factors related to disability inclusion as the greatest benefits of attending the event.

**Conclusions:** Inclusive strategies in arts programming can facilitate attendance and foster participation of families with a member with disabilities. Common barriers to attendance can be addressed by tailoring to specific needs based on the disability. Facilitators to attendance can be embedded into the event's design, such as the choice of venue and its facilities.

**411.140 (Poster) "Weaponized Autism": A Discourse Analysis of Gab Posts**

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**Background:** There is mounting concern that extremist groups, including the alt-right, are intentionally using online content to engage and recruit autistic people. The term "weaponized autism" is frequently used on alt-right platforms and has begun to make its way into mainstream media.

**Objectives:** To understand the meaning of the term "weaponized autism", the realities it represents, and its potential impacts on autistic people.

**Methods:** The dataset included 711 posts from Gab, an online platform known for hate-based discourse. Posts were collected by the Southern Poverty Law Center and had been posted on dates spanning 2018-2019. Posts were filtered for mentions of weaponized autism and variations on this term. The first author was deeply immersed in the data and applied a health-science-informed approach to discourse analysis. This involved examining Gab users' processes for claiming authority, this discourse's relationships with other relevant discourses, the roots and construction of the major concepts and roles enacted, and finally, potential implications for practice. We interrogated the data with specific *a priori* questions at each stage of the analysis. Our interdisciplinary team met at three junctures in the analytic process to enhance and extend the analysis, leveraging our diverse clinical, academic, and experiential knowledge base to further contextualize the findings.

**Results:** Most of the Gab users discussing weaponized autism did not themselves identify as autistic. Rather, 'weaponized autists' were generally spoken of, and sometimes spoken to. We found that the term "weaponized autism" was reflective of highly stereotyped and ambivalent views of autism. 'Weaponized autists' were described as omnipotent masters of technology, who are also socially unskilled. This resulting depiction is of a group of people who are effective weapons to exploit for the aims of the alt-right. Autistic Gab users discussed the exclusion they experience in real life and the relative sense of purpose that was offered in this space. An important limitation relevant to these results, is that the terminology used in alt-right online communities is constantly changing, and the meaning of 'weaponized autism' may have shifted since our posts were collected. Additionally, different platforms and online spaces have their distinct vernacular and so other sites, including those associated with online hate, may have different nuances associated with the term 'weaponized autism'.

**Conclusions:** Within this dataset, 'weaponized autism' is a term used by mainly non-autistic Gab users, indicative of a reductive, stereotyped, and predatory view toward autistic people. Autistic people who experience exclusion in broader society might be more vulnerable to engaging with this identity, which signals the importance of supporting truly inclusive spaces as a protective factor.

## POSTER SESSION — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES

### 424 - Family Issues and Stakeholder Experiences II

**424.055 (Poster) Patterns of Maternal Communicative Behaviors Among Low-Income Chinese Immigrant Mothers of Children with ASD- an Exploratory Study**

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**Background:**

Around the world bilingual speakers outnumber monolinguals (Kohnert, & Medina, 2009). According to recent census data in the U.S. one in five Americans speak a language other than English at home. Research with mostly monolingual children in the sample had shown that maternal communicative behaviors are associated with language development (Levickis et al., 2014; Rowe, 2012). It is also known that low-resource households, the quality and quantity of parent-child interaction are factors that significantly impact the language development in children (Roberts and Kaiser 2011; Hirsh-Pasek et al., 2015) Research is emerging on the topic of bilingualism and Autism Spectrum Disorders (ASD, Drysdale et al., 2015; Reetzke et al., 2015). However, little is known about maternal communicative behaviors among low-resourced immigrant families of young children with ASD.

## Objectives:

To fill this gap, we collected mother-child interaction video clips from low-income Chinese immigrant families of young children with ASD to explore maternal communicative behaviors in naturalistic settings.

## Methods:

Thirteen Chinese mothers and young children under the age of five with ASD from Chicago and New York metropolitan area were recruited as part of a pilot parent psychoeducational intervention study with Chinese immigrant mothers. To meet inclusion criteria, mothers need to speak Chinese fluently. We used the 138% Federal Poverty Level as the cutoff for “low-income”. We collected data on child’s social communication skills (SCQ), level and frequency of challenging behavior (SIB-R), severity of ASD (CARS-2), home and community language exposure (in English, Mandarin or other Dialect), access to speech therapy, family empowerment and parental stress. Each mother-child dyad was asked to select three daily activities from the following: play with small toys (e.g., cars, figurines, puzzles), play with larger objects (e.g., large ball), play with people, reading a book, caregiving (e.g., changing diaper, washing hands), and house chores. Coding of maternal communicative behaviors will follow Conway et al. (208)’s protocol.

## Results:

We present results for 13 mother-child dyads, who participated the study between January and March of 2021 during the COVID-19 pandemic. The majority of these mothers live in low-income households (54%). Three children were female while 10 were male. Children were on average 3.7 years old ( $SD=1.32$ ), had a mean SCQ of 20.9 ( $SD=5.85$ ), mean SIB-R of 121.3 ( $SD=12.91$ ). Mothers were on average 33.2 years old ( $SD=5.58$ ), PSI-SF had a mean score of 103.7 ( $SD=15.96$ ). Preliminary analysis shows that higher income is marginally associated with child’s higher SCQ scores ( $p=0.057$ ), and SIB-R scores ( $p=0.066$ ). We will further compare if income and other mother or child characteristics have any association with maternal communicative behavior and quality of mother-child interaction.

## Conclusions:

This study explores how Chinese immigrant mothers communicate and interact with their children during a daily activity. Further video analysis will help contribute to the gap of literature on maternal communicative behaviors among low-income Chinese immigrant families of children with ASD. These findings will inform parent educational interventions to help under-served immigrant mothers navigate strategies to support language development of their bilingual children with ASD.

## **424.056** (Poster) Play and Emotional Availability of Fathers of Young Children with ASD: Impact on Development

*S. Perzolli, A. Bentenuto, G. Bertamini and P. Venuti, Department of Psychology and Cognitive Science, University of Trento, Rovereto, Italy*

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## Background:

Research on fatherhood has focused primarily on fathers of children with typical development, even if recent findings revealed an increasing interest in the investigation of fathers of children with Autism Spectrum Disorder (ASD). Most research on parental interaction focused on mothers, even if a healthy father-child with ASD relationship may have peculiar consequences on child development and child emotional regulation (Rankin et al. 2019; Hirschler-Guttenberg et al., 2016). Recent studies on paternal involvement during treatment showed consistent benefits concerning child’s outcomes (Flippin et al., 2011; Elfert et al., 2015). Despite this, research is still scarce, and it is not yet possible to have a consistent profile about paternal interactive behaviors.

## Objectives:

In line with this, this work wants to analyze paternal behaviors through highly standardized observative tools. Specifically, we aimed to:

1. Investigate father-child affective and play dyadic behaviors
2. Explore systematically the variables that impact on dyadic aspects of play.

## Methods:

Data of 67 fathers and their preschoolers with ASD ( $M$  chronological age= 45.47;  $SD= 12.19$ ;  $M$  mental age= 31.83;  $SD=12.88$ ) were collected through ten minutes of video-recorded play interactions. In order to assess the affective quality, the Emotional Availability Scales (EAS, Biringen et al., 2008) were used. Further, on the same interaction’s sequences, the Play code (O’Reilly & Bornstein, 1993) was employed to assess the levels of both child and fathers’ exploratory and symbolic play. Interactions were coded by two independent observers.

## Results:

Results revealed that fathers display good but non-optimal levels of EA (e.g.,  $M$  sensitivity = 5.11;  $SD=0.89$ ;  $M$  structuring=4.7;  $SD=0.86$ ) despite their children having low levels of responsiveness ( $M=3.76$ ;  $SD=0.88$ ) and involvement ( $M=3.32$ ;  $SD=0.83$ ). Fathers showed more exploratory play ( $M=169$ ;  $SD=108.49$ ) than symbolic play ( $M=37.38$ ;  $SD=46.23$ ), coherently with child’s play behaviors. Child responsiveness is associated with

child's cognitive functioning ( $r=0.39$ ;  $p=0.002$ ;  $BF=25$ ) and symptom severity ( $r=-0.44$ ;  $p<0.001$ ;  $BF=101$ ). Involvement is as well associated with child's cognitive functioning ( $r=0.47$ ;  $p<0.001$ ;  $BF=184$ ) and symptoms severity ( $r=-0.51$ ;  $p<0.001$ ;  $BF>100$ ). Currently we are implementing and evaluating a set of predictive models with validation controls for model selection. Until now, paternal levels of exploratory play seem to be predicted by child's levels of play ( $b=0.31$ ;  $t(57)=3.42$ ;  $p=0.001$ ), suggesting fathers ability to adapt to child's activities ( $F(2,57)=8.79$ ;  $p<0.001$ ).

#### Conclusions:

From a theoretical perspective this study may enhance knowledge about affective and cognitive domains of paternal dyadic characteristics. From a clinical standpoint, these findings might help clinicians in the implementation of optimized and personalized interventions for children with ASD considering paternal and maternal behaviors in a complementary way for the achievement of better developmental outcomes.

#### **424.057 (Poster)** Psychological Functioning and Resilience in Mothers and Fathers of Children with and without Autism Spectrum Disorder during the COVID-19 Pandemic

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**Background:** Parents of children with Autism Spectrum Disorder (ASD) often experience greater levels of psychological distress than parents of typically developing (TD) children. The COVID-19 pandemic presented unique challenges for all parents due to work from home requirements and decreased childcare. However, the stress and mental health problems parents of children with ASD experience may be different and/or exacerbated during the unprecedented time of the coronavirus pandemic.

**Objectives:** This project aimed to identify how experiences and functioning may have differed for mothers and fathers of TD children and children with ASD in the United States during the COVID-19 pandemic. Specifically, this study examined group and gender differences in anxiety, depression, parental burnout, and resilience.

**Methods:** One-hundred and eighty five parents of children with and without ASD (ages 4 -16 years) self-reported on measures of psychological functioning (*Depression, Anxiety, and Stress Scale – 21*), parental burnout (*Parental Burnout Assessment*) and resilience (*Parenting Resilience Elements Questionnaire*). The ASD group included 88 parents (48 females, 38 males, one non-binary parent, and one unreported gender) and the TD group included 97 parents (55 females, 41 males, and one parent who did not to report gender).

**Results:** Independent samples *t*-test revealed that the ASD group reported higher levels of anxiety,  $t(183) = 9.36$ ,  $p < .001$ , depression,  $t(183) = 8.48$ ,  $p < .001$ , and total burnout,  $t(145.158) = 8.62$ ,  $p < .001$ , than the TD group. A two-way ANOVA showed that fathers reported more depression symptoms than mothers in the ASD group,  $F(1, 178) = 6.63$ ,  $p = .011$ , partial  $\eta^2 = .036$ , and fathers in the TD group,  $F(1, 178) = 55.74$ ,  $p < .001$ . Mothers in the ASD group reported higher depression levels than mothers in the TD group  $F(1, 178) = 24.34$ ,  $p < .001$ , partial  $\eta^2 = .120$ . There was no main effect of gender in anxiety symptoms or total burnout. However, a two-way ANOVA revealed a significant main effect of gender for parental burnout related to emotional distancing,  $F(1, 178) = 8.23$ ,  $p = .005$ , partial  $\eta^2 = .044$ , with fathers reporting higher levels than mothers in the ASD group. Lastly, a two-way ANOVA showed that fathers reported lower levels than mothers in both groups on resilience related to Knowledge of Child's Characteristics,  $F(1, 178) = 10.26$ ,  $p = .002$ , partial  $\eta^2 = .054$ , and Perceived Social Supports,  $F(1, 178) = 7.10$ ,  $p = .008$ , partial  $\eta^2 = .038$ .

**Conclusions:** This study demonstrates that parents of children with ASD reported greater psychological distress compared to parents of TD children during the COVID-19 pandemic. A high percentage of parents in the ASD group reported parental burnout indicating that it is essential for clinicians to assess parents' level of functioning and feelings related to their parenting role. Additionally, results suggest that fathers have experienced more psychological distress and burnout compared with mothers, which highlights the necessary inclusion of fathers in both research and clinical services.

#### **424.058 (Poster)** Risk for Mild Cognitive Impairment in Mothers of Autistic Children

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**Background:** Emerging evidence suggests that mothers of children with disabilities are at risk for accelerated age-related cognitive decline (Song et al., 2016). Mothers of autistic children, specifically, have documented challenges in working memory and verbal fluency. They also experience significant risk factors for age-related cognitive decline, such as high levels of parenting stress. Yet, research to date has not examined risk for mild cognitive impairment (MCI; a transitional zone between normal cognitive function and dementia) among mothers of autistic children, or its relation to parenting stress.

**Objectives:** Objective 1 - Compare mothers of autistic children and control mothers on performance on an MCI screener. Objective 2 - Examine associations between parenting stress and MCI screener performance within mothers of autistic children.

**Methods:** Thirty-one mothers of autistic children and 43 control mothers who were between the ages of 35 and 65 years participated in a virtual assessment as part of a larger study. All participants were fluent English speakers without existing neurological diagnoses (e.g., traumatic brain injury). Examiners completed formal training to administer the Montreal Cognitive Assessment (MoCA), which is a widely-used MCI screener. The MoCA assesses skills such as memory and attention. Test developer recommendations for remote administration were followed. The traditional cut-off for MCI is a score below 26 out of 30. However, this has been criticized as being too high, with a more conservative proposed cut-off of 23. Analyses include both cut-off scores. Parenting stress was measured using the Parenting Stress Index-4, a self-report questionnaire that assesses current life stress related to raising a child. Percentile scores were calculated using normative data. The normative mean is a score of 50; higher scores indicate higher levels of parenting stress.



**Results:** Results from a logistic regression, controlling for age and years of education, indicated that mothers of autistic children were 2.42 times more likely to fall below the cut-off for MCI at a score of 26 on the MoCA (95% CI [0.92, 6.39];  $p = .016$ ). Using the conservative cut-off of 23, mothers of autistic children were 7.13 times more likely to fall below the threshold for MCI (95 % CI [1.4, 36.45];  $p = .016$ ). Within-group analyses examined correlations between parenting stress and the dichotomous MoCA status for both cut-off scores among mothers of autistic children. Findings indicated that parenting stress was not significantly related to either cut-off outcome among the mothers of autistic children (cut-off of 26:  $p = .215$ ; cut-off of 23:  $p = .684$ ).

**Conclusions:** Mothers of autistic children may be at risk for falling below the cut-off for MCI on the MoCA. Of note, this study only used one index of cognitive impairment; though the MoCA is a sensitive measure, future work should include a comprehensive battery of neuropsychological measures to characterize the risk for mild cognitive impairment. Contrary to our hypothesis, parenting stress was not significantly associated with cut-off status. Future research should assess other risk factors of MCI that are common in mothers of autistic children, including poor sleep quality and depression.

**424.059 (Poster) Sensory Processing and Meaningful Community Participation in Autistic Adults**

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**Background:** Sensory processing differences, commonly reported in autistic children, have been shown to impact involvement in community activities. While research shows that sensory processing differences continue into adulthood, relatively little is known about how these differences affect participation in the community, and whether sensory processing contributes to lower overall rates of community participation (Levy & Perry, 2011; Orsmond et al., 2013; Song et al., 2021).

**Objectives:** This project uses a novel approach (i.e., integration of qualitative interview data, quantitative survey data, and GPS data) to explore how autistic adults' sensory processing patterns contribute to participation in the community, including where people go, how often they are in the community, and their preferred locations.

**Methods:** We report on data gathered from six autistic adults (see Table 1 for demographic information) and their caregivers who participated in two different studies. From Study 1 we reviewed results of the Adolescent and Adult Sensory Profile (AASP; completed by caregivers) and transcripts from a two- part interview with caregivers. The interviews included the Vineland Adaptive Behavior Scales 2 and a semi-structured interview focused on services and future plans. From Study 2, we reviewed GPS tracking data collected over one week and transcripts from structured interviews with the autistic adults focused on community participation. The analysis process for the current investigation involved creating a participant narrative linking sensory processing patterns to community participation.

**Results:** Each participant had a unique sensory processing profile that influenced where people went, the activities in which they engaged, how much time they spent in the community, and their preferred locations (see Table 2). Those whose sensory processing patterns indicated sensory sensitivity and sensory avoiding described the experience of certain environments as overwhelming and fatiguing and thus either spent less time in the community, visited fewer places, or utilized other adaptive strategies than those with other sensory processing patterns. Reviewing the sensory processing and community participation data yielded notable patterns, particularly related to sensation seeking and community involvement. Time in the community, however, was not the only factor related to sensory processing profiles; other factors such as access to transportation, employment status, and living status impacted time spent in the community and community engagement.

**Conclusions:** Results highlight the importance of sensory processing in daily life, especially as it impacts participation in the community. Sensory processing patterns should be considered along with other personal and contextual factors when assessing community participation. It is important to match personal sensory processing patterns with environmental demands. It is also critical that efforts aimed at advocating for sensory-friendly environments consider the variety of sensory processing patterns of autistic adults.

**424.060 (Poster) Stakeholder Input on Opportunities and Challenges Related to Inclusion in Research**

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**Background:**

Inclusion of people on the autism spectrum in ongoing health research (e.g., trials in vaccines, cardiovascular disease, diabetes, obesity and other areas) is critical to the success of these studies given that they have unique characteristics and add diversity to the study population. To generalize results to the autism community, being inclusive of people with autism is paramount. However, challenges remain related to including this population in research.

**Objectives:** The goal of this initiative was to solicit feedback from community members as well as professionals in an open forum to discuss the opportunities and challenges of representation of people with autism and other intellectual and developmental disabilities (IDD) in research. The findings from this initiative were used to enhance our consultations with researchers at our institution who were interested in including more participants with IDD in their work.

**Methods:** Our Vanderbilt Kennedy Center held a virtual dinner that included medical professionals, researchers, self-advocates, caregivers, and the general public.

Questions were discussed in virtual breakout rooms with small numbers of participants to facilitate input, paired with moderators and notetakers in each room. The questions were:

1. What are the opportunities you see in including individuals with IDD in research?
2. What are the potential barriers?
3. What ideas do you have that might increase people with disabilities in research?

## **Results:**

*For Question 1*, participants emphasized the following opportunities:

- Inclusion is the ideal way to create a more comprehensive understanding of a condition.
- Inclusion in decision-making processes allows for increased awareness and engagement by study participants.
- Diversity of individuals with different characteristics allows for better assessment of how effective study treatments will be.

*For question 2*, participants emphasized the following barriers:

- Participating in research requires effort—including transportation and parking to the research facility, availability of social supports (e.g., childcare, time off from work), and other factors.
- Research protocols may limit flexibility for those with behavioral challenges and anxiety. One parent stated:

"I don't know how our son would sit still in for an MRI or EEG."

- Convincing families that a study is worth their investment.
- Effectively communicating the study details in the consent or assent documents.

*For question 3*, participants provided the following ideas on increasing the number of people with IDD in research:

- Understand the possibility of conducting visits more virtually to decrease the burden of distance, transportation, and availability. COVID-19 restrictions helped advance this possibility.
- Using community networks to recruit, support, and gain public awareness
- Exploring reasonable incentives both in the short term and the long term, such as offering a direct service during recruitment (e.g., clinical consultation), or providing assistance for the entire family to attend (e.g., siblings).
- Equipping researchers with tools to communicate with individuals with IDD, including providing photos and toolkits to show what to expect during a visit or a procedure

## **Conclusions:**

Several points emerged from the discussions to promote inclusion as outlined above. We are incorporating these points into our consultations with researchers to strengthen their inclusive efforts.

**424.061** (Poster) Systematic Review: Parent-Mediated Interventions and Their Impact on Parent's Stress.

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**Background:** Parent mediated interventions (PMIs) are recommended as part of best practices for early intervention programs for children with autism (Zwaigenbaum et al., 2015). PMIs train parents in techniques and strategies that they in turn use to teach their own children. Although there is considerable evidence that PMIs are effective for improving child outcomes, less is known about how this model effects parents and how factors like delivery modality impact parent experiences. This review provides an overview of parent outcomes in the context of PMIs, with a focus on the impact of PMIs on parental stress.

**Objectives:** This review addresses the following questions: 1) Do PMIs improve measures of parental stress? 2) Are parental stress outcomes consistent across cultural contexts? 3) Are parental stress outcomes influenced by intervention delivery modality?

**Methods:** To identify eligible studies, a comprehensive search was conducted on the following databases: PsycINFO (EBSCO), Child Development & Adolescent Studies (EBSCO), CINAHL (EBSCO), PubMed, ProQuest Dissertations & Theses (ProQuest) and World Cat Dissertations Theses (OCLC). Peer reviewed journal articles and dissertations and theses published were included in the search process. Literature in the final review met the following criteria: experimental design, implementation of a PMI, at least one child diagnosed with an Autism Spectrum Disorder between the

age of 0-5 years, and one parental wellbeing measure reported as an intervention outcome measure. Extracted variables included: study design, participant characteristics (e.g., race/ethnicity), intervention model, intervention delivery (modality, dosage, duration), and types of reported outcomes.

**Results:** The search identified 1785 manuscripts on electronic databases and grey literature, of which 79 were included in this review from between the years 1998-2020. Among the 79 manuscripts, 47 measured parental stress as an outcome. Preliminary results indicate parental stress was reduced in 34 (72%) of the manuscripts that measured stress. Eleven manuscripts (14%) reported no change in stress after participating in a PMI and one study from Australia found an increase in stress in the home-based intervention group and a decrease in stress in their center-based intervention group. Parental stress results did not differ for remote and in-person interventions. From the 79 manuscripts, 56 (71%) were conducted in North America, 12 (15%) were conducted in Europe, 9 (11%) were led in Asia, and 2 (3%) were conducted in Australia. Given these demographics, cultural differences were not found in the stress outcomes of parents after participating in a PMI.

**Conclusions:** Despite parents taking on an additional role of an interventionist when participating in a parent-mediated intervention, evidence shows there to be a positive impact on their overall well-being. An increase in knowledge and techniques to understand their child's autism symptoms and behaviors may have given parents more confidence to handle stressful situations and reduce their feeling of stress. Thus, greater involvement by parents in the intervention improves their overall quality of life and wellbeing (Koly et al., 2021). This was also found to be consistent across cultures indicating that when PMIs are translated and tailored to other cultures, they can produce similar positive parental outcomes.

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**424.062 (Poster)** The Association between COVID-19 Impact and Barriers to Healthcare for Autistic Youth and Their Families

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**Background:** The COVID-19 pandemic has had broad and long-lasting impacts on physical and mental health across communities. Autistic youth and their families may be disproportionately impacted by the increased structural challenges created during the pandemic, such as barriers to accessing healthcare. While autistic youth typically face difficulties accessing healthcare, it is possible that the COVID-19 pandemic may have exacerbated such barriers due to factors such as clinic closures, increased provider waitlists, and a rapidly changing health services landscape.

**Objectives:** The current study aims to 1) examine differences in the impact of the COVID-19 pandemic for caregivers of autistic versus non-autistic youth, 2) evaluate whether caregivers of autistic youth report significantly more barriers to healthcare during compared to before the pandemic, and 3) explore whether the impact is associated with healthcare barriers prior to the pandemic or changes in self-reported healthcare barriers during the pandemic.

**Methods:** Caregivers of autistic ( $n=117$ ) and non-autistic ( $n=125$ ) youth ages 2 to 17 ( $M=8.58$  years) were asked to report on barriers to healthcare for their child before and during the pandemic and to complete the Coronavirus Impact Questionnaire (CIQ), which assessed psychological, financial, and resource impacts of COVID-19. We conducted independent-samples  $t$ -tests to examine group differences on the CIQ subscales and a paired-samples  $t$ -test to determine whether parents of autistic youth reported more barriers to healthcare during compared to before the start of the pandemic. Finally, using Pearson  $r$  correlations, we explored the association between the CIQ scales, pre-pandemic barriers to healthcare, and change in barriers to healthcare during the pandemic.

**Results:** Caregivers of autistic youth reported significantly greater impacts of the COVID-19 pandemic than caregivers of non-autistic youth across all three CIQ subscales (Table 1). Caregivers of autistic youth did not report differences in barriers to healthcare access before ( $M=158.24$ ,  $SD=52.10$ ) compared to during ( $M=155.15$ ,  $SD=46.90$ ) the pandemic,  $t(66)=-.81$ ,  $p=.419$ . All CIQ scales were moderately correlated with level of pre-pandemic barriers to healthcare in the autistic group (psychological  $r=.33$ , resource  $r=.38$ , financial  $r=.37$ ,  $ps \leq .002$ , Figure 1). Additionally, changes in barriers to healthcare were not correlated with any CIQ scale ( $ps > .320$ ).

**Conclusions:** Caregivers of autistic youth reported greater impact of the COVID-19 pandemic compared to caregivers of non-autistic youth across psychological, financial, and resource-related domains. Pre-pandemic barriers to healthcare were correlated with COVID-19 impact, suggesting that families with greater difficulties accessing healthcare prior to the pandemic were also more likely to experience higher levels of COVID-19 impact. Caregivers of autistic youth did not report increased barriers to healthcare services during the pandemic as compared to before. This may reflect high levels of barriers pre-pandemic; alternatively, it is possible that treatment approaches such as telehealth served to decrease some barriers to healthcare during the pandemic. Additional research should continue to evaluate the impact of COVID-19 on the wellbeing and care access of autistic youth and their families; future interdisciplinary work is needed to consider policy outcomes that would benefit youth and families particularly impacted by pandemic-related stress.

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**424.063 (Poster)** The Effect of Training and Experience on Preservice Teachers' Knowledge Related to Autism and Language Development

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**Background:** The increasing number of students being identified with autism, the trend towards an inclusive education model, and the consistently poor academic and post-secondary outcomes for individuals with autism necessitates an examination of teacher preparedness to meet the learning needs of this population. Research suggests that special education preservice and in-service teachers are more knowledgeable about autism than general educators. However, teachers across both categories demonstrate knowledge deficits and do not feel adequately prepared to meet the learning needs of their students with autism. Furthermore, social and structural language difficulties are prevalent in this population of students, and learning

depends on successful language use. However, research has not examined what preservice teachers know about language development in general or the specific language characteristics typically associated with autism spectrum disorders.

**Objectives:** This pilot study examined the effects of autism-specific instruction and experience interacting with individuals with autism on preservice teachers' knowledge of autism, language development, and language characteristics typically found in the autism population.

**Methods:** This descriptive study utilized the Autism and Language Knowledge Questionnaire (ALK-Q) to gather data on participants' training and experiences and measure their knowledge in three distinct areas: autism, language development, and language characteristics associated with autism. Analysis of variance (ANOVA) was used to identify variables that influenced preservice teachers' knowledge scores. In addition, analysis of individual questions identified trends in knowledge gaps and misconceptions.

**Results:** Preservice teachers studying special education had higher average knowledge scores than those studying general education. General education teachers also demonstrated greater knowledge gaps and more misconceptions. While ANOVA did not determine a significant effect between the number of courses and knowledge scores, those students who took more courses that addressed autism had better scores across all three knowledge scales. Participants who received outside training in addition to their teacher preparation program outperformed peers without additional training. ANOVA and GLM model fit analysis indicate that level of experience has a significant effect on knowledge scores. Those with more experience interacting with individuals with autism had higher levels of knowledge across all three scales.

**Conclusions:** This preliminary research supports the existing literature and has important implications for Institutes of Higher Education that prepare future educators. The results support the need for autism-specific instruction during teacher preparation programs to improve preservice teacher knowledge of autism. They also support the need for increased opportunities for preservice educators to interact with individuals with autism as a part of their training.

**424.064 (Poster)** The Effect of an Etiologic Genetic Diagnosis on Family Adjustment and Parental Stress Among Families of Children with Autism Spectrum Disorder (ASD)

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**Background:** Genetic diagnoses are a widely known etiology for autism spectrum disorder (ASD). In order to identify genetic diagnoses, the American College of Medical Genetics, American Academy of Pediatrics, and other professional organizations recommend that all children with ASD undergo genetic evaluation and appropriate testing. Identification of a genetic etiology for ASD can assist with prognosis and recurrence risk counseling as well as medical management. However, the effects of a causal genetic diagnosis on family adjustment and parental stress among families of children with ASD remain unknown.

**Objectives:** To explore the potential effects of receiving an etiologic genetic diagnosis upon family adjustment and parental stress among families of children with ASD.

**Methods:** Parents of children with ASD aged 12 years and younger were recruited through the SPARK (Simons Foundation Powering Autism Research for Knowledge) Research Match (RM) program. Participants responded to a multi-part survey including a custom survey regarding their experiences with genetic evaluation and testing for their child with ASD, the *Family Adjustment Measure* (FAM; measure of family's adjustment to the ASD diagnosis) and *Parenting Stress Index™, Fourth Edition, Short Form* (PSI™-4-SF; measure of parenting stress), and other validated measures.

**Results:** A total of 282 participants (93.6% female, 97.9% in the role of parent, grandparent, or non-family caregiver) began the multi-part survey and reported on 76.9% male children. 49.5% reported that their child with ASD received genetic testing, 8.7% were referred but did not receive testing, and 41.2% were never referred. Of those who completed genetic testing, parents reported whether the results definitely did (25.4%), possibly did (26.2%), or definitely did not (48.4%) provide an etiological diagnosis for the ASD. There were no significant differences among these three groups on any subscales of the FAM, although a trend emerged for parents of children with a genetic diagnosis to score higher on the Family-Based Support and Social Support subscales and lower on the Parental Distress and Positive Coping subscales. Likewise, there were no significant differences among these three groups on any subscales of the PSI™-4-SF; however, there was a trend for parents of children with an etiological genetic diagnosis to score lower across all subscales and total PSI™-4-SF score.

**Conclusions:** Compared with those whose children's genetic test results were ambiguous or negative, families of children for whom a genetic etiology was confirmed tended to have more support in their family and other social circles. They reported lower distress, but also less positive coping. On measures of parenting stress, caregivers of children with an identified genetic etiology tended to have decreased distress and improved parent-child interactions. Though these differences were not statistically significant, these trends warrant further investigation since our outcomes suggest that finding genetic causes for children's ASD may influence whole family outcomes. Future work will focus on the impact of families' perception of genetic test results in comparison to medical providers' perception; as well as differences between families of children who did and did not undergo genetic testing, regardless of testing outcome.

**424.065 (Poster)** The Lived Experience of Gender Dysphoria in Autistic Young People: A Phenomenological Study with Young People and Their Parents

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## Background:

*Gender dysphoria* means distress due to an incongruence between an individual's gender and sex assigned at birth. Gender clinics offer support for people who are exploring their gender, and who are experiencing gender dysphoria. There is a higher prevalence of autism in young people attending gender clinics than in the general population.

## Objectives:

We aimed to explore the lived experiences of autistic young people who have experienced gender dysphoria, and their parents, using a multiperspectival Interpretative Phenomenological Analysis (IPA).

## Methods:

Young autistic people aged 13-17 (n=15), and their parents (n=16), completed in-depth interviews about the young person's experience of gender dysphoria. We analysed each individual transcript using IPA to generate individual themes, and for each of the dyads, we developed themes which acknowledged the similarities and differences in the perspectives of parents and young people.

## Results:

The first overarching theme was *coping with distress* which had two subthemes: (a) *understanding difficult feelings* and (b) *focus on alleviating distress with external support*. This theme was about young people being overwhelmed by negative feelings which they understood as being about gender incongruence. Young people then looked to alleviate these feelings through a gender transition. The second overarching theme was *working out who I am* which had two subordinate themes: (a) *the centrality of different identities and needs* and (b) *thinking about gender*. This theme was about how young people and their parents focused on different needs; while young people more often focused on their gender-related needs, parents focused on autism-related needs.

## Conclusions:

We conclude autism and gender dysphoria were seen as intersecting in meaningful ways by parents and young people. A key finding is that while autistic young people tended to see their needs as mostly linked to gender dysphoria, parents more often saw their difficulties through the lens of autism.

**424.066 (Poster)** The Oral Health Knowledge, Attitudes, and Practices of Black Caregivers of Children with and without Autism Spectrum Disorder  
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## Background:

Oral health is vital to overall physical and psychological health. However, some pediatric populations, such as children from underserved minoritized groups (e.g., Black/African American [B/AA]) and children with special health care needs (e.g., autism spectrum disorder [ASD]), are at greater risk for oral health disparities (e.g., increased caries and oral-related chronic diseases, poorer overall oral health status and access to care). Gaps in oral care knowledge, attitudes, and practices may contribute to oral health disparities in these populations.

## Objectives:

The purpose of this study was to identify the oral health knowledge, attitudes, and oral care practices of B/AA caregivers of children with and without ASD.

## Methods:

Participants were 125 caregivers (e.g., parents, grandparents, guardians) of children 4-14 years who self-identified as B/AA or mixed (including B/AA) and identified their children similarly (B/AA or mixed), with (n=65) or without ASD (n=60). Caregivers completed a 120-item culturally-tailored survey to examine the oral health knowledge, attitudes, access, and practices in minoritized populations.

## Results:

Significant correlations were found for both groups combined between caregiver oral care knowledge and child daily oral care practices ( $p=0.016$ ), caregiver daily oral care practices and child's daily oral care practices ( $p<0.001$ ), and caregiver oral care knowledge and caregiver oral care attitudes ( $p<0.001$ ). For the ASD group, a significant correlation was found between child's daily oral care practices ( $p=0.014$ ) and access to care. For the non-ASD group, significant correlations were found between access and caregiver oral care knowledge ( $p=0.001$ ), and access and

maternal/caregiver education ( $p=0.004$ ). Nearly half of respondents reported that they and their child are fearful of dentists, although 90% indicated they trust their child's dentist. Despite that trust, 74% of the ASD group and 28% of the non-ASD group stated that they believe their race/ethnicity negatively influences how their child is treated at the dentist. Although caregivers of children without ASD reported more years of education, they also exhibited significantly less oral care-related knowledge than caregivers of children without ASD ( $p<0.001$ ). Regardless of ASD status, an overwhelming number of caregivers (89%) reported they would like to learn additional ways to improve their child's oral health.

#### Conclusions:

This study highlights the relationship between caregiver oral health knowledge, attitudes, and oral care practices. B/AA caregivers of children without ASD have some foundational knowledge about oral health and basic practices, but parents of children with ASD have significantly less. This is an area that needs to be addressed, and fortunately most caregivers report their interest in learning more. Given the inconsistency between families' reported trust of their child's dentist alongside a feeling that their child's treatment is negatively impacted by their race/ethnicity, it is important to develop and implement culturally-tailored oral health education and behavioral interventions to mitigate oral health disparities for B/AA families. Therefore, it is important to explore the intersection of culture and oral health for this population.

**424.067 (Poster)** The Role of Autistic Features in Parental Mental Health and Quality of Life: Comparison between Parents of Children with Idiopathic Autism, Phelan Mcdermid Syndrome (PMS) and Other Copy Number Variants (CNVs)

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#### Background:

Parents of autistic children sometimes report more mental health issues and lower quality of life (QoL) than parents of non-autistic children. Contributing factors include strength of their child's autistic features, level of care need, and strength of autistic features within the parent. Rare genetic conditions associated with autism, such as Phelan McDermid Syndrome (PMS) and other copy number variants (CNVs) that involve multiple and profound disabilities, may pose a unique challenge to parents.

#### Objectives:

- Identify differences in parental anxiety, depression, and QoL based on child's diagnosis (idiopathic autism [iASD], PMS or other CNV, or typical development [TD])
- Examine the relationship between parental anxiety, depression, QoL and the strength of their child's autistic features
- Examine the relationship between parental anxiety, depression, QoL and the strength of autistic features within parents

#### Methods:

32 parents (20 mothers/12 fathers) of iASD children, 34 parents (21 mothers/13 fathers) of PMS or other CNV children, and 28 parents (17 mothers/11 fathers) of TD children completed the Becks Anxiety and Depression Inventories, the QoL for Adult Carers Questionnaire (AC-QoL), and the Social Responsiveness Scale (SRS). Parents also completed the Sensory Experience Questionnaire (SEQ), Child Routines Inventory (CRI), and the Vineland Adaptive Behaviour Scales (VABS-II) about their child.

#### Results:

No difference in levels of anxiety, depression, or QoL were observed between parental groups based on child's diagnosis. Parental anxiety was positively associated with parental depression ( $r(94) = 0.583, p < .001$ ), strength of parental autistic features ( $r(94) = 0.456, p < .001$ ), and child's level of motor behaviours/compulsions (cMBC) ( $r(53) = 0.337, p < .05$ ). Parental depression was positively associated with strength of parental autistic features ( $r(94) = 0.337, p < .001$ ), cMBC ( $r(53) = 0.380, p < .01$ ), and negatively associated with child's level of social adaptive functioning ( $r(86) = -0.271, p < .05$ ). Parental QoL was negatively associated with child's level of sensory experience ( $r(18) = -0.670, p < .01$ ), cMBC ( $r(17) = -0.634, p < .01$ ), and child's rigidity/insistence on sameness (cRIS) ( $r(17) = -0.645, p < .01$ ).

Linear regression found 55.9% of variance in parental anxiety levels was explained by level of parental depression, strength of parental autistic features, and cMBC ( $F(3,52) = 20.745, p < .001$ ). 45.1% of variance in parental depression levels was explained by level of parental anxiety, strength of parental autistic features, and child's MBC and social adaptive functioning ( $F(4,47) = 8.828, p < .001$ ). Levels of parental depression accounted for the most variance in levels of parental anxiety (33.9%) and visa versa (37%). 63.7% of variance in parental QoL could be explained by child's level of sensory experience, cMBC and cRIS ( $F(3,16) = 7.588, p < .01$ ). Child's level of adaptive functioning was not predictive of parental anxiety, depression, or QoL.

#### Conclusions:

Parental mental health was better predicted by parent's own mental state than the strength of their child's autistic features or level of adaptive functioning. Parental QoL was negatively impacted by the strength of their child's sensory experiences and restricted and repetitive behaviours (RRBs).

**Background:** Children with autism spectrum disorder, a pervasive developmental disorder, have been shown to potentially increase levels of parental stress when compared to children with no psychological disorders (Rao & Beidel, 2009). Additionally, extant literature demonstrates a relationship between parental stress and judgements on one's own parenting abilities, including limit setting (Fong, 1991; Reed et. al., 2017). When analyzing which factors contribute the most to parental stress, Faulk, Norries, and Quinn (2014) found that parental cognitions were a better predictor of stress over child-centric variables.

**Objectives:** This study investigates the role of parent's self-reported stress and psychopathology as a predictor for limit setting abilities in families with a child with autism spectrum disorder.

**Methods:** There were a total of  $n = 31$  parents of children with ADOS-confirmed ASD. This sample was 76.5% male, 47.1% white, 47.1% African American, 5.9% Asian with an average age of  $M = 5.21$  years ( $SD = 2.591$ ). All assessments were collected by parent report during an evaluation at a university autism spectrum disorder clinic. Parental stress was assessed using the validated and reliable Parental Stress Scale (PSS; Algarvio et al., 2018; Zelman et al., 2018). Parental psychopathology was rated using the Hopkins Symptoms Checklist (Derogatis et al., 1974). Additionally, self-perceived limit setting was rated using the Parent-Child Relationship Inventory Limit Setting subscale (PCRI; Gerard, 1994). Linear regression analyses were conducted to determine the influence of psychopathology and parent stress on limit setting abilities.

**Results:** Limit setting was significantly correlated with parental stress ( $r = -.56, p = .001$ ) and parent-rated psychopathology ( $r = -.38, p = .046$ ). Analysis indicated that parental stress significantly predicted limit setting abilities, but parents self-rated psychopathology did not significantly predict limit setting. A linear regression analysis model was demonstrated to be significant ( $p = .004$ ) and explains about 30% of the variance (adj  $R^2 = .301$ ). Parent self-rated psychopathology did not significantly predict limit setting ( $B = -9.319, p = .129$ ), but parent stress did significantly predict limit setting ( $B = -.488, p = .009$ ).

**Conclusions:** Parental stress, but not psychopathology, significantly predicts a parent's limit setting. Lower parental stress is associated with higher limit setting abilities with their autistic child. This finding is consistent with previous research on the relationships between parental stress and limit setting abilities. These findings have the potential to impact parent support resources and parent training modules. When looking to reduce parental stress, it may be important to help parents effectively set limits with their children. Additionally, future research should look to understand underlying mechanisms within this relationship and ways to improve parental stress.

**424.069 (Poster)** Time Is Not Money—Examining the Relationships between Parental Stress and Family Resources after the Clinical Support Withdraws for Lower Resourced Families and Their Children with Autism  
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#### **Background:**

Parenting stress in caregivers of children with ASD has been well documented (e.g., Benson & Kersh, 2011; Hayes & Watson, 2013; Zaidman-Zait et al., 2017). Core deficits of ASD were found to significantly predict maternal depressed mood (Benson & Kersh, 2011; Davis & Carter, 2008). Maladaptive behaviors could hinder the parents' daily routines, social engagement, such that parents may reduce time running errands or socializing with friends and family, feeling withdrawn from the community (Harper et al., 2013). As parenting stress negatively impacts both parental and child outcomes (Neece et al., 2010) and potentially counteracts the effectiveness of early interventions (Osborne et al., 2008), it is imperative to understand the parenting stress that caregivers experience and the supporting resources available within their ecological system.

#### **Objectives:**

To extend previous work by Kasari et al. (2014) by investigating how parenting stress changed over the active treatment course and after the clinical support had been withdrawn, between the two treatment groups that received either an individual coaching version of a manualized intervention (i.e., JASPER; Kasari et al., 2010) or a group-based caregiver education module (i.e., CEM) that covered similar materials.

#### **Methods:**

This secondary analysis included 31 children with ASD ( $M_{age} = 42.3$  months) and their caregivers who were lower resourced and part of a multi-site RCT trial (Kasari et al., 2014). The Parenting Daily Hassles (PDH; Crnic & Greenberg, 1990) was administered at entry, exit, and 3-month follow-up to assess parenting stress. Linear mixed-effect models were utilized to examine the PDH score changes over time by treatment group, specifically before and after the clinical support was withdrawn. Income, family resources (FRS; Leet & Dunst, 1987), and Mullen Scale of Early Learning (MSEL; Mullen, 1995) score at entry were examined as predictors of the parental stress.

#### **Results:**

Parental stress scores changed specifically before and after exit. The CEM group reported significantly worsened stress from entry to exit [ $t = 3.79, p < .01$ ] though the change was not significant from exit to follow-up. Whereas JASPER group reported no significant change in stress from entry to exit but experienced significantly higher stress from exit to follow-up [ $t = 4.14, p < .01$ ]. Higher level of family resources significantly predicted lower parenting stress [ $F(1,19) = 38.37, p < .001$ ] over time for both groups. Such significance was not present at exit, but only from exit to follow up [ $F(1,10) = 59.26, p < .001$ ]. No significant group by time interactions.

#### **Conclusions:**

Family resources were a significant predictor of parental stress for both treatment groups, especially after the families exited the study. Sources are not limited to tangible capital, such as money, housing, and transportation, but also include intangible assets, like social support and private time for self-care. Having such resources could alleviate the daily hassles perceived by parents of children with ASD. To reiterate, different treatment modules may be differentially suitable for families with various levels of resources. For lower resourced families, intensive treatment modules could improve outcomes at exit but instill latent ramifications, such as aggravated parental stress, if the clinical support ceases abruptly from exit to follow-up.

**424.070 (Poster)** Tracking Outcome of Early Career Researchers in ASD

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**Background:**

Many private and public funding agencies offer fellowships to scientists at the beginning of their careers. In addition to supporting rigorous scientific training and high-quality research, there is often a further goal of encouraging retention of these early-career scientists within the autism field past their funding period. However, very little data has been collected on the impact of this funding on career trajectories.

**Objectives:**

Our objective is to explore the potential impact of early career research funding on retention and productivity through an analysis of five and ten-year outcomes among applicants to Autism Science Foundation's (ASF) pre- and postdoctoral fellowship programs. This analysis was designed to determine the impact of fellowship training support on a number of scientific measures as well as those more directly relevant to community impact.

**Methods:**

We utilized publicly available data resources and databases (iCite, LinkedIn, Google, Dimensions) to capture information on researchers who applied to the ASF's pre and postdoctoral fellowship programs from 2010-2016 (n=400). We determined the career trajectories of all applicants at 5 years after their initial application, and where data was available from the earliest cohorts, at 10 years. This analysis examined the differences in retention in autism and publications who were funded by ASF and those who applied but were not funded.

**Results:**

At 5 years follow up, we found a higher percentage of those who were funded (80%) stayed in the autism field compared to those who applied but were not funded (57%). ( $\chi^2 = 9.89$ ,  $p = .001$ ). However, when the subset of applicants funded in 2010-2011 were tracked to 10 years post award, the difference in autism retention was no longer significant.

Regardless of whether or not the fellows stayed in autism research, funded and non-funded researchers were equally as productive in terms of publications at 5 years post award. This suggests that both groups were publishing in academic journals in whatever scientific career they chose.

**Conclusions:**

This study design allowed for rigorous tracking of funded researchers in a non-biased way (not relying on individual progress reports) with the presence of a control group (non-funded applicants). Funding the training of early career researchers improved the retention in the autism field at 5 years. There are a number of factors which may influence the 5 year retention that are not directly related to ASF funding. Funded and non-funded researchers published in scientific journals at the same rates. Future analyses will also include citation ratios and a measure of networking. These findings suggest that support to early career researchers that includes a strong training component is critical to recruit and retain scientists into autism research.

**424.071 (Poster)** Trust Takes Times: Using a Patient-Centered Outcomes Research (PCOR) Approach to Build and Sustain Engagement with Transition-Age Autistic Youth and Stakeholders

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**Background:** The transition to adulthood is fraught with challenges as individuals depart familiar systems of care and begin to navigate new and unfamiliar systems. This transition is particularly difficult for autistic youth, who often present with co-occurring psychiatric and medical conditions, in addition to the core symptoms of autism spectrum disorder (ASD). There is great concern regarding how the intersection of these co-occurring conditions and core symptoms impact their overall health, healthcare decision making, and health outcomes. Recent data suggests that the transition to adulthood disproportionately impacts autistic individuals compared to neurotypical peers and individuals with other chronic conditions. This amplifies the need to better understand the challenges encountered during the transition to adulthood for transition-age autistic youth.

**Objectives:** The purpose of this study was to build and sustain engagement with transition-age autistic youth, their caregivers, and other stakeholders to better understand the challenges encountered during the transition to adulthood and identify meaningful ways to address these challenges.

**Methods:** A Patient-Centered Outcomes Research (PCOR) approach was used to form partnerships among transition-age autistic youth ages 14-36, their caregivers, and stakeholders (e.g., clinicians, educators, researchers). These individuals met monthly within their respective communities over the course of three years to identify barriers to the transition to adulthood for transition-age autistic youth, as well as facilitate the identification of patient-centered solutions. Appointed leaders from these groups attended a monthly advisory board consisting of autistic adults, caregivers, and stakeholders to further share this information and develop PCOR and comparative effectiveness research (CER) questions. Partnerships were created through local autistic self-advocacy and community organizations to provide a sustainable infrastructure.



**Results:** Outcomes of this study included the identification of seven key areas of transition for autistic individuals (e.g., healthcare, self-advocacy, safety, education, employment, social relationships, and daily living). A total of 30 PCOR/CER questions were identified to be executed in future research. Additionally, outcomes included knowledge of how best to build and sustain engagement with autistic individuals, caregivers, and stakeholders. Included in these outcomes were lessons learned on best practices on creating an inclusive environment for authentic engagement and strategies to ensure engagement is equitable.

**Conclusions:** Transition-age autistic youth face many challenges as they embark on the transition to adulthood, even more so than their neurotypical peers or other individuals with chronic conditions. This often results in poorer transition outcomes. This study demonstrated the need and ability to build and sustain engagement with transition-age autistic youth, caregivers, and other stakeholders to better understand these challenges from a PCOR perspective. This type of approach allows for not only a better understanding of their unique needs, but also provides a means of developing patient-centered solutions to address these needs. Many lessons were learned over the course of the study, including that although trust takes time to build and sustain engagement, the outcomes that result from this investment have the potential to make a meaningful impact on the lives of autistic youth embarking on the transition to adulthood.

**424.072 (Poster)** What Are the Experiences of Primary to Secondary Transition for Children with Autism? an Exploration of the Experiences of Primary to Secondary School Transition for Children with Autism in One East London Borough.

**E. Valizadeh**, Support for Learning Service, London Borough of Tower Hamlets, London, United Kingdom

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**Background:**

This research acknowledges that there is a lack of literature specifically focused on the views of children with autism with regards to primary to secondary transition. As Makin, Pellicano and Hill (2017) note this transition is often reported as problematic and existing literature considering the views of parents and teachers reveals a number of difficulties related to primary to secondary transition. Despite this, there is little research capturing the voice of the children themselves. A literature review will provide an overview of other relevant research focused on the experiences of children with autism transitioning from primary to secondary school, the wider experiences of children with autism in secondary school more generally as well as reviewing methods used in other research to elicit views of young people with autism. E.g. Fayette and Bond (2018).

An extensive literature review has revealed that there is a considerable need for more research exploring the voices of children with autism, particularly with a view to using these views to improve practice going forward.

**Objectives:**

The aim of the research is to explore the experiences of children with autism in their transition from primary to secondary school. The research aims to explore these experiences from the perspective of the children themselves, capturing their authentic voice with a view to improving practice going forward.

**Methods:**

The research used a qualitative participatory approach within a phenomenological framework. Sixteen children in year 7 with a diagnosis of autism were individually interviewed using semi structured interviews in the summer term of year 7. With regards to methodology and approach of capturing the authentic voice of the children with autism considerations must be given to methods which allow for the most credible capture of the views and experiences of the sample group. Therefore this research used an innovative approach, the Three Houses tool, in all interviews as a flexible interview schedule

**Results:**

Overall the children described negative experiences moving from primary to secondary school. The data, thematically analysed, confirmed that transition to secondary school and experiences once there were problematic. These difficulties related to a number of school level factors. Peer relationships, academic pressure and teachers understanding appeared to be key difficulties experienced by all the children interviewed.

**Conclusions:**

This research identified predominantly negative experiences of the primary to secondary school transition for the children interviewed. This research revealed that a number of school and system related factors need to be addressed to improve the transition experiences of children with autism. Additionally, the findings point towards the need for greater research which captures the authentic voices of children with autism and further considerations regarding the methods used to capture those voices. The research makes a number of recommendations of changes to practice moving forward to support improved experiences of children with autism moving from primary to secondary school.

**424.073 (Poster)** Participants' and Researchers' Perceptions of Effective Recruitment Strategies: Lessons Learned through SPARK

**R. P. Goin-Kochel**, Baylor College of Medicine, Houston, TX

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**Background:** Recruitment for clinical studies remains one of the biggest challenges to performing studies of all sizes. As many as 75% of studies are unable to enroll the proposed number of participants and 90% fail to enroll within the original timeframe (Kost et al., 2015). Understanding which recruitment methods are most likely to facilitate participant enrollment is of utmost importance financially, scientifically, and ethically.

**Objectives:** To identify (a) the most commonly endorsed research-recruitment strategies through which SPARK participants learned about the study, (b) which strategies participants rated as most influential in their decisions to enroll, and (c) the strategies that SPARK research staff endorsed as the most successful in increasing participant enrollment.

**Methods:** In study one, 52 of 150 research staff from 23 SPARK clinical sites (35%) were surveyed about the recruitment strategies that their site had used for the SPARK study and which they felt were most successful in influencing families to enroll. Staff were invited via email to complete a REDCap questionnaire and were incentivized with a chance to receive one of five \$100 gift cards. In study two, 4,144 of 26,997 primary account holders enrolled in SPARK (15%) were surveyed about all ways they heard about SPARK prior to enrollment, which was most influential in their decisions to enroll, and their understanding of what participation entailed. Participants were incentivized with a chance to receive one of 25 portable chargers. For both studies, up to three reminders were sent to nonresponders.

**Results:** In study one, the most frequently cited recruitment methods that study personnel believed were most influential in families' decisions to participate included *speaking with a SPARK study-team member* (36.5%), *speaking with a medical provider* (19.2%), *word of mouth* (11.5%), and *a live TV news story* (11.5%). Table 1 shows the methods that they would/would not repeat/recommend. In study two, the most common methods by which families learned about SPARK were through *social media* (46.8%), *speaking with a medical provider* (22.9%), *online search* (20.0%), *hearing about SPARK from a friend/family member* (13.2%), and *a flyer/printed material* (12.7%). Among all the ways they heard about SPARK, the strategies that most influenced their decisions to enroll were *social media* (30.5%), *speaking with a medical provider* (17.5%), *online search* (12.8%), *hearing about it from a friend/family member* (7.8%), and through an *email from the SPARK research team* (5.8%). Figure 1 illustrates the proportion of recruitment strategies that families rated as most influential in their decision to enroll. For example, among all those who reported learning about SPARK from their medical providers, 72% rated medical providers and 28% rated some other strategy as the most influential in their decision to enroll.

**Conclusions:** The most common and influential ways families learned about SPARK were through social media and medical providers. The strategies that research staff would repeat/recommend often differed from those that families indicated were most influential. Findings have implications for the selection of recruitment strategies that have the greatest reach and most influential impact.

#### **424.074 (Poster) Mental Health of Siblings of Children with Autism Spectrum Disorder**

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**Background:**

ASD is a complex neurodevelopmental disorder. This disorder can cause a major modification in the family routines and interactions. Its clinical peculiarities can be life-threatening for neurotypical siblings.

**Objectives:**

To describe the emotional and psychosocial disorders of neurotypical siblings of children with ASD and the factors associated with

**Methods:**

This is a correlational descriptive study conducted among 94 normally developing siblings of children with ASD, collected by sampling for convenience within the child psychiatry out-patient unit of Monastir, Tunisia. Data collection was carried out using two measurement instruments validated in Arabic (CBCL 6-18 and safety scale) over a period of three months.

**Results:**

Over 98% of sibling had a pathological score in at least one domain of the CBCL: 75% of sibling had anxiety / depression, 32% had somatic complaints, 74% had social integration problems, 30% thoughts problems, 71% had attention problems, 11% had delinquent behaviors and 60% had aggressive behaviors. In 95% of cases, sibling had internalized disorders and in 84% had externalized disorders. Being a sister, the first born, having more than one sibling and the presence of family violence were associated to higher score in the anxiety / depression domain. Attention problems were associated to moral violence exposure. Delinquent and aggressive behaviors were associated to male gender.

**Conclusions:**

Siblings of children with ASD suffer from multiple emotional and psychological problems. Anxiety and depression seem to be the most frequent. Developing a special program for this population could help improve their quality of life and may, the evolution of the ASD children.

#### **424.075** (Poster) Parent Perceptions of Autism and Policing: Similarities and Differences By Race

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**Background:** Individuals with disabilities – such as ASD – are at high risk of negative outcomes during police interactions, including injury and death (Bronson et al., 2015; Perry & Carter-Long, 2016; Swaine et al., 2016). This problem stems from a combination of historically dysfunctional police expectations, tactics, and procedures, as well as challenges associated with autistic individuals' abilities to rapidly respond to unusual demands of law enforcement interactions (Rava et al., 2016). Police interactions are typically unexpected, include unusual sensory stimulation, require novel problem solving, and necessitate rapid processing of social situations, which can make them particularly difficult for autistic people (Channon et al., 2001; Salerno-Ferraro & Schuller, 2020; Vanmarcke et al., 2016). Extensive evidence also suggests that police interactions differ significantly in under-served neighborhoods and communities of color, further increasing the risk of serious negative outcomes (Brunson, 2007). Given the dearth of formalized education about this topic, parents play a critical role in educating their children about police interactions. Due to high risk of negative outcomes, it is imperative to explore how parents of autistic individuals perceive police interactions.

**Objectives:** (1) Query parents of children with autism about their perceptions of law enforcement, particularly with regards to their own child; (2) Compare perceptions of policing among White and Black or African American parents of autistic children.

**Methods:** One hundred and twenty-eight parents of individuals with ASD were emailed a link to an anonymous 10- to 15-minute online survey. Most participants were White (66%), female (89%), non-Hispanic (93%), and lived in the suburbs (47%). A substantial subgroup of participants were Black or African American (27%). The majority of participants had a Bachelor's degree or higher education (70%). Most parents reported incomes greater than \$91,000 per year (Table). Answers to four questions were compared between parents who self-reported being Black or African American, and parents who self-reported being White.

**Results:** The majority of parents in both racial groups expressed concern that police lack the skills necessary to interact safely with their autistic children (86% overall), and were worried that their child's autistic symptoms might be misinterpreted by police (89% overall). Black and White parents of individuals with autism had very different views on equitability and justice in policing (31% of Black parents agreed that their police department works to provide justice equally to all people vs. 69% of White parents). The majority of both subgroups agreed that police officers need to change how they interact with Black and Brown individuals (94% of Black parents, 76% of White parents).

**Conclusions:** Parents of autistic children are deeply concerned about the safety of police interactions, especially in the case of Black and Brown people. This highlights the need for better police officer training, including targeted skills development and benchmarks for interacting safely with autistic individuals. Current research efforts include querying police officers about their knowledge of autism, with the goal of developing a pilot intervention to improve police officers' knowledge about autism, empathy toward autistic individuals, and ability to interact safely with autistic people.

### **VIRTUAL POSTER SESSION — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES**

#### **511 - Family Issues and Stakeholder Experiences I --- (V)**

#### **511.063** (Virtual Poster) A Mixed-Methods Systematic Review of Community Involvement in Autism Research

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**Background:**

Participatory autism research describes an approach in which autistic people are involved in the research process including in study conceptualisation, design, implementation, interpretation, and dissemination. To date, community participation has taken various forms in autism research, ranging from autistic people having no say at all in the research process (e.g., as participants), to tokenism (e.g., providing inputs as consultants without affecting outcomes), to having decision-making power that is equal to, or even greater than, researchers. In a scoping review published in 2014, Jivraj et al. identified only two published papers reporting community involvement in autism research. They also revealed limitations in the reporting of the depth of community involvement across research in neurodevelopmental conditions.

**Objectives:**

Given the increasing calls for participatory research to be more widely adopted in autism, we sought to conduct a comprehensive mixed methods systematic review to provide an overview of participatory autism research published to date. This review addresses the following questions: (a) Has community involvement in autism research increased over time? (b) What is the level and breadth of community participation in autism? (c) What is the quality of reporting of community involvement in autism research? (d) What are some factors that may be associated with greater involvement of community members in autism research (e.g., funding source, type of research)?

**Methods:**

A pre-registration of this review has been submitted to PROSPERO. A search strategy that utilised a combination of searches through titles, abstracts, keywords, and full texts related to 'autism' and 'participatory research' was devised in consultation with the broader team and a university librarian. Search terms were entered into seven databases, namely, PsychINFO, Scopus, PubMed, MEDLINE, EMBASE, ERIC, and ProQuest Dissertations and Theses. Electronic database searches have been conducted on 9-Aug-2021 and were limited to articles published in English. We also adopted a participatory approach for this study, in which autistic advocates and researchers were involved in the design, search and coding stages, and interpretation of the findings.

#### Results:

Our searches yielded a total of 3,855 records. After removing 1,534 duplicates, the titles and abstracts of 2,321 records were screened to determine their eligibility using a double-blind review process by autistic and non-autistic team members. The full-text screening of 1,058 records is currently underway and data extraction and synthesis will be completed by February 2022. We are using a convergent integrated approach to synthesise and integrate findings from the included studies based on the four review questions. Findings will also be visualised using tables and figures.

#### Conclusions:

This systematic review will yield important findings on changes in the extent and nature of participatory research in the field of autism. It will also provide an opportunity to take stock and reflect on the progress that has been made in increasing community involvement in autism research, and its potential impact.

**511.064** (*Virtual Poster*) A Qualitative Study Exploring Autistic People's Experiences of Stigma at Universities in Australia  
**D. W. Tan, M. Rabuka, T. Haar and E. Pellicano, Macquarie School of Education, Macquarie University, Sydney, NSW, Australia**

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#### Background:

In recent years, the number of autistic people entering university has doubled. While an encouraging trend, autistic students' completion rates remain much lower than non-autistic students in Australia (35% vs. 51-67%). Autistic people's low completion rates have been attributed to non-academic challenges of university life, such as social isolation and loneliness. But autistic people are also more vulnerable to stigma compared to non-autistic students. Across several qualitative studies investigating university experiences of autistic people, experiences of stigma consistently emerged as one of the main themes underlying their university lives. To date, there are no qualitative studies that have been designed specifically to understand the experiences of autism stigma in universities.

#### Objectives:

In this project, we seek to understand the contexts and circumstances under which autistic students felt stigmatised or experienced discrimination across a variety of settings, including their transition into university life, social environment, interactions with teaching and professional staff, and navigations through the university systems and physical environment. We also aim to determine the psychological, social, and practical impacts of stigma.

#### Methods:

Semi-structured interviews are being conducted with three groups of autistic people: 1) Ten autistic adults who have completed at least one university course in Australia, 2) ten autistic adults who have enrolled in but discontinued at least one university course in Australia, and 3) ten autistic adults who are currently studying a university course in Australia. Participants are being recruited through purposive sampling via social media posts. This project adopts a participatory approach and is co-produced with autistic researchers, who are involved in the study design, execution, interpretation, and dissemination of this research.

#### Results:

Data collection for this project is ongoing and will be completed by February 2022. We are analysing the data using reflexive thematic analysis, adopting an inductive approach to identify key features of the semantic content of the data within an essentialist framework. All members of the study team will independently familiarise themselves with the data and meet regularly to review coding, themes, and subthemes.

#### Conclusions:

The study findings will lead to a better understanding of autistic people's experiences of stigma within the university environment. It will also inform the design of further studies to develop ways in which such stigma can be reduced or prevented, as well as policy changes to improve social inclusivity for autistic and other neurodivergent students attending universities.

**511.065** (*Virtual Poster*) Associations between Parental Stress and Quality Time Spent with Youth on the Autism Spectrum  
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**Background:** Parents of youth with autism spectrum disorder (ASD) experience high levels of stress due to their caregiving role. While research indicates that parental stress may decrease when positive interactions between parents and their children increase, little is known about this relationship or the nature of these interactions.

**Objectives:** This study aimed to explore the relationship between parental stress, time parents and children spent together, shared enjoyment, and synchronicity in a nationally representative sample of parents of youth with ASD.

**Methods:** Caregivers ( $N = 511$ ) of youth ages 4 – 18 completed the Parenting Stress Index-Short Form (PSI) and a survey of parent-child quality time developed by the research team. Mean youth age was 10.81 years ( $SD = 4.50$ ). Most children in the sample were male ( $N = 393$ ; 77.2%) and White ( $N = 448$ ; 77.0%). Caregivers were between the ages of 22 – 66 ( $M = 40.4$ ,  $SD = 7.73$ ) and two-thirds were married ( $N = 353$ ; 69.2%).

**Results:** Results indicated that as parental stress increased, amount of time parents and children spent together ( $r = -.098$ ,  $p = .027$ ) and shared enjoyment during these interactions decreased significantly ( $r = -.331$ ,  $p < .001$ ). Further, parents with clinically significant levels of stress reported engaging in shared activities and experiencing synchronicity with their child less often than parents below the clinical threshold ( $X^2 = 12.37$ ,  $p < .001$ ;  $X^2 = 16.32$ ,  $p < .001$ , respectively). Significant associations between demographic factors (e.g., child age, race, family income) and stress, shared enjoyment, and synchronicity are also presented.

**Conclusions:** The primary aim of the current study was to explore the relationship between parental stress, quality time, and shared activities among parents of youth with ASD. Results indicated parental stress was negatively associated with the amount of time parents spent with their child during the weekday, but not the weekend. These findings suggest the routine of weekday and weekend days may have differing impacts on the relationship between parent-child quality time and stress. Further, parental stress was negatively associated with both parent and child enjoyment during shared activities. These findings suggest that parents with higher stress spend less time with their child with ASD and their interactions tend to be less enjoyable for both parties. This study contributes to the body of work exploring shared enjoyment and quality time among families of youth with ASD and has implications emphasizing parent-child interactions in ASD clinical practice.

**511.066 (Virtual Poster)** Autism in the Context of Humanitarian Emergency: The Lived Experiences of Syrian Refugee Parents  
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**Background:** The Syrian Crisis emerged due to various sociopolitical factors, including an authoritarian regime, finite resources, and proxy involvement (Musarurwa & Kaye, 2016). There is a dearth of literature investigating the impact of the Syrian Crisis, which is scarcer for families resettling with autistic children. Indeed, autistic children are tremendously susceptible to the adverse impacts of war and displacement as influenced by their diagnostic profile (Jabri, 2015), which includes impairments with social communication (American Psychiatric Association [APA], 2013). That is, war-related circumstances may elicit withdrawal or aggressive behavioural responses, and/or exacerbate already existing symptomatology (Jabri, 2015). Considering the resettlement experiences of refugee populations is important to enhance adjustment, adaptation, service acquisition, and well-being outcomes (Hynie, 2018; Ryan et al., 2008). Indeed, pre-migration experiences that consist of stigma, a lack of psychological resources, and reduced professional support (e.g., Hedar, 2019) can impact refugee adjustment (Ryan et al., 2008).

**Objectives:** The aim of this study was to obtain a comprehensive understanding of families' migration and resettlement experiences, which can serve to inform and enhance future service provision. The following research question guided this study: How has the lived experience of resettling in Alberta, Canada, and accessing supports/services been for Syrian refugee families with an autistic child? Despite the current study being framed within a Canadian province, it has several international implications and applications to broader theories.

**Methods:** The qualitative analytical approach of interpretive phenomenological analysis (Smith et al., 2009) was used with careful consideration of ontology, epistemology, and axiology. In line with literature guidelines, purposeful sampling was conducted with three participants meeting inclusion criteria and, subsequently, undergoing in-depth semi-structured interviews (Smith et al., 2009). A professional Arabic interpreter was used during data collection, which aligned with established rationale in the literature (e.g., Croot et al., 2011). This study established trustworthiness through peer debriefing, triangulation, and thick contextual description (Amin et al., 2020). Additionally, credibility and validity were enhanced through use of Yardley's four metrics of qualitative rigor (sensitivity to context, commitment and rigour, transparency and coherence, and impact and importance). Transcribed interviews underwent systematic analysis.

**Results:** Each participant's interview rendered 11 unique emergent themes. These themes contributed to the superordinate conceptual thematic structure that accounted for cross-participant experiences. Seven superordinate conceptual themes were derived: (1) Crises Affecting Autism; (2) Cultural Importance and Relevance; (3) Impactful Perceptions; (4) Support and Service Gaps; (5) Positive Attributions; (6) Quotidian Resettlement Difficulties; (7) Vital Relational Networks. All participants described barriers with resettlement, positive experiences with supports/services, and areas of continued need.

**Conclusions:** The results of this study were situated within existing theoretical frameworks for contextualization and elucidation of the results. Such theoretical frameworks include models for migrant adaptation (Ryan et al., 2008), psychosocial adjustment (Georgis et al., 2017), and stress (McCubbin & Patterson, 1983). Implications for practice included informing effective support and service practices, bolstering culturally responsive practice, and addressing crisis-sensitive practice. This study also aimed to address gaps in autism-related research, such as the importance of attending to diverse populations with complex layers of vulnerability.

**511.067 (Virtual Poster)** Understanding the Experiences of Autistic Working Mothers in Australia: An Exploratory Study

#### Background:

The lives and experiences of autistic women, including parenthood and employment, is an emerging area of research. Autistic females have historically been misdiagnosed and/or diagnosed with autism later in life and have higher levels of co-occurring mental health conditions than autistic males and the general population. Managing employment and parenthood are factors that influence female mental health and quality of life. Research has demonstrated a decrease in Australian female life satisfaction in recent decades, attributed to increased stressors through juggling work and family roles, contributing to a greater share of unpaid household labour, and other aspects of gender inequity including the gender pay gap. Studies investigating employment have identified that autistic adults experience greater unemployment and underemployment than non-autistic populations and require specific supports in finding and maintain employment. This prior research leads us to question whether autistic women require specialised supports for managing work and motherhood. To the best of our knowledge, there is no current research focused on autistic working mothers; thus better understanding of the experiences of autistic women who are working and caring for children is imperative.

#### Objectives:

This study aimed to understand the benefits of employment and being a parent/caregiver for autistic mothers, to determine the challenges in being an autistic working mother, and to identify whether there are specific supports that are needed for autistic mothers who manage caring and work responsibilities.

#### Methods:

A qualitative methodology was adopted, utilising a phenomenological research design. An advisory group of five autistic adults reviewed participant materials. Ten autistic working mothers aged between 28 and 49 years of age were recruited via social media advertisements, and participated in a 45-60-minute semi-structured interview. The resulting data was analysed using an inductive thematic analysis approach. A second rater recoded 20% of the data, with fair to good inter-rater agreement (Kappa = 0.51). Member checking occurred with participants to improve trustworthiness of results prior to finalisation of key themes.

#### Results:

Three key themes were identified: 'Work gives me purpose' - how employment supports mental wellbeing, financial independence, and provides important social interaction; 'Everyone thinks I look okay' - autistic working mothers balance challenges in addition to those typically experience by non-autistic working mothers, which include supporting the needs of their, often, neurodiverse children, managing workplace accommodations, and autistic burnout; 'Self-sufficiency out of necessity' - the lack of specialised supports is a key issue which leads to many autistic working mothers no longer asking for assistance and coping as best they can.

#### Conclusions:

Autistic working mothers experience unique challenges in addition to the stressors typically encountered by non-autistic working mothers, which impact their mental and physical wellbeing. These findings support the need for specific supports for autistic working mothers to enable greater workforce participation and mental wellbeing in this under-researched population.

#### **511.068** (Virtual Poster) Caregiver Concerns during Prodromal Autism; A Qualitative Study

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#### Background:

Despite progress in early identification, the average of diagnosis for autism spectrum disorder has remained around four years for decades (CDC, 2020). Parents often notice developmental differences as early as the first year of life, but face long waitlists when seeking early evaluations and services (Kanne and Bishop 2020; Zuckerman et al., 2015). Better understanding the specific behaviors that drive parents to seek early services may help to improve early screening and identification tools and help to guide the future development of supportive interventions for this early period.

#### Objectives:

Our aim is to understand specific concerns parents have during the prodromal period that lead them to seek out early specialized evaluations, using a qualitative approach that identifies shared themes from parents' open-ended text responses.

#### Methods:

Thirty-seven (n = 37) participants from an ongoing study evaluating the feasibility of telehealth evaluations for infants completed three questionnaires that prospectively asked parents about their current concerns. These questionnaires were qualitatively analyzed for themes within six broad domains: social communication, repetitive and restrictive behaviors, motor, general, medical, and family history. Participants' open-ended responses to each questionnaire were coded individually. Codes were then tallied across all three questionnaires for each participant, without duplicating reappearing codes. Codes were used to generate qualitative themes based on the similarity of the reported concerns within each domain and within each questionnaire. The frequency of each theme was tallied and used to calculate averages, standard deviations, and percentages of parents reporting a given theme within each category. Finally, illustrative quotes were chosen from the questionnaires, and organized per theme.

#### Results:

With a total of 231 concerns reported across all 3 questionnaires, on average parents reported 6.24 concerns (SD = 3.89). Across all domains, 47.61% of reported concerns were for social communication, 24.24% for RRB, 6.92% for motor, 14.71% for general, 4.76% for medical, and 1.73% for family history.

Themes occurring with a frequency over 20% are considered highly prevalent. For the social communication domain, the most prevalent parent concern themes were reduced eye contact. For RRB the most prevalent themes were around repetitive movements, sensory stimulation, and other unusual movements or behaviors. Motor concerns included fine and gross motor delays, and specific motor delays concerns. General concerns included temperament, overall care, and general developmental delays. For medical, neurodevelopmental concerns were reported. And family history concerns only included an older sibling already being diagnosed with ASD.

An illustrative quote describing reduced eye contact from the social communication domain: "I started to notice a shift before he turned 6 months, such as decrease in eye contact;" for repetitive movements: "Repetitive playing with taking objects out of a container and putting them back in."

#### Conclusions:

In this sample of caregivers, concerns around social communication development and restricted and repetitive behaviors were highly prevalent. The identified themes point to future directions for developing assessments and supportive interventions to better address families needs during a prodromal period of development by guiding specialists to heed social communication and restrictive and repetitive behaviors concerns from caregivers.

#### **511.069** (Virtual Poster) Caregiver Experiences Related to Employment of Their Adult-Aged Children with Autism

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**Background:** Meaningful and lasting employment has been difficult for many individuals with autism spectrum disorder (ASD) to obtain. Caregivers are often highly involved in the employment process for their adult children with ASD (Nicholas et al., 2018). Caregivers develop deep relationships with their adult children with ASD, often making them most familiar with their characteristics and how they might impact training and potential employment (Gal et al., 2013; Hand et al., 2018). Although highly credible and central to the employment process of many adults with ASD, parental caregiver experience is particularly absent in the literature on employment for adults with ASD.

**Objectives:** The objective of this study was to examine caregivers' experiences and perceptions surrounding employment for their adult-aged children with ASD.

**Methods:** The authors used phenomenological methodology to explore caregivers' experiences surrounding employment for their adult-aged children with ASD. Criteria for participation in the study included: Caregiver of an adult-aged child with ASD (18+ years), 50+ years of age, and able to read and comprehend English. Caregivers were recruited throughout the United States through autism support groups and organizations.

Interviews focused on caregivers' quality of life, social support networks, and experiences related to caregiving adult children with ASD. Interviews were transcribed and redacted of identifying information. Accuracy of each transcript was reviewed by the principal investigator and interpretation was confirmed for accuracy by 10 participating caregivers. Line-by-line coding was completed using a phenomenological approach that employed the following steps (Polkinghorne, 1989): (1) dividing text into units, (2) transforming units into meaning by identifying themes, and (3) bringing together meaning-based themes to describe caregivers' experiences on the topic. The last step in the coding process involved independent coders coming to consensus about the final set of themes and representative quotes from caregivers.

**Results:** Fifty-one caregivers participated, with 66% between 50-59 years (range: 50-70 years), 82% female, and 90% Caucasian/white. Additional demographic information will be presented. Three themes emerged with findings depicting caregivers' perceptions of a shared experience with their adult-aged children with ASD surrounding motivation and challenges related to employment pursuits. The overarching themes were (1) motivation for employment and independence, (2) variability of job training experiences and (3) negative experiences surrounding employment. Each of the themes will be described with quotations to add context and depth.

**Conclusions:** Results add to the growing body of research on the perspective of caregivers in transition and employment processes for adults with ASD. Caregivers interviewed for this study indicated a critical role in helping their adult child locate and secure employment, especially as school-based support faded. Caregivers' contributions went beyond financial capital to include investment of social capital through networking and building

of relationships to expand opportunities. Further examination of concerns surrounding long-term interdependence could be explored as both the caregiver and adult with ASD age and enter new stages of transition.

**511.070** (*Virtual Poster*) Characterizing the Accommodations Made By Parents of Young Children with Autism: A Mixed Methods Analysis  
**Y. G. Dai** and A. S. Carter, *Department of Psychology, University of Massachusetts Boston, Boston, MA*

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**Background:** Social communication challenges, inflexible adherence to routines, and heightened response to sensory input often interfere with an autistic child's participation in activities (Bonis, 2016). Accordingly, their parents frequently make changes to their daily routines (i.e., accommodations). Few studies have explored the types of accommodations caregivers make to their *family's* routines after their young child is diagnosed with autism.

**Objectives:** (1) Characterize the frequency and domains of accommodations by parents of children with autism; (2) Explore whether child characteristics predict the number of accommodations; (3) Identify themes within accommodation domains.

**Methods:** One hundred seventy-four parents (166 mothers) of a child with autism (17-38 months old;  $M = 28\text{mo.}$ ) completed the family accommodations interview. The interview was developed by Seltzer and Krauss to assess accommodations in six domains (household routines, social activities, work schedule, finances, religious activities, and engagement with family members) over the past 18 months. Parents were interviewed using the Vineland Adaptive Behavior Scales (Sparrow et al., 1984) to assess child adaptive skills and children were tested with the Mullen Scales of Early Learning (Mullen, 1995) and Autism Diagnostic Observation Schedule (Lord et al., 2000) to assess cognitive skills and autism symptom severity respectively. We used a mixed methods analysis to characterize the frequency and types of parental accommodations.

**Results:** 158 participants (91%) made accommodations in at least one domain, 98 (56%) made accommodations in at least three domains, and 11 (6%) endorsed accommodations in all domains. The number of accommodations made by caregivers was not predicted by the child's cognitive functioning,  $F(4,167) = 1.75, p = .14$ , autism symptom severity,  $F(4,161) = 0.16, p = .96$ , or adaptive skills,  $F(4,168) = 0.74, p = .57$ . Parents most often reported accommodations in social activities ( $N = 118$ ; 67.82%) followed by household routines ( $N = 110$ ; 63.22%), work ( $N = 101$ ; 58.05%), communication with family ( $N = 70$ ; 40.23%), finances ( $N = 62$ ; 35.62%), and religious activity ( $N = 39$ ; 22.41%).

Thematic analysis was used to qualitatively explore themes within accommodation domains. Examples of predominant themes include: (a) having to quit ( $N = 29$ ) or cut-back ( $N = 22$ ) on work; (b) participating in fewer social activities (e.g., gatherings, parties, restaurants;  $N = 75$ ), (c) experiencing disruptions to errands ( $N = 54$ ); (d) withdrawing from religious services ( $N = 29$ ); and (e) having fewer interactions with family members ( $N = 57$ ). Children's disruptive behavior in community settings, intensive early intervention schedules, and a perceived lack of understanding from others about their child's behavior, contributed to accommodations across domains. Positive themes emerged in the social and family contact domains: seven parents reported socializing more (e.g., through support- and play groups) and 10 parents reported increased support from family members since their child's diagnosis.

**Conclusions:** Characterizing accommodations may (a) illuminate when accommodations support optimal child development and when they negatively impact parent and child wellbeing, and (b) inform policy changes, including improving family leave and adding psychoeducation to religious institutions to support parents who are raising children with autism.

**511.071** (*Virtual Poster*) Child Disruptive Behavior and Parenting Stress: The Moderating Role of Shared Enjoyment in Parent-Child Activities  
**R. Bradley<sup>1</sup>**, E. A. del Rosario<sup>1</sup>, L. B. Quetsch<sup>1</sup>, C. Brown<sup>2</sup>, L. Aloia<sup>3</sup> and S. M. Kanne<sup>4</sup>, (1)University of Arkansas, Fayetteville, AR, (2)Pacific University, Hillsboro, OR, (3)Communication, University of Arkansas, Fayetteville, AR, (4)Center for Autism and the Developing Brain, White Plains, NY

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**Background:** It is well-documented that caregivers of youth with ASD experience increased rates of parenting stress. Child problem behavior emerges in the literature a key factor implicated in increased parenting stress among these caregivers, with recent prominent research indicating that this relationship is likely bidirectional. Research among families in the general population suggests that parenting behavior plays a role in the transactional relationship between parenting stress and child problem behaviors, such that maladaptive parenting behaviors (e.g., increased criticism, decreased enjoyment) are associated with both parenting stress and child externalizing behavior. However, qualities of the parent-child relationship in families of youth with ASD have rarely been examined in this context. Given the significant global family impacts of both child problem behavior and parenting stress, examining familial factors that can potentially buffer this relationship is of clinical importance.

**Objectives:** The present study assessed the potential moderating effect of parental enjoyment during parent-child shared activities on the relation between child problem behavior and parenting stress.

**Methods:** Caregivers ( $N = 511$ ) of youth ages 4 – 18 completed the Parenting Stress Index-Short Form (PSI) and two measures of child problem behavior (Eyberg Child Behavior Inventory; ECBI; Children's Scale of Hostility and Aggression; C-SHARP). The ECBI and C-SHARP together produced four total scores measuring child disruptive behavior that were used in the present analyses: the ECBI Intensity scale, the ECBI Problem scale, the C-SHARP Verbal Aggression scale, and the C-SHARP Physical Aggression scale. Parents also reported on their level of enjoyment during shared activities with their child. Four moderation models were conducted to determine whether the association between child problem behavior and parenting stress was moderated by parental enjoyment.

**Results:** Results indicated that greater child disruptive behavior and lower self-reported parental enjoyment during shared activities were both associated with increased parenting stress in all models ( $p$ -values  $< .001$ ). However, the interaction between child problem behavior and parental



enjoyment was only significant in the models assessing the C-SHARP Verbal Aggression and ECBI Problem scales. Results suggest parental enjoyment moderates the relationship between child behavior problem and parenting stress in the context of parent-perceived verbal aggression and broad severity of child disruptive behavior problems ( $\beta = 1.63$ ,  $SE = .82$ ,  $p < .05$ ;  $\beta = .28$ ,  $SE = .13$ ,  $p < .05$ ) but not in the context of physical aggression or parent-reported frequency of problem behavior ( $\beta = .78$ ,  $SE = .97$ ,  $p = .42$ ;  $\beta = .72$ ,  $SE = .83$ ,  $p = .39$ ).

**Conclusions:** This investigation found support for an interaction between parental enjoyment in parent-child interactions and child problem behaviors, such that parents with low enjoyment experience increased parenting stress even in the context of low child problem behavior. This relationship differed by problem behavior index, suggesting that specific problem behaviors may impact the family in distinct and clinically meaningful ways. These findings demonstrate the importance of examining the quality of the parent-child relationship as a potential treatment target among families endorsing child problem behavior and parenting stress.

**511.072 (Virtual Poster) Child Disruptive Behaviors As a Mediator of the Impact of Child Sleep Quality and Parental Stress**

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**Background:** Over 50% of children with autism spectrum disorder (ASD) experience sleep disturbances (Liu et al., 2006). The high prevalence of sleep problems in children with ASD has been associated with greater levels of child disruptive behaviors (Mazzone et al., 2018). In addition, prior findings reveal that increased sleep problems in children with ASD predict higher levels of parental stress. Further, the presence of child disruptive behaviors can also lead to increased levels of parental stress (Ward, 2020). However, the role of child disruptive behaviors in the association between child sleep quality and parental stress remains unclear – especially as it relates to families of children on the autism spectrum.

**Objectives:** The primary objective of this study was to examine the role disruptive behaviors in children with ASD have on the relationship between child sleep quality and parental stress. Examining this relationship may help to better understand the mechanisms underlying child disruptive behaviors in children with ASD.

**Methods:** In this study, participants were a sample of families of children ages 4-18 years with ASD and disruptive behaviors ( $N = 502$ ). Bootstrap mediation analyses (using 5,000 samples) were used via PROCESS in SPSS (Hayes, 2013) to examine if disruptive behaviors (measured by the Eyberg Child Behavior Inventory; ECBI) mediated the impact of child sleep quality (measured by the Children's Sleep Habits Questionnaire; CSHQ) on parental stress (measured by the Parenting Stress Index: Short Form). Higher scores on the CSHQ indicated poorer sleep quality. Indirect effects were considered significant when zero was not contained in the 95% confidence intervals.

**Results:** The results revealed that controlling for disruptive behaviors, the regression of child sleep quality on parental stress was significant,  $\beta = 1.9$ ,  $t(500) = 10.7$ ,  $p < .01$ . The regression of child sleep quality on child disruptive behaviors was also significant ( $\beta = 3.46$ ,  $t(500) = 9.63$ ,  $p < .01$ ). Controlling for the mediator (disruptive behaviors), child sleep quality predicted parental stress to a lesser extent ( $\beta = 1.12$ ,  $t(499) = 6.77$ ,  $p < .01$ ), indicating that disruptive behaviors partially mediated the relationship between child sleep quality and parental stress,  $\beta = 0.71$ , 95% CI= [.5145, .9414].

**Conclusions:** Child disruptive behaviors mediated the relationship between child sleep quality and parental stress. The results suggest that increased sleep disruptions may result in increased child disruptive behaviors, which may lead to increased parental stress. Interventions targeting sleep difficulties in children with ASD and child disruptive behaviors concurrently may be helpful to reduce parental stress. Future directions will be discussed in the poster.

**511.073 (Virtual Poster) Community Participation Challenges of Minority Transitioning Adults with Autism Spectrum Disorder (ASD); Parental Perspective**

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**Background:** Individuals with Autism Spectrum Disorder (ASD) face challenges with community participation. Black or African Americans with ASD experience additional barriers to community participation. Parents of Black or African American individuals with ASD experience extra concern when their child participates in the community.

**Objectives:** The purpose of this research was to determine parents perceived barriers with community participation for Black or African American individuals with ASD.

**Methods:** Focus group and Photovoice design. Demographic Survey of Parents of Self-identified Black or African American individuals with ASD completed on-line. Photovoice data and narratives were collected to describe their concerns. Data was analyzed using grounded theory methodology. Data was coded into themes and subthemes and relationships between themes were identified.

**Results:** Seven (87%) women, and one (13%) man participated in the study. Results identified to two major themes: 1.concerns with community participation and 2. strategies for emergency responses. Five subthemes emerged from those two main themes: 1. disability related 2. race related 3. negative experiences 4. caregiver burden 5. community participation strategies. Parents of Black or African American individuals report vulnerabilities associated with disability as their greatest concern when participating in the community. Race was a close second.

**Conclusions:** This study identified important considerations to understand perceived challenges of community participation for minority individuals with ASD. Targeted research to collect information about barriers and facilitators to community participation, emergency response, safety, and race education is necessary to increase access to participation for this population. Focus groups are ongoing.

**511.074 (Virtual Poster)** Comparisons of Parental Stress and Child Behavior in Families Seeking Behavioral Treatment: A Diverse Sample of Children with Autism Spectrum Disorder

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**Background:** Approximately 50% of children with autism spectrum disorder (ASD) exhibit disruptive behaviors (DB; Bearss et al., 2013). While evidence-based treatments in community settings to reduce DBs in youth with ASD are continuing to grow, the evidence that exists to support these services rests on outcomes from White middle- to upper-class families. Little is known about the characteristics of families of children with ASD among systemically racial and ethnic minoritized groups. Exploring the family characteristics for multicultural families of children with ASD who use DB treatments may help researchers and clinicians better understand pressing treatment concerns.

**Objectives:** The goal of this present study was to examine characteristics in a sample of ethnically and racially diverse families of children with ASD who utilize treatments for child DBs. The primary aim of this study was to compare parental stress and behavior characteristics between families who endorsed using services ( $N = 69$ ) and those who do not endorse using treatments for DB ( $N = 95$ ). Frequency of the types of services used will also be reported.

**Methods:** The sample consisted of families living in the United States who identified as Latinx ( $N = 90$ ), Black ( $N = 50$ ), Asian ( $N = 24$ ), Native Americans ( $N = 16$ ), and Pacific Islander ( $N = 6$ ). Some of the families identified with multiple racial and ethnic groups. Analyses were conducted to examine whether families differed on parent (Parenting Stress Index: Short Form) and behavioral measures (Eyberg Child Behavior Inventory; ECBI) based on whether they endorsed using DB therapy.

**Results:** The results revealed that families who endorsed using services reported significantly greater ECBI Problem scores ( $t(162) = 3.244, p = .001, d = .51$ ) and parental stress ( $t(162) = 3.609, p < .001, d = .55$ ). No significant differences in ECBI Intensity scores were found between the two groups ( $t(162) = 1.929, p = .055$ ). The highest endorsed DB treatments included medications, Applied Behavior Analysis, and general therapy.

**Conclusions:** The findings from this study suggest that multicultural families of children with ASD who use treatment for DBs are likely to perceive their child's behaviors as more problematic and are likely to present with higher levels of parental stress. This either suggests that families of children with ASD who use treatments for DB may benefit from services that target parental stress as well as help parents feel more confident in addressing child DBs (e.g., Parent-Child Interaction Therapy) or families are currently participating in services that are not addressing their needs, resulting in parental stress and views of child DB as more of a problem. The results also demonstrated that non-White families of children with ASD are using alternative approaches to treatment more frequently than parent training programs.

**511.075 (Virtual Poster)** Describing the Experience of Suicidal Thoughts and Behaviours in Autistic Youth

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**Background:**

Suicidal thoughts and behaviours (STBs) are exceptionally common in autistic youth, with suicidal thoughts being about 3-5 times higher than in non-autistic youth. Untreated STBs can have detrimental impacts not only on the youth but also their family. Research has focused primarily on prevalence of STBs in autistic youth, with very little known about the lived experience. Although suicide is often viewed as a solitary act, STBs profoundly impact the entire family, with caregivers often playing a crucial role in suicide prevention. Thus, when considering experiences of STBs and related support needs for autistic youth, it is critical to include the perspectives of caregivers.

**Objectives:**

Although STBs are highly prevalent in autistic youth, the unique characteristics of STBs in these individuals is largely unknown. This study 1) describes *past and present experiences of STBs in autistic youth*, and 2) discusses *caregiver experiences of providing care and obtaining support for the family*.

**Methods:**

Seven semi-structured interviews were conducted with caregivers ( $n=6$  female) of autistic youth (12-20 years,  $M = 15.4$  years old) who experienced STBs. Purposive sampling was used to recruit caregivers through social media advertisements and autism-specific community agencies. Themes were generated using Interpretative Phenomenological Analysis.

**Results:**

Four core themes emerged each with related subthemes. In theme 1, caregivers described *reasons for wanting to die as diverse and varied among youth*. Subthemes indicated youth wished to die: to *take control* (e.g., when not offered choice); as a *strong emotional response in a difficult moment*

(e.g., angry, frustrated, build up and explode); after a *major life event* (e.g., traumatic event); due to *overwhelming sensory or physical experiences* (e.g., auditory stress); when *longing for social connection*; when *feeling not enough* (e.g., letting others down); and to *end emotional pain* (e.g., don't want to live this way anymore). In theme 2, caregivers viewed youth to benefit from *external support to manage suicidal thoughts* (e.g., caregiver intervention to distract, electronics). In theme 3, caregivers expressed *hesitation around emergency services* where they were concerned *emergency medical care might escalate their youth further* or would not offer added support. Finally, in theme 4, caregivers indicated *available support lacked accessibility and was incomplete*. Specifically, caregivers felt support *underemphasized their own caregiver needs*, was *reactive and not preventative*, and included *systemic barriers* (e.g., too many hoops, too much energy, long waitlists, too expensive).

#### Conclusions:

This study offers a preliminary description of the experience of STBs in autistic youth as well as of their caregivers' experience of supporting them through crisis. Caregivers offered rich insight and attributed a wide range of reasons for their autistic youths wish to die, suggesting that a highly individualized approach to assessment and intervention is required. Caregivers played a significant role in supporting their youth to manage thoughts of self-harm. They were ambivalent about traditional medical crisis services and deemed support difficult to access due to barriers. Further investigation of how mental health crisis intervention and prevention strategies can be tailored to meet the needs of autistic youth and their caregivers is needed.

#### **511.076** (Virtual Poster) Developing Screen Time Guidelines for Children and Youth with Autism Spectrum Disorder: Using the Knowledge to Action Framework

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#### Background:

Over the past decade, screen-based usage among children and youth has increased significantly, particularly among those with Autism Spectrum Disorder who are more susceptible to the potential detrimental effects on health and development. Current screen time guidelines exist for typically developing children and youth. However, these guidelines do not address the specific needs of autistic children and youth.

#### Objectives:

To develop population-specific guidelines that are agreed upon by caregivers and expert clinicians.

#### Methods:

The first stage was an exploratory qualitative study in which experienced clinicians working with children with autism participated in semi-structured in-depth focus groups. The results highlighted a lack of knowledge and awareness, concerns regarding addictions, and a lack of evidenced based and population specific guidelines. In the second stage, based on these results and an extensive literature review on screen time, a survey was created that included different statements regarding the management of screen time. Using the Delphi method, 30 expert researchers, clinicians, and caregivers who have experience working with or caring for children with Autism Spectrum Disorder were invited to complete a series of three surveys. In each round, participants had to rate their agreement on a series of statements. The consensus level was set to 75%. Finally, knowledge translation methods were used to disseminate the final product to stakeholders.

#### Results:

The final guidelines were accepted by more than 80% of the panel in the first and second rounds of the survey. The guidelines included a few sections with the following contents: (1) Special considerations in screen time management for children and youth with Autism Spectrum Disorder (2) Recommendations for caregivers and clinicians to support monitoring and regulating time and content of screen time use (3) Additional resources including a) behaviors to monitor for screen time problematic use b) websites with general information about screen time use. In the third survey, the panel was asked about the best ways to disseminate the new guidelines. 82% of experts agreed that a booklet (online or printed) would be a "good way" to share the guidelines. Experts also reached an agreement that accessibility, organization and structure, clarity, relevance, knowledge, and delivery are important aspects to consider within the knowledge translation product for the next phase of this project.

#### Conclusions:

Providing guidance to parents and clinicians regarding the use of screen time with children with Autism Spectrum Disorder is timely. These guidelines include the best ways to use screen time, the benefits and limitations of screen time, and strategies for mediating screen time conflicts. The agreed-upon guidelines developed in this study could be the steppingstones for clinical interventions for screen time overuse of children with Autism Spectrum Disorder, addressing the screen time crisis that many families are experiencing.

#### **511.077** (Virtual Poster) Differences in Parenting Stressors, Family Resilience, Cognitive Appraisals, and Perceptions of Psychological Crisis Among and within Parents of Children with Developmental Disabilities

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**Background:** There are some differences in perceptions of psychological crisis and family relationships among parents of children with developmental disabilities. For example, mothers of children with autism perceive lower family adaptation than mothers of children without disabilities. However, there is no difference between fathers (Gau et al., 2012). Moreover, Otsuka & Hotta (2013) revealed that mothers of children with developmental disabilities experienced higher stress levels than the fathers. Therefore, it is assumed that parents of children with developmental disabilities perceive their stress and family relationships differently.

**Objectives:** This study was designed to examine (a) differing of parenting stressors, family resilience, cognitive appraisal of parenting stress, psychological stress, mental health, and family adaptation between parents, and (b) the difference of these variables in parental pairs.

**Methods:** A questionnaire was administered to 136 parents (42 fathers and 94 mothers) of children with developmental disabilities. The mean ages of the parents was 44.53 years (30-57 years old;  $SD = 5.50$ ). The mean age of the children was 12.71 years old (5-18 years old;  $SD = 3.95$ ). Thirty-six parent pairs were used for dyadic data. The questionnaire assessed parents' age, child's age, relationship to the child, sex, diagnosis, parenting stressors, family resilience, cognitive appraisal of parenting stressors, psychological stress, mental health and family adaptation.

**Results:** Unpaired  $t$ -tests between parents showed that "difficult understanding and coping" ( $t(128)=2.09, p < .05, d=.40$ ) and "inadequate understanding of child's disability" ( $t(128)=2.43, p < .05, d=.46$ ) in parenting stressors, "appraisal of threat" ( $t(133)=2.57, p < .05, d=.48$ ) in cognitive appraisal, "depression/anxiety" ( $t(129)=2.31, p < .05, d=.43$ ) and "lethargy" ( $t(129)=2.41, p < .05, d=.45$ ) in psychological stress were higher in mothers than fathers. The results also showed that "trust in the power of family" ( $t(122)=1.99, p < .05, d=.38$ ) was higher in fathers than mothers. Intra-class correlation coefficients showed that "conflict caused by child's disability", "cohesion", "trust in the power of family", "balance of individuals and family", "appraisal of impact", "commitment", "moodiness/anger", "mental health", "family adaptation" were slightly or moderately similar ( $ICC=.39-.60$ ) between parents. Paired  $t$ -tests between parents showed "difficult understanding and coping" ( $t(34)=2.15, p < .05, d=.42$ ) and "inadequate understanding of child's disability" ( $t(33)=2.47, p < .05, d=.49$ ), "lethargy" ( $t(35)=2.04, p < .05, d=.48$ ) were higher in mothers than fathers. The results showed that "cohesion" ( $t(35)=2.31, p < .05, d=.37$ ) and "trust in the power of family" ( $t(32)=2.73, p < .05, d=.50$ ) was higher in fathers than mothers. These results indicate differences in perceptions of each variables between parents, and some similarities in perception of each variables in the father-mother pairs.

**Conclusions:** Our findings suggest that fathers and mothers perceive their stress and family resilience differently, while parental pairs were comparable in how they perceived these factors. In the future, it is necessary to consider how the difference influences mutually between parents.

**511.078 (Virtual Poster) Echo Autism STAT: Caregiver Satisfaction and Needs**

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**Background:**

Evidence has shown that the systems of autism care are fragmented, and children with ASD are four times more likely to experience unmet health care needs compared to children without disabilities (Karpur, 2019). Some commonly reported challenges include delayed diagnosis (Zuckerman et al., 2017), insufficient care coordination (Vohra, 2013), or long waitlists for therapy (Dimian et al., 2021).

These challenges are further exacerbated for underserved groups, such as racial and ethnic minorities (Travers et al., 2013), people with public health insurance (Kuhn et al., 2021), and people living in rural areas (Antezana et al., 2017).

ECHO Autism STAT was developed to solve the aforementioned problems and is growing rapidly to enable primary care physicians to reliably diagnose autism and connect families with the right resources (Mazurek et al., 2019).

**Objectives:** To preliminarily evaluate caregiver satisfaction about the ECHO Autism STAT evaluation and their needs.

**Methods:** We surveyed fourteen caregivers whose children received an autism diagnosis through ECHO Autism STAT.

**Results:**

### **Demographic Information**

A majority of caregivers were white (72%); the rest of the caregivers were Black (7%) and Latinx/Hispanic (21%). The average age of the caregivers was 29.1 years old. Approximately 60% of caregivers reported a household of less than or equal to \$20,000 or \$20,000 to \$40,000. Approximately 64% of the caregivers had a high school GED or some college education.

All children were enrolled in an insurance health plan, and approximately 57% of them enrolled in the state Medicaid health plan.

### **Caregiver satisfaction**

A hundred percent of caregivers reported their STAT PCP providers explained things in a way that was easy to understand, listened carefully to them, showed respect for what they had to say, spent enough time with their child, knew important information about their child's medical history, and followed up with them to help them get connected with services that would help with their child's development. The average caregiver rating of providers was 9.9 out of ten.

### Caregiver support

86% of parents reported that they had not received parent training on how to deliver autism-specific strategies to support their children at home. 92% reported that they were not connected with a parent support group.

### Conclusions:

Empirical evidence has shown that caregivers were satisfied with ECHO Autism STAT providers, and that ECHO Autism STAT positioned well to support the unmet caregiver needs.

### 511.079 (Virtual Poster) Effects of COVID-19 on the Transition Services for Autistic Youth: A Qualitative Analysis

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**Background:** Previous literature has shown that adequate transition planning for autistic students can increase the likelihood of attending postsecondary education, and other adaptive, prosocial outcomes (e.g., employment, independent living). The COVID-19 pandemic has pervasively impacted human and social services that support the ASD community. In March 2020, Virginia declared a state of emergency which ceased all in-person K-12 instruction. This change brought unprecedented challenges for students with disabilities including reduced or paused school-based therapeutic services. Our qualitative study is the first to examine the effects of the pandemic on transition services for autistic students.

**Objectives:** Elucidate the disparities in transition services for transition-age autistic students following the COVID-19 pandemic.

**Methods:** Caregivers ( $n=5$ ) of children aged 14-21 with an autism classification who received special education services and special education school providers ( $n=5$ ) were interviewed. Autistic students were invited but not required to participate alongside their caregiver in the interviews. Demographic information is reported in Table 1. Participants completed an online demographic survey and a 1-hour virtual interview to describe how transition services have been impacted by the COVID-19 pandemic. Participants received a \$25 gift card upon completion.

Two research assistants transcribed video recordings of the interviews and three separate coders analyzed data using a data-driven thematic approach. Coders initially read the interview transcripts to discuss content and identify preliminary codes. They, then, independently coded each transcript and resolved discrepancies through discussion to achieve consensus to generate and refine content themes.

**Results:** *Misalignment* (e.g., between student skills/interests, parent feedback/concerns, transition services) and resulting *dissatisfaction* were common themes that emerged from caregiver interviews regarding their child's transition services. These conflicts were present prior to COVID-19 and continued as the pandemic persisted. While IEP and transition planning meetings were easily shifted to a virtual format, caregivers and teachers described a *dearth of integrated community-based transition-related experiences* (e.g., on-site job skills training, public transportation practice) and a *lack of access to typical transition-related resources* (e.g., state and local community services). This resulted in an *added burden* on caregivers, who attempted to supplement services at home, as well as teachers, who attempted to adapt to virtual teaching. Interviews with school personnel revealed that *learning opportunities were lost* as virtual skills training (e.g., social skills) remained a challenge for students. As students returned to in-person schooling, social distancing mandates continue to complicate transition planning services.

Despite these challenges, *post-transition goals remain unchanged* for interviewed families. Additionally, caregivers emphasized many *positive effects* of the shift to virtual learning, including improved behavior, gains in adaptive living skills, and decreased family conflict.

Several areas for improvement regarding transition services emerged, including *use of evidence-based behavioral approaches* and an emphasis on *individualized services* that are based on student strengths and interests.

**Conclusions:** These initial qualitative observations show that families and school providers across Virginia have experienced both negative and positive effects on transition services following COVID-19. Future research will provide in-depth analysis of participant's qualitative responses. Data collection is ongoing and will be complete by the time of presentation.

### 511.080 (Virtual Poster) Examination of the Correlation between Physical and Psychological Measures in Parents of Individuals with Autism Spectrum Disorder

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## Background:

Autism Spectrum Disorder (ASD) impacts the health of the whole family. The World Health Organization recommends adults participate in aerobic physical activity (PA) that is moderate- intensity for 150-300 minutes a week or vigorous-intensity for 75-150 minutes, or a combination of the two intensities. Parenting is associated with declines in physical activity from the pre-parent state due to lack of time, motivation, and need for child care. While exercise improves autistic individuals' health, no literature was located on exercise interventions for parents of individuals with ASD, or on the correlation of physical and psychological health of parents.

## Objectives:

The purpose of this study was to assess baseline physical and mental health of parents of individuals with ASD to tailor a exercise intervention program to their needs. A second purpose was to estimate the relationship of physiologic correlates with psychological correlates of health for parents of individuals with autism spectrum disorder.

## Methods:

As part of a mixed methods pilot study to assess barriers to exercise, and baseline physical and psychological health correlations, N=44 English-speaking parents [n=39 female, n= 5 male; mean age= 46.6 years; n=33 white, n=6 Black, n=3 Hispanic, n=1 Asian, n=1 other] of individuals with ASD (n=31 male, n=13 female) participated in this descriptive, correlational, cross-sectional study, in a Midwest USA city. Physiologic measures included body mass index (BMI), weight, waist and hip measures, sit -stand test, grip test, 2-minute walk test (timed), sit/stand test (timed), and time in sedentary, moderate, and vigorous activity over the course of 7 days from a hip-height accelerometer. Psychological and demographic measures included the (1) Parenting Stress: Autism subscales (Likert scales ranging from "1" not stressful to "5" extremely stressful), for (i) behavior and communication (bc: 6 questions), (ii) advocating for child needs (an: 4 questions), (iii) personal family life (pfl: 10 questions), (iv) parental caregiving (pc: 8 questions); (2) Parent state anxiety (stai: 20 questions) (Likert scale from "1" not at all to "4" very much so), (3) parent positive thinking (pts: 9 questions) (Likert scale from "0" never to "3"always), parent depression (Phq-9: 9 questions) (Likert scale from "0" not at all to "3" nearly every day), and 10 demographics questions to describe the sample. All the composite variables for psychological scales were calculated as the average across items.

## Results:

Parent's median body fat was high (39.2 % (min/max, 20.3-59.1%). The median for parents' time in moderate physical activity was 152.5 minutes (mins)(min/max, 4- 496.8 mins), thus individuals were meeting requirements, yet there was a large range where many were sedentary. Further the parenting stress of advocating for the child's needs ( $p=0.043$ ) was inversely correlated with moderate physical activity. Positive thinking was related to less depression ( $p=0.002$ ).

## Conclusions:

Results of this pilot showed that some parents had a low amount of activity. Low activity correlated to increased stress of advocating for child's needs. Parents need supports to be able to prioritize exercise. Future studies should include a larger sample to verify these effects.

## **511.081** (Virtual Poster) Examining the Impacts of Stress on Parent Emotion Regulation Abilities

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## Background:

Parents of children with Autism Spectrum Disorder (ASD) consistently report higher levels of stress compared to parents of children with neurotypical and delayed development (Hayes and Watson, 2012). Parent-mediated interventions (PMIs) necessitate parents to learn therapeutic techniques to maximize and generalize child gains, adding to the burden of parenting. While several PMIs for young children with ASD target challenging child behaviors, parent factors that may play an important role in successful adoption of strategies, such as emotion regulation (ER) abilities, are often overlooked. As a first step, we aim to explore the impacts of stress on parent ER abilities.

**Objectives:** (1)Examine parent stress profiles and changes in parent stress over 6-month period of time.(2)Evaluate the effects of parent stress on parent ER abilities.

## Methods:

Participants included 43 dyads of toddlers with ASD ( $M_{age}=32.6$  months,  $SD_{age}= 7.8$ ) and a primary caregiver ( $M_{age}=37.8$  years,  $SD=5.3_{age}$ ). Parents self-reported on their levels of stress as it relates to multiple domains (Parenting Stress Index-Short Form subscales: Parental Distress [PD], Parent-Child Dysfunctional Interaction [PCDI], and Difficult Child [DC], with higher values indicating more stress) and ER abilities (cognitive reappraisal and emotion suppression [Emotion Regulation Questionnaire subscales] and psychological inflexibility [Action and Acceptance Questionnaire]). A subset of families (n=11) completed stress measures 6 months later. Separate regressions were run for each parent ER strategy with all three parent stress subscales entered as predictors. There were no significant correlations between parent age, child age, child NVIQ and parent ER abilities;

therefore, these parent and child factors were not included as covariates in regression analyses. Paired sample t-tests were run to examine changes in parent stress over 6 months.

#### Results:

In the current sample, the percentage of parents who reported clinically elevated levels varied across stress domains ranging from 11.9% ( $n=5$ ) for PD to 16.7% ( $n=7$ ) for PCDI and 21.4% ( $n=9$ ) for DC. For the subset of parents with two timepoints, no significant changes were noted in regard to any parenting stress subscales. The model predicting cognitive reappraisal was not significant. The model predicting parent emotion suppression use was significant; however, no parent stress predictors were significant. Parental Distress ( $\beta=.66$ ,  $p<.001$ ) and Difficult Child ( $\beta=-.39$ ,  $p=.03$ ) significantly predicted psychological inflexibility, such that higher report of distress regarding the parenting role and lower perception of child difficulty corresponded with increased inflexibility toward negative or unwanted emotions.

#### Conclusions:

The current study sheds light on the importance of examining the role of parenting stress on parent ER known to impact parenting abilities. Parenting stress, especially as it relates to the parenting role and child characteristics, significantly impacted parents' psychological inflexibility, or the unwillingness to experience unwanted thoughts and emotions even when valued goals are identified. PMIs may benefit from the inclusion of interventions that specifically target psychological inflexibility, such as Acceptance and Commitment Therapy. Interestingly, the current sample consisted of lower rates of clinically significant stress compared to previous studies (Padden and James, 2017) and results should be replicated with larger, more diverse samples to better understand the influences of these factors.

#### **511.082** (Virtual Poster) Exploring Nutrition, Physical Activity, and the Role of Pet Dogs in Households with a Child with Autism Spectrum Disorder: The Dane Study

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**Background:** Children with autism spectrum disorder (ASD) have unique risk factors that can impact healthy eating and physical activity behaviors. However, few obesity prevention interventions take into consideration the attributes of ASD, and fewer still offer family-based lifestyle programming. Incorporating pet dogs already living with families may enhance healthy eating and physical activity behaviors among children with ASD through several potential mechanisms, such as patience with gross-motor skill challenges or an indirect approach to modeling healthy eating. Notably, little is known about the experiences of children with ASD and their families with respect to dog ownership and the potential approaches through which an animal-assisted intervention (AAI) might work.

**Objectives:** The overall goal was to conduct a formative, qualitative study to gain an understanding of the role of pet dogs in the lives and lifestyle habits of families with ASD.

**Methods:** We conducted interviews with ten parent-child dyads. Eligibility criteria were living with a pet dog, English-speaking, child between 8-18 years of age with an ASD diagnosis, and IQ greater than 70. Dyads were recruited via postings to listservs and social media and by sharing study information with healthcare providers. The interview guides were designed to explore the relationship between children with ASD and their pet dogs; the role of the dog in family life; attitudes and practices related to physical activity and nutrition; and thoughts about intervention strategies. Interviews were conducted from August-December 2020 using Zoom videoconferencing. All interviews were audio-recorded and transcribed verbatim. We used a directed qualitative content analysis approach. NVivo 12 was used to assist with the analysis.

**Results:** Both parents and children described a strong and loving bond between the child and dog. Parents felt that the relationship benefitted the child socially because of the dog's attention and companionship. Parents stated that the dog integrates well with the family's routine, although negative impacts included added responsibilities and financial concerns. With respect to nutrition and physical activity, children felt that healthy eating and exercise were important for both them and their dog. Most parents said that they make healthy eating a priority for the whole family but mentioned challenges such as rejection of new foods. Parents described physical activities that the family does together, but expressed challenges that included inconvenience and added effort when the dog is involved. In terms of programming that would incorporate their dog to help teach children about nutrition and physical activity, most children expressed interest in learning more, either from their parents or by reading about it. Almost all parents were favorable toward this type of program, although some were concerned about having the bandwidth to implement it.

**Conclusions:** This exploratory work suggests that while pet dogs present some challenges to a family with a child with ASD, overall the dog integrates well and provides benefits for the child. AAIs to improve nutrition and physical activity could build on the strong bond that children can have with their pet dogs, but it may not be feasible for parents to deliver such programs.

#### **511.083** (Virtual Poster) Exploring Occupational Balance and Quality of Life in Primary Caregivers of Autistic Children: A Qualitative Study **G. Davy**, K. L. Unwin, J. Barbaro and C. Dissanayake, Olga Tennison Autism Research Centre, La Trobe University, Melbourne, VIC, Australia

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**Background:**

Occupational balance (i.e., subjective experience of engaging in sufficient occupations/activities) has been shown to have a positive influence on health, well-being, and life satisfaction in the general population. Parents of autistic children, particularly primary caregivers, often modify their participation across leisure, social, and workforce contexts to meet the caregiving needs of their child. Past research suggests that changes to occupational balance may play a role in the subjective quality of life (QoL) in parents of autistic children. However, few studies have examined the occupational experiences of caregivers and the impact that participation may have on their QoL.

#### Objectives:

The aim in the current study was to examine caregiver experiences, perceptions, and beliefs in relation to parenting their autistic child/ren with a particular focus on their QoL in relation to their ability to participate in leisure, workforce, and community related activities.

#### Methods:

An experiential qualitative approach was adopted where 20 primary caregivers aged 29–48 years (all female) of children (7–11 years) diagnosed with autism participated in individual semi-structured interviews regarding participation and QoL. Additional questions were included to capture the impact of the COVID-19 pandemic (e.g., “*How has COVID-19 impacted your participation both at home and in the community?*”). Audio recordings were transcribed verbatim via Otter.ai software and analysed utilising a reflexive approach to thematic analysis in NVivo.

#### Results:

A number of themes were identified capturing the parenting experience of *balancing caregiving responsibilities* with occupational needs and QoL. While many benefits were identified with parenting an autistic child, primary caregivers also acknowledged challenges such as accommodating the child’s needs and organising and attending their child’s appointments. These challenges were exacerbated for single parents and parents of children who needed added vigilance and support in daily activities.

A broader theme of *achieving occupational balance* suggests the importance of participation for the caregivers own QoL and identity. While a range of meaningful activities were reported, re-engaging in the workforce was commonly identified, particularly for the caregiver’s identity outside of the parenting role. Finding the time for participation was often complex due to the increased time pressure and fatigue experienced by the parents and the planning/support required, often resulting in parents avoiding occupational participation beyond that which was necessary.

Themes relating to *living through the COVID-19 pandemic* captured the additional challenges to daily life reported by parents, such as balancing home schooling while working from home. However, positives were also identified such as the forced time at home providing new opportunities for self-care, leisure, and family activities.

#### Conclusions:

The responsibilities associated with raising an autistic child impacts the occupational balance of primary caregivers. Advocating/laiaising with services and/or supports for the child, and the vigilance required outside of the home environment increases the mental load for parents of autistic children, limiting the time available to engage in meaningful activities. The findings highlight that additional consideration and support is needed for caregivers of autistic children, particularly single parents, to improve their ability to meet and maintain their occupational balance and QoL needs.

#### **511.084** (Virtual Poster) Family-Centered Care in ABA: Parent and BCBA Perspectives

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Background: In recent decades, the autism field has embraced family-centered care (FCC), with several studies demonstrating the positive impact of FCC on families. FCC involves offering care to families that is aligned with their needs, wishes, and values. However, parents of children with ASD are less likely to report receiving FCC than parents of children with other health care needs. Treatment providers often spend significant amounts of time with parents and children with ASD and as such have ample opportunities to implement FCC. Applied Behavior Analysis (ABA) is the most commonly utilized category of treatment for ASD, giving providers of ABA the opportunity to have a particularly significant impact on families. No known studies have examined the state of FCC in ABA, and FCC is not a required component of training for Board Certified Behavior Analysts (BCBAs). In order to improve FCC in ABA, it is necessary to first explore the current implementation of FCC

Objectives: To examine the current state of FCC in ABA and identify training needs for BCBAs.

Methods: Separate national focus groups were conducted with a) parents of children with ASD receiving ABA intervention and b) BCBAs providing ABA intervention to children with ASD. Focus groups followed a semi-structured format and were guided by a moderator. Parent Focus Groups focused on communication and interactions with BCBAs and the impact of BCBAs on parental stress. BCBA Focus Groups focused on professional topics in which additional training is desired and communication and interactions with parents. Focus groups were conducted until data saturation was reached. In total, three Parent Groups (n=16) and three BCBA Groups (n=10) were conducted. A two-step qualitative data analysis process was conducted in order to determine themes. First, open coding was completed by two coders who independently reviewed the transcripts from each focus group and labeled “codes,” representing themes. Axial coding was then completed, during which each code and corresponding text was examined to identify subthemes. Discrepancies in coding were settled by a third coder.



Results: For the Parent Groups, the open coding process revealed 13 broad themes: Role of the BCBA, Barriers, Interdisciplinary Collaboration, Family Considerations, Stigma, Parental Stress and Mental Health, Transition and Future Planning, Rapport/Relationship, Communication, Parental Preferences, Treatment Goals, Comorbidity, and Child-Centered Focus. Definitions of these 13 broad themes as well as subthemes will be presented. Additionally, the themes and subthemes identified during the BCBA Groups will be presented.

Conclusions: Although parents report many positive experiences with BCBAs, they also identify several areas in which additional training for BCBAs would improve the quality of care received. BCBAs also identify areas in which they do not feel adequately trained and would like additional resources and support. Many of the training needs identified by parents and BCBAs overlap, including parental stress, mental health comorbidities, the diagnostic process, and communication skills. BCBAs identified additional training needs, such as trauma-informed care and family-centered care in general. These identified needs should be considered for academic programs, continuing education opportunities, and professional development opportunities.

**511.085** (Virtual Poster) "I Was Done with the Volcanoes in Me": Exploring the Perspectives of Young Autistic People with Lived Experience of Suicidal Ideation/Behaviour and Self-Harm

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Background: Young people with autism spectrum disorder (YP-ASD) experience high rates of suicidal ideation/behaviour, with risk factors including being female and masking ASD traits. Evidence suggests that current clinical practices and theories of suicidality may not adequately serve YP-ASD due to differing needs and experiences, however this has not yet been qualitatively explored.

Objectives: This project aimed to explore how YP-ASD experience suicidal behaviour and self-harm, the relationship between suicidal ideation/behaviour and self-harm for autistic young people, their experience of seeking help from mental health services, and whether their experience is influenced by their gender.

Methods: Five young people (four identifying as female including one who was identified as male at birth; one identifying as male) aged 15-25 (M = 17.6) with diagnoses of ASD or self-identifying as autistic were recruited from the Orygen Youth Health Clinical Program and headspace centres in Melbourne, Australia. Data were collected from semi-structured interviews and analysed using reflexive thematic analysis

Results: Three main themes and three further subordinate themes were described:

- 1) Interpersonal and Intrapersonal Understanding Facilitates Connection to the Self and Others;
- 2) Suicide and Self-Harm can fill a Need for Emotional Expression (with subordinate themes: 2.1) Suicidal or self-harm actions tend to be quick and impulsive; 2.2) Suicide and self-harm can cause meta-distress);
- 3) The Duality of Relating to Others (with subordinate theme 3.1) Connection within the therapeutic relationship tends to be slow and complex).

Conclusions: The implications of these findings are discussed with reference to clinical practices including safety planning and ASD-inclusive therapy, with consideration given to limitations and directions for future research.

**511.086** (Virtual Poster) "I'm the Family Ringmaster and Juggler": Autistic Parents' Experiences of Parenting during the Early Phase of COVID-19  
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Background: There is a dearth of research on autistic parenthood. The limited literature that does exist suggests that autistic mothers are more likely to experience prenatal and postnatal depression than non-autistic mothers, and can find it difficult to manage the everyday demands of parenting and domestic life, including heightened sensory experiences. While emerging research has also highlighted more positive autistic parenting experiences, there is a need to understand autistic parenthood in greater depth.

Objectives: Using qualitative methods, the current study sought to understand what parenting was like for autistic and non-autistic parents of autistic children during a particularly unsettling time: the initial phase of the COVID-19 pandemic.

Methods: Our participants included 35 Australian autistic parents (95% women) of autistic children (aged 4 – 25 years). Each took part in semi-structured interviews about their experiences of life during the initial phase of the pandemic (interviews ranged between 21.80 and 86.30 mins). Once transcribed, the interviews were subjected to reflexive, thematic analysis using an inductive (bottom-up) approach to identify patterned meanings within the dataset. We also adopted a participatory approach, in which non-autistic academics, autistic researchers and advocates, including an autistic parent of autistic children as lead author, were actively involved as partners in the research – in the design and implementation of the methods, and in the analysis, interpretation and dissemination of the results.

**Results:** We identified four themes (Figure 1). Parents repeatedly spoke of how life before COVID-19 could “be really hard” and that the lockdown brought some initial relief from the intensity of their usual lives and from “the obligations to be social” (Theme 1). Nevertheless, most parents felt that the “cumulative stress” of trying to juggle everything – home-learning, working from home, maintaining the house – proved very challenging (Theme 2). These challenges eventually took their toll on parents’ mental health (Theme 3). Parents were aware they needed support but found it difficult to reach out to their usual (autistic) social supports for help and formal support was virtually non-existent. Consequently, they felt “very much forgotten”. Despite all of this, many described how their connections with their children grew stronger over lockdown as they focused on nurturing their children’s “mental health ahead of everything else” (Theme 4).

**Conclusions:** Our analysis clearly shows how unsatisfactory normal life can be for autistic parents. Research has already documented these challenges for autistic adults, but parenting requires grappling with a distinctive set of demands, including juggling and transitioning between multiple commitments and dealing with different social expectations and obligations. These challenges are usually at least partially overcome as a result of the informal supports that many autistic parents draw upon. But the relative absence of informal supports during the pandemic left them reliant on more formal supports, many of which were not forthcoming. Nevertheless, parents kept going, in part because of the deep attachments and love they had with their children. Urgent research is needed to identify the most effective formal supports for autistic parents, ideally in partnership with autistic parents themselves.

**511.087** (Virtual Poster) Autism and Bilingualism: A Thematic Analysis of Practitioner Perspectives and Experiences

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**Background:** Around 25% of autistic children worldwide have the opportunity to learn multiple languages and access the plethora of cultural, familial and community connections that come with this. However, many autistic children are being denied opportunities to access additional languages in and outside of the home. There is little evidence identifying the barriers to language learning and access, and in particular, no research addressing the perspectives of practitioners, who are crucial in supporting parents to make informed choices about bilingualism for their child.

**Objectives:** The aim of this research is to understand the experiences of practitioners working with autistic bilingual children and their families. Specifically, this work identified barriers to best practise relating to family understanding, the knowledge base of practitioners and the relationship between socio-cultural factors and practise and recommendations.

**Methods:** Twelve speech and language practitioners from across the UK were recruited for this study. All participants had significant experience (M=7 years, Range 4-23 years) working with autistic bilingual children and their families. Semi-structured interviews were conducted and focused on attitudes and beliefs of practitioners regarding family bilingual experiences, the effect of socio-cultural factors of practise, and the general work barriers.

**Results:** Inductive thematic analysis was conducted on the interview data. A total of 25% of first level codes were checked for consistency by a second coder, with 100% intercoder reliability. Three central themes arose from the interviews (see figure 1).

The majority of practitioners described a number of recurring barriers to optimally support parents and children: Practitioners do not have confidence in the tools available to conduct diagnostic or language assessments with autistic bilingual children and described a lack of emphasis on cultural factors during their training period as a challenge when supporting families. Many were concerned at the limited options for resources and interventions available in other languages, which could be challenging for parents who were less proficient or confident communicating in English, and practitioners highlighted a lack of understanding of autism from many families as an additional barrier. Furthermore, practitioners reported having limited opportunities to access additional cultural training after they qualified or to keep up to date with relevant research.

**Conclusions:** This is the first study to understand the perspectives of speech and language practitioners working with autistic bilingual children, and identifies a number of key difficulties in supporting access to language learning. These findings will have important implications for practitioners and in turn, the families and children they support.

Practitioner concerns mirror previous research showing that findings regarding the potential positive effects of bilingualism are not trickling down to parents or specialists. This study also highlights the need for culturally relevant resources and training, and for practitioners to be provided with opportunities to receive up-to-date and accessible findings from research.

It is clear that families of autistic bilingual children will also benefit from evidence-based resources about autism and the interplay with bilingualism, to ensure that stakeholders can make informed decisions about language use at home.

**511.088** (Virtual Poster) Autistic Teens Show Greatly Reduced Self-Determination Compared to Their Typically Developing Peers

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**Background:**

Self-determination (SD) can be described as the skills someone has to become a primary causal agent in one's own life. This includes making decisions regarding one's own goal in areas a person feels is important. The small amount of prior research with autistic youth has shown that parents rate SD to be significantly lower than their typically developing (TD) peers. However, prior research in this area has not distinguished between autistic youth with and without intellectual disability (ID); furthermore, almost no research has examined differences in SD specifically between autistic teens without ID and TD peers.

### Objectives:

Examine differences between autistic teens and their TD peers in SD skills and opportunities to practice SD as reported by both parents and students.

### Methods:

Participants included 99 adolescents aged 14-20 ( $M = 16.05$ ,  $SD = 1.39$ ) with  $FSIQ \geq 70$  ( $M = 106.38$ ,  $SD = 13.74$ ). Autistic participants ( $n = 68$ ) met DSM-5 criteria supported by the SCQ and/or ADOS, and TD participants ( $n = 31$ ) had no diagnoses or active treatment. Parent- and self-reported SD was assessed using the American Institutes for Research Self-Determination Scale (AIR-SDS). The AIR-SDS measures SD skills (e.g., I/My child set their own goals to satisfy wants or needs) and opportunities to practice SD at home and school with higher scores indicating greater SD. Independent samples t-tests and chi-squared analyses were calculated to determine group differences on SD skills, and opportunities to practice SD at home and school for both parent- and self-report forms. Bivariate correlations examined the relationship between parent and self-report SD in both groups.

### Results:

There were no significant differences in age ( $t = -1.32$ ,  $p > .11$ ), IQ ( $t = 0.81$ ,  $p > .37$ ), or gender ( $X^2 = 2.5$ ,  $p > .11$ ) between ASD and TD groups. Parents of TD teens reported significantly higher SD skills when compared to autistic teens' parents ( $t = 7.49$ ,  $p < .001$ ). The same relationship was seen regarding opportunities to practice SD at home ( $t = 2.35$ ,  $p = .02$ ) and school ( $t = 2.25$ ,  $p = .01$ ), with autistic teens having fewer parent-reported opportunities. When examining self-report of SD, TD teens reported greater opportunities to practice SD at home compared to autistic teens ( $t = 2.56$ ,  $p = .01$ ). SD opportunities at school were trending towards significance ( $t = 1.75$ ,  $p = .08$ ;  $t = 1.84$ ,  $p = .07$ ). There were no significant differences between autistic and TD teens' report of overall SD skills ( $t = 1.20$ ,  $p > .01$ ). Bivariate correlations for the ASD group show parent and student agreement on opportunities to practice SD at school ( $r = .278$ ,  $p = .04$ ). In the TD group parents and students agreed on SD skills ( $r = .438$ ,  $p = .03$ ) and overall level of SD ( $r = .378$ ,  $p < .001$ ).

### Conclusions:

Results indicate that autistic teens have great impairments in SD when compared to their TD peers. Understanding SD in TD teens helps to further understand the differences seen in autistic teens.

### 511.089 (Virtual Poster) Classroom Practices and General Autism Awareness of Faculty Among Three California Public Universities

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**Background:** In recent years, there has been an influx in research focused on college students with autism. Studies have found that these students may face challenges related to mental health, social relationships, and academic aspects in college. Self-reported experiences of neurodiverse students also indicate specific difficulties with disclosure of diagnosis to faculty (Bolourian et al., 2018), and research on faculty perspectives demonstrates that many professors view autism as an invisible disability (Zeedyk et al., 2019). Findings from these studies highlight the need to identify the classroom practices and knowledge base in autism that faculty members possess for working with this population.

**Objectives:** The present study aims to describe the teaching practices and knowledge in autism of faculty from three large state universities in California.

**Methods:** An online survey was disseminated across three public universities (U) in Southern California; 214 faculty members (U1 n=78; U2 n=47; U3 n=89) responded to the survey. Survey questions included basic demographics for describing the sample, five questions on classroom practices, and 14 autism knowledge questions. Descriptive statistics, frequencies, and Chi-square or Fisher's exact tests were used to describe the findings and compare across the three institutions.

**Results:** The majority of participants were female (69.9%), predominantly White (68.2%), and most held a doctorate degree (58.4%). The average years of experience teaching was 12.88 ( $SD=9.11$ ). A total of 207 participants responded to five classroom practices questions. Overall, responses indicated that the three universities employed similar teaching practices. Statistically significant differences were found for only 2/5 statements asked: (1) More participants from U1 included a statement in their syllabus regarding disability services/accommodations compared to U2; (2) More U1 participants reported being approached by a student with documentation from student disability services than those from U2. As for general autism knowledge, faculty respondents shared similar views, though significant differences in proportions across the three universities were observed on two items related to genetic and dietary information specifically. For example, when asked if autism runs in families, significant differences were found across the three universities: 40.3% participants from U1, 17.1% participants from U2, and 37.2% participants from U3 *disagreed* with this

statement. When asked if changing a child's diet would lessen the severity of autism symptoms 40.3% participants from U1, 15.0% participants from U2, and 24.4% participants from U3 agreed with this statement.

**Conclusions:** Although faculty at the three universities expressed some differences in classroom practices and autism knowledge, there were more similarities than differences. These findings suggest that overall faculty members from these public universities possess a strong understanding of autism within and outside of the classroom. These survey results, particularly regarding classroom practices, can be used for preparing future faculty training in autism. A simple act of including a statement on accessing disability services/accommodations within course syllabi may help open the door to communication and normalize the accommodation process for neurodiverse students.

**511.090 (Virtual Poster)** Efficacy of Coping Mechanisms Used during COVID-19 As Reported By Parents of Children with Autism  
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**Background:** The COVID-19 pandemic's disruptions and alterations to daily life have been especially challenging for families with Autism Spectrum Disorder (ASD). Adapting to new daily routines, environmental changes, and uncertainty related to the pandemic have been determined to be causing distress in autistic children, worsening both the core features of ASD and their overall mental health. There is a need to develop different coping mechanisms and determining their efficacy in reducing anxiety in individuals with ASD.

**Objectives:** This study aims to evaluate various coping strategies employed by autistic children and their efficacy in mitigating stress and anxiety during the COVID-19 pandemic.

**Methods:** For this study, we used the data from a survey regarding alterations in children's behaviors and concerns throughout the COVID-19 pandemic as reported by their parents. We performed comprehensive analysis regarding how often a child with autism is using a certain coping strategy in mitigating stress and anxiety during pandemic (frequency) on a scale of 1 to 5 where 1 is very rarely and 5 is very frequently. We also determined to which extent child benefits from a particular strategy (efficacy) on a scale of 1 to 5 where 1 is not at all and 5 is extremely. Using Spearman's rank-order correlations and repeated measures ANOVAs, correlation coefficients between the frequency and efficacy of each coping mechanism, as well as significant differences between the two measures, were determined.

**Results:** Based on the Spearman's correlations, the "positive" coping mechanisms of distraction, focusing on positive aspects, and telling jokes had strong correlations amongst all age groups. Younger children managed stress by changing their way of thinking about the situation, while older children either avoided information about the pandemic or talked about it as much as possible. Amongst the "negative" behaviors, isolation was a common highly correlated behavior for all three age groups, however, all "negative" behaviors in the over 15 years old group had strong correlations in contrast to the two younger groups. Regardless of the child's age group, all parent behaviors had high associations between frequency and efficacy. Repeated measures ANOVAs revealed significant differences in frequency and efficacy ratings across the coping mechanisms. Interactions between the behaviors and age groups indicated variations in frequency and efficacy based on the child's age group, yet establishing a routine was rated as the most frequently and effectively used for all age groups.

**Conclusions:** The coping mechanisms defined as "positive" had stronger correlations between frequency and efficacy than the "negative" ones at all three age groups. The results of this study will lay the foundation to develop novel coping strategies that will help in alleviating stress in autistic children especially during this era of COVID-19 pandemic. Further studies using large cohort are warranted to develop effective coping mechanisms for individuals with ASD, especially for future public health emergencies.

**511.091 (Virtual Poster)** Experiences and Perspectives of Parents of Children with Autism Spectrum Disorder in Lima-Peru  
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**Background:** Most research on autism spectrum disorder (ASD) has been conducted in developed countries, which have extensive available resources to address the needs of children with ASD (Samadi & McConkey, 2011). However, there are limited studies in the field of ASD in developing countries, and specifically in Peru. Specially, few studies have examined the experiences and perspectives of parents of children with ASD regarding access to ASD service and ASD services in Peru.

**Objectives:** The purpose of this study was to examine (a) the experiences and perspectives of parents regarding accessing services for their child with ASD, the services their child received, and parental involvement. This study seeks to better understand parents' experiences and perspectives to inform the development of policies and services that will help improve the lives of children with ASD and their parents in Peru.

**Methods:** This study employed a multiple case design to explore the experiences and perspectives of parents of children with ASD in Peru. Criterion sampling was used to select potential participants. Parents were recruited from centers that provide services for individuals with ASD. Ten parents of young children with ASD participated in the study. This study was conducted virtually via Zoom. Data collection methods included 60-min semi-structured individual interviews, five diaries, 10 photos and 30-min interviews regarding the photos that were taken. Each session was audio and video recorded. Each interview was transcribed verbatim in written Spanish and then translated into English. NVivo software was used to organize, analyze and visualize the data. First cycle coding and second cycle coding were conducted to find patterns and themes. Finally, cross-case analysis was employed to compare commonalities and differences among participants.

**Results:** The results of this study revealed that the cost of the services for children with ASD in Lima, Peru, was high, taking into account the average income in the Peruvian Capital. Costs ranged from 35 to 100 Peruvian Nuevos Soles per 45 minutes each therapy session. Six major themes emerged from the preliminary results of this study: Service access, service experience, parental involvement, parental empowerment, discrimination, and parental expectations.

**Conclusions:** Parents of children with ASD experience greater challenges in Peru due to an inadequate health care system and scarce public services. Only financially stable caregivers can access private services, and those who are financially unstable can only access a limited amount of private services due to the high cost of their services. Overall, this study provides an understanding of barriers children with ASD, and their parents encounter regarding service access.

**511.092 (Virtual Poster)** How Can We Effectively Engage Autistic Teens in Online Learning Opportunities?: Use Universal Design but Remember It Is a Process and Should be Student Interest Driven

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**Background:** Autistic people are often chronically underemployed (Burgess & Cimera, 2014) despite interest in computers (Murray & Lesser, 1999) and the growing need for computing professionals (Bureau of Labor Statistics, 2015). Efforts to improve autistic people's employment outcomes should not *just* focus on computing, given their diverse career aspirations (Cheriyen et al., 2021). However, computing is a path toward employment for *some* autistic people. Universal Design (UD; providing multiple options to engage diverse learners) and informal learning opportunities may help disabled students succeed in technology-related careers (Moon et al., 2012), and thus, could help autistic youth develop employment-related skills. However, research with non-autistic people suggests that UD may overwhelm learners with redundant information (Mayer, 2001).

**Objectives:**

1. Iteratively develop instructional strategies to engage autistic learners.
2. Assess the validity of online assessments (we shifted to online instruction/assessment due to COVID-19).

**We hypothesized that:**

1. Students with more focused attention would prefer unimodal instruction; those with less focused attention would prefer multimodal instruction.
2. Workshops would lead to improved STEM self-efficacy and self-determination.

**Methods:** Assessments were piloted with autistic teens and revised by a participatory team. Two virtual 2-week game design workshops were conducted with an informal technology education non-profit (July 2021:  $n=20$ , Mage=17.2; 63% White; August 2021:  $n=19$ , Mage=16.5; 65% White). Students made games and discussed career opportunities and social justice issues. Students rated engagement with probed activities including varied group sizes, activity types, and modalities (Table 1), using an adapted picture-based engagement scale, assessing interest and understanding (Riccio et al., 2020). Pre- and post-tests assessed video game self-efficacy, self-determination (Shogren et al., 2020), and computational thinking (CT: Román-González et al., 2017). Cambridge Brain Sciences games assessed inhibition, spatial planning, deductive and grammatical reasoning, and memory. Workshop 1 informed adaptations for Workshop 2.

**Results:**

Across workshops, CT was positively associated with inhibition and memory, but *not* video game self-efficacy (Table 2). Unexpectedly, CT and inhibition were uncorrelated with engagement while self-efficacy and self-determination were correlated with each other and often with engagement.

At pre-test, Workshop 1 students reported more interest in game design ( $p = .045$ ) and learning how to make things ( $p = .035$ ) than Workshop 2 students.

Engagement did *not* vary across workshops. Students rated video+voice more engaging than voice only and video+voice+text instruction ( $ps < .05$ ). Self-determination improved across workshops ( $p = .003$ ). Unexpectedly, planning also improved ( $p = .003$ ). Video game self-efficacy did not improve ( $p = .36$ ), but trended toward being higher in Workshop 1 ( $p = .057$ ).

**Conclusions:** Self-report measures aligned with *self-reported* engagement while skills-based measures often cohered, suggesting that both types of information are needed. Self-determination improvements are promising as self-determination is associated with numerous positive outcomes. However, data-driven adaptations in Workshop 2 did *not* lead to improved outcomes, likely because Workshop 1 students were more interested in game design. Findings suggest that UD *can* overwhelm learners. Instructional adaptations should be iteratively revised guided by students' interests

and feedback. We are also evaluating if engagement and/or pre-test skills align with the games students made.

**511.093** (Virtual Poster) Inequities in Identification and Access to Services between Spanish-Speaking and English-Speaking Caregivers in California

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**Background:** Access to autism identification, diagnostic and intervention services are not equal, with the most vulnerable families receiving a late identification and unequal access to services. In this study we gathered caregivers' perspectives in a large district in southern California with identified inequities in autism identification (i.e., disproportionality of autism for White children). Specifically, the school system identified for the study had a documented overrepresentation of White students with autism and a documented under identification of Latinx/Hispanic students with autism.

**Objectives:** RQ: What are the experiences of caregivers related to their navigating the special education system for their children with autism? Are there any differences in knowledge about the IEP between English-speaking and Spanish speaking Latinx/Hispanic families?

**Methods:** A caregiver online survey was developed and approved by the Institutional Review Board of a large university in Southern California. We distributed the online survey to all parents of children with disabilities via a personalized email in the district. The survey was distributed in English and Spanish. The survey took 10-15 minutes to complete. Two previously published measures were used in the survey. **Caregiver Identification/Diagnosis Questionnaire.** Participants completed a short questionnaire (4- item) about the child's initial identification of a disability (e.g., Who first noticed the red flags of disability in your child). The questionnaire was adapted from a previous study gathering facilitators and barriers for racial/ethnic minority families (Stahmer, et al., 2019). **IEP Advocacy Knowledge Scale.** A community-developed 10-item multiple choice assessment of basic facts about special education parents' rights in special education. The items assessed basic knowledge of the IEP: zero reject, least restrictive environment, and Free and Appropriate Public Education (e.g., the least restrictive environment). Each item on the test has one correct response and was graded as correct or incorrect (0,1).

**Results:** Several differences were observed between the English-speaking parents and the Spanish speaking parents across all measures in the online survey responses (N=79). The results of the IEP Advocacy Knowledge Scale showed significant differences between the Spanish speaking and English-speaking respondents. Specifically, Spanish speaking parents had lower scores on IEP advocacy knowledge on average (M=4.73 SD=1.71) than the English speaking caregivers, (M=7.42, SD=2.5),  $t(44) = -6.89, p < .001$ . Additionally, 77% of English speaking parents reported they were the ones to identify "red flags" of autism, compared to only 14% of Latinx/Spanish speaking families. At the same time, Spanish speaking caregivers reported greater satisfaction with the IEP system when compared to English speaking caregivers.

**Conclusions:** The results showed that while Spanish speaking caregivers have a more positive assessment of the school system and its services, they might not be advocating as much as English speaking caregivers, who showed greater advocacy skills in navigating the special education process.

**511.094** (Virtual Poster) The Impact of COVID-19 on Individuals with ASD in the US: Parent Perspectives on Social and Support Concerns  
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**Background:** COVID-19 pandemic related lockdown measures and disruptions to services and daily routines for children with ASD and their families have resulted in a lack of access to the daily resources they have through school and private therapies. In addition, children with ASD and their families are experiencing a loss of support networks and social connections due to the pandemic.

**Objectives:** The current study aimed to determine the impact of the COVID-19 pandemic's social environmental changes on parental ratings of personal and child concerns about family conflict, opportunities for social interaction, and loss of institutional support.

**Methods:** The impact of COVID-19 on the concerns of families of individuals with ASD in the US was evaluated using surveys. The survey consisted of questions regarding parental concerns before, at the start of and during the COVID-19 pandemic, as well as parents' perception of children's concerns at these same three time points. Four specific areas of concern were evaluated in caregivers: concern that their child had fewer opportunities for social contact and interactions, concern that their child was not able to approach others, concern about family conflict, and concern about the loss of institutional support, including interventions, for their child. Parents also rated the degree to which they felt that their child was concerned about these issues. Changes in the level of concerns/worries were evaluated at 3 different time points (before or pre-COVID-19), at the start or beginning of the pandemic, and several months into the pandemic for 3 distinct age groups (2 – 9 years old, 10 – 15 years old, and over 15 years old) among children who were "aware" or "not aware" of the pandemic. This investigation specifically looked at trends in how concerns evolved over time, as well as whether there were any significant differences between the age groups or awareness status at each time point.

**Results:** The comprehensive analyses of the responses from families with ASD in the US determined differences in concerns across all three time points. Parents reported clear and significantly increased levels of concern over the course of pandemic regarding their child's loss of opportunities for social interactions, restrictions on being able to approach others, family conflict, and loss of institutional support. Parent ratings of perceived child concern also increased significantly in all areas during the course of the pandemic.

**Conclusions:** The information gathered from this study can be useful in determining effective techniques to support individuals with ASD and their families during health emergencies. By using this data, specialists can place a focus on the areas of increased stress delineated through this study, such as family conflict and access to social opportunities, in order to guide stress-mitigation techniques and inform modifications to autism therapies and services. The high levels of concerns highlighted in the current study provide support for the need to assess families' priorities and tailor services to best meet families' needs. This will potentially increase the quality of life of family members, and improve ASD services across the lifespan, and improve outcomes.

**511.095 (Virtual Poster) Maternal Factors Influencing Anxiety in Children with Developmental Disorders Compared to Children with Typical Development in Japan**

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**Background:**

Anxiety symptoms are common in children with developmental disorders (CDD). Studies have indicated that maternal anxiety and overprotection are associated with the anxiety of children with typical development (CTD). Thus, the same factors may influence the anxiety of CDD. There is a need to examine the mechanisms through which maternal factors impact children's anxiety between CDD and CTD.

**Objectives:**

We aimed to examine a model of the influence of maternal factors, adding Sense of Coherence (SOC), on anxiety symptoms in CDD and CTD. We hypothesized a multi-group model in which maternal SOC (comprehensibility, manageability, and meaningfulness), maternal anxiety, and maternal overprotection influence anxiety symptoms in CDD and CTD (Figure 1).

**Methods:**

From October 2020 to May 2021, mothers of children aged 6 to 15 participated in a survey. The sample comprised 105 mothers of CDD (mean age = 41.77 years,  $SD = 5.19$ ) and 292 mothers of CTD (mean age = 40.41 years,  $SD = 5.46$ ). The mean age of CDD was 9.56 years ( $SD = 2.58$ ), with 80 boys (76.19%) and 25 girls (23.81%); 69 of these were children with autism spectrum disorders (ASD) (65.71%). For CTD, the mean age was 9.56 years ( $SD = 2.58$ ), with 148 boys (50.68%) and 144 girls (49.32%).

The questionnaire measured their child's total anxiety, maternal SOC, maternal anxiety, and maternal overprotection. Moreover, since COVID-19 had a significant influence on the lifestyles of residents of Japan, we added questions regarding children's and mothers' anxiety about COVID-19 and set them as control variables. We utilized SPSS Version 27.0 and M-plus Version 8.5 for the analysis.

**Results:**

Multi-group path analysis was utilized to examine the hypothetical model. Comparing the configural invariance model, the partially constrained model (the path of maternal anxiety to child anxiety was constrained), and the fully constrained model, the partially constrained model yielded an adequate fit to the data ( $CFI = 1.00$ ,  $RMSEA = .03$ ) (Figure 2). After controlling for anxiety regarding COVID-19, there were negative paths from comprehensibility to maternal anxiety and from meaningfulness to overprotection ( $\beta = -.28$ -.50,  $p < .05$ ) in the CDD group. Moreover, in the CDD group, there was a positive path from maternal anxiety to child anxiety ( $\beta = .26$ ,  $p < .001$ ). In contrast, for the CTD group, there were negative paths from comprehensibility and manageability to maternal anxiety ( $\beta = -.17$ -.33,  $p < .05$ ), a path from maternal anxiety to overprotection ( $\beta = .29$ ,  $p < .001$ ), and paths both from maternal anxiety and overprotection to child anxiety ( $\beta = .23$ ,  $p < .01$ ).

**Conclusions:**

Our results suggest that maternal comprehensibility and meaningfulness influence maternal anxiety and overprotection, and maternal anxiety directly influences child anxiety in the CDD group. In the CTD group, however, lower comprehensibility and manageability influence maternal anxiety, and maternal overprotection mediated by maternal anxiety influences child anxiety. These findings suggest that assessment and treatment for anxiety of CDD should measure maternal SOC and maternal anxiety. There may be a need to treat anxiety of mothers of CDD.

**511.096 (Virtual Poster) The Wellbeing and Support Needs of Australian Caregivers of Neurodiverse Children.**

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**Background:**

Neurodiverse children have individual support needs across various areas of life, including home life, school, and extracurricular activities. In Australia, most disability-related supports are provided through the National Disability Insurance Scheme (NDIS). The NDIS aims to provide

individualised, person-centred supports to people with disabilities of all ages (NDIS participants). However, with supports required to be directly related to the participant, there is a risk that caregiver supports are disappearing. Caregiver supports are important for supporting caregivers' health and mental wellbeing. These supports also allow caregivers to support their neurodiverse children to the best of their capacity, reducing reliance on external, paid support. To date there has been little understanding of how the introduction of the NDIS has affected caregivers' wellbeing and their support needs.

#### Objectives:

This study aimed to a) explore the wellbeing of Australian caregivers of neurodiverse children (0-12), b) understand how their caregiver role impacts their wellbeing, and c) identify the support needs of Australian caregivers of neurodiverse children (0-12 years).

#### Methods:

An online survey of multiple-choice questions and open-ended questions was conducted. The survey included four sections: a) demographic information; b) caregiving responsibilities; c) caregiver wellbeing (including the personal wellbeing index and parenting stress index); and, d) Support needs. Qualitative information was analysed using content analysis, and the quantitative information was analysed descriptively (with published measures scored according to their manuals). Participants were recruited through social media and disability-related organisations from across Australia. Ethical approval was granted for this research.

#### Results:

A total of 66 participants completed the survey, with the majority being female (n=63, 95.5%) and biological parents to their care recipients (n=64, 97%). Just under a quarter (n=14) identified as being neurodiverse themselves. The majority of the care recipients were male (n=59, 69%), with a diagnosis of ASD (n=80, 82%), and were an average of eight years old. Caregivers spent an average of 16.3 hours per day caring for their neurodiverse children (SD=6.6 hours), and their responsibilities included managing their daily routine (n=66, 100%), meal times (n=65, 98.5%), organising health appointments (n=65, 98.5%) and protective behaviours (n=65, 98.5%). The samples' average Personal wellbeing index score was 55 (SD=12.8), significantly lower than the Australian population average of 75. On the Parenting Stress Index, the average score fell in the 92<sup>nd</sup> percentile, indicating clinically significant levels of stress. In the qualitative responses, themes included significant mental health concerns, impact on relationships and self-identity, barriers to community participation, financial hardship, and lack of or barriers to needed supports (including therapy and diagnostic services).

#### Conclusions:

These results have identified significant wellbeing and mental health concerns for caregivers of neurodiverse children in Australia. The results identify a wide range of negative impacts on these caregivers' wellbeing and gaps in the available supports. More support is needed from various sources for these caregivers to support their wellbeing and allow them to support their children.

**511.097 (Virtual Poster)** Autistic Women's Experience - or the Dynamic Interaction between the Characteristics Associated to the Activities They Engage in and Their Environment with Their Own Personal Characteristics.

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**Background:** While it used to be considered that the prevalence of autism was of 1 girl for every 4 boys, research now tends to paint a different picture. Indeed, many Autistic women are not formally identified as such until adulthood (compared to men, which are more likely to be identified during childhood), as their experiences and functioning deviate from the traditionally male representation of autism. Indeed, very few studies have focused on the lived experience of Autistic women, hence an important knowledge gap. Moreover, emerging research shows that Autistic women's late identification may negatively impacts their identity-building processes (Baldwin, S. et al., 2016; MacLeod, et al., 2013).

**Objectives:** This research aimed to understand the experiences of Autistic women and how their personal characteristics manifest themselves in their daily lives (i.e., through their activities and in their environment, whether physical, social, cultural or institutional).

**Methods:** A qualitative strategy and a descriptive design were used. Data were collected via an electronic questionnaire (sociodemographic) and written life stories/ storytelling (Burrick, 2010). More specifically, Autistic women from Québec (Canada) were invited to reflect on their story, by sharing significant events and/or perceived difficulties, as well as what, evokes her perceived differences. Data analysis relied on descriptive statistical analyses and Paillé's grounded theorizing analysis, which was supported by the theoretical basis of the Person-Environment-Occupation (PEO) theoretical model (Law et al., 1996).

**Results:** 38 Autistic women participated in the study. All of them had been identified as autistic as adults and they were between 24 and 59 years of age. The life stories' narrative content was associated to three main categories, namely the interaction between the participants' personal characteristics (related to autism) and the characteristics of: i) the environment in which they evolve; ii) the occupations in which they engage; and iii) the particular environments in which they perform given occupations. Results show that, among participants, camouflage is a common strategy that is used to promote a better fit with their environment. Such a strategy is used at their own expenses since it generates significant cognitive and



sensory load. Results also show that in the end, it is often the mismatch between the autistic women characteristics and their environment that leads them to initiate steps to obtain a formal diagnosis.

**Conclusions:** The analyzed life stories' narrative attests of a great capacity in terms of introspection and environments' observation. Findings show that for the participants, recognizing and considering themselves as Autistic contributes to a better understanding of themselves and their daily functioning, while conferring a sense of belonging to a group. While the challenges and obstacles reported being essentially related to the mismatch between their profile and the contexts (environmental and occupational) in which they evolve, this knowledge of themselves can guide choices to promote their well-being and development.

**511.098 (Virtual Poster)** The Importance of Contexts on the Experience of a Fulfilling Life - What Can We Learn from a Comparison of COVID-19 Lockdown's Impact on Life Satisfaction of Autistic and Non-Autistic Adults

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**Background:** Public health measures taken to limit the spread of COVID-19 led to changes in all individuals' lifestyle (e.g., personal, and professional roles and routines, way to carry out activities). These changes have led to the interruption, modification, or replacement of some or even several of the activities that people perceived as important, enriching, necessary or significant to them. The unpredictability of events and the loss of reference points that we have been experiencing had an impact on the life satisfaction of a large segment of the population (Brown, 2021). The major changes experienced since March 2020 has been said to pose an even greater threat to the mental health and life satisfaction of Autistics, who are thought to have higher rates of anxiety (Wright, Spikins & Pearson, 2020). However, several Autistic adults have expressed on social media their appreciation of home confinement, due to reduced exposure to certain potentially anxiety-provoking contexts (Asperger au féminin - Québec, 2020; Aspie Québec, 2020), either related to social interactions or to sensory stimuli.

**Objectives:** This research aimed to assess the life satisfaction of Autistic and non-autistic individuals ( $\geq 16$  years old) living in Québec (Canada) before and during the COVID-19 lockdown.

**Methods:** A survey was launched using an online questionnaire between July 1 and October 31, 2020. Participants were those capable of completing the online survey offering an introspective perspective at their lived experience of the sanitary crisis. The questionnaire comprised the Satisfaction with Life Scale as well as questions on the impacts of the pandemic on occupations & social relationships. Data analysis relied on descriptive statistical tests.

**Results:** Slightly under 400 adults responded to the survey, one quarter of which being Autistic. In both groups, more than half of the participants were between 26 and 45 years of age. While both groups reported a decreased of their life satisfaction during the COVID-19 lockdown, the discrepancy (before – during the lockdown) was lower in Autistic adults. In fact, once the initial shock overcame, autistic participants coped well with the pandemic context. They were satisfied with their living conditions and their interpersonal relationships improved, while they reported an increase in the significance and the importance given to their activities. Among non-autistic adults, there was an overall decrease in life satisfaction, as well as a decrease in the importance and meaning of their occupations.

**Conclusions:** Results show that the Autistic participants were able to adapt and benefit from the new context, compared to non-autistic adults who had difficulty coping with the changes and perceived loss during the COVID-19 pandemic period. This finding highlights the influence of environmental and occupational contexts on life satisfaction in Autistic and non-autistic adults, thereby reinforcing a socio-environmental understanding of autism. It also shows that while contexts that are appropriate to people's characteristics allow for fulfilling lives, such contexts differ among the Autistic adult and the non-autistic adult population.

## VIRTUAL POSTER SESSION — FAMILY ISSUES AND STAKEHOLDER EXPERIENCES

### 524 - Family Issues and Stakeholder Experiences II --- (V)

**524.023 (Virtual Poster)** Trends in U.S. Autism Research Funding: Interagency Autism Coordinating Committee Autism Research Portfolio Analysis Report

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**Background:**

The Office of Autism Research Coordination (OARC) of the U.S. National Institutes of Health (NIH) will present findings from the upcoming 2019-2020 *Interagency Autism Coordinating Committee (IACC) Autism Research Portfolio Analysis Report* that describes autism research investments made by both government and private funders.

OARC/NIH coordinates and manages the IACC, a federal advisory committee composed of federal officials and public stakeholders. The Committee was established by Congress to coordinate federal agency activities and to provide advice to the Secretary of Health and Human Services related to autism spectrum disorder (ASD). The IACC's *Strategic Plan* provides a framework to guide the efforts of U.S. federal agencies and partner organizations. OARC conducts an annual portfolio analysis of U.S. research projects to help guide the IACC's strategic planning efforts and inform

the IACC of progress toward implementation of the *Strategic Plan*. The *Portfolio Analysis* is also used by agencies and organizations to better understand trends in ASD research funding.

#### Objectives:

OARC will present findings from its *2019-2020 IACC ASD Research Portfolio Analysis Report*, which provides information on autism research investments made by U.S. federal and private funders of ASD research.

#### Methods:

Data including project description, institution, and funding amount were collected from U.S government and non-government funders of autism research. All projects included in the *Portfolio Analysis* were coded according to the seven research questions and 23 objectives outlined in the *2016-2017 IACC Strategic Plan*. Each of the questions in the *Strategic Plan* address general topic areas that are represented as community-focused questions (e.g., How can I recognize the signs of ASD, and why is early detection so important?). Each question includes three to four objectives; there is also one cross-cutting objective that focuses on ASD in females. The data were analyzed in several ways to provide information on the types of research being funded and the research topic areas supported by each funder. This report also assesses the composition of research projects that are investigating racial and ethnic disparities in ASD.

#### Results:

OARC collected U.S. ASD research project data for 2019 and 2020 and aligned research projects with the 23 objectives in the *Strategic Plan*. The analysis provides an overview of the distribution of research projects and funding across the seven *Strategic Plan* Question areas, analysis of projects across multiple scientific subcategories, a breakdown of federal and non-federal funders' contributions to ASD research investments, geographical distribution of research projects, and trends in research funding over time. The data provide information on the degree to which the objectives and budget recommendations described in the *IACC Strategic Plan* are being met. These data will be made available to the public through the Autism Research Database on the IACC website: <https://iacc.hhs.gov/funding/data/>.

#### Conclusions:

These analyses of ASD research funding provide a broad overview of the autism research landscape in the U.S. and the roles of government and non-government funders in supporting ASD research.

#### **524.024 (Virtual Poster) Multiple Perspectives Regarding Barriers to Minoritized Populations' Participation in Genetic Research: Examining Practitioner and Community Responses on This Critical Issue**

**M. J. Oyeyemi<sup>1</sup>, Z. Algaze<sup>2</sup>, V. Ranganathan<sup>3</sup>, A. Quinones<sup>2</sup>, S. Horner<sup>4</sup>, E. LaSasso<sup>2</sup>, A. Daniels<sup>5</sup>, K. Diehl<sup>1</sup>, J. K. Law<sup>6</sup>, N. Nagpal<sup>1</sup>, R. T. Schultz<sup>1</sup>, J. Pandey<sup>1</sup> and S. Consortium<sup>1</sup>, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Center for Autism Research at the Children's Hospital of Philadelphia, Philadelphia, PA, (3)CHOP, Philadelphia, PA, (4)CHOP Center for Autism Research, Havertown, PA, (5)Simons Foundation, New York, NY, (6)Maryland Center for Developmental Disabilities, Maryland Center for Development Disabilities, Kennedy Krieger Institute, Baltimore, MD**

Background: Individuals with Autism Spectrum Disorder (ASD) who belong to communities of color are often underrepresented in autism research, which contributes to further disparities in healthcare (Maye et al., 2021). The Simons Foundation Powering Autism Research for Knowledge (SPARK) study, a nationwide genetic study, has reviewed their recruitment efforts and report that 6% of participants are Black and 3% are Asian, significantly less than national demographic data (13.4% Black, 5.9% Asian) and that of Philadelphia (42.1% Black, 7.2% Asian; U.S. Census Bureau, 2020).

Objectives: To (a) better understand the barriers ASD families, especially those from underrepresented communities, face in genetic autism research and (b) to discover and improve strategies to ethically recruit families from underrepresented communities based on the perspectives of ASD community members and healthcare providers who serve ASD families.

Methods: The Children's Hospital of Philadelphia (CHOP)-SPARK team developed two surveys for distribution to Philadelphia ASD community members and healthcare providers. The surveys included 21 multiple choice and open-ended questions about genetic research participation and recruitment efforts, with the community survey addressing the responder's concerns and the provider survey focusing on that of their minoritized patients. A randomized sample of community responses were compared with healthcare provider responses.

Results: Both groups identified logistical issues and lack of awareness as the biggest barriers to genetic research participation, also citing privacy concerns and the possibility for misuse of information (Tables 2 & 3). One community member noted that "doctors...[should] give out some sort of flyer" about SPARK to increase participation, an idea shared by 66% of providers, who stated that they would discuss SPARK more if provided with recruitment materials. However, the groups had different views on what resources ASD families need. The top choices for community members were research finding updates and relevant webinars, while 65% of providers recommended social service access, a resource only 46% of community members selected (Tables 4 & 5).

Concerns and needs of underrepresented communities seemed to differ from that of white community. A majority (85%) of survey respondents identified as white, followed by 10% and 4% from the Black and Asian communities, respectively (Table 1). Black community members saw the fear

of being taken advantage of and mistrust of clinical/research staff as significant barriers to genetic research participation, while less than 10% of white respondents shared these concerns (Table 2).

Providers believed that having research staff present in healthcare settings would be the most effective tool to increase minoritized family participation. Underrepresented communities supported this method, as 60% felt most comfortable meeting with researchers in a CHOP clinic. In the total sample, community members felt more comfortable scheduling at-home visits than meeting with research staff in healthcare settings.

Conclusions: ASD families from underrepresented groups have unique experiences that guide their hesitancy to participate in genetic research. Acknowledging specific needs through targeted recruitment strategies and provider partnership may help reduce racial disparities in autism research. Additional findings that highlight the significance of comparing community and provider perspectives on this issue will be presented.

**524.025 (Virtual Poster)** Representation Counts: Assessing the Needs, Barriers, and Fears of Minoritized Populations' Participation in Genetic Research

**M. J. Oyeyemi<sup>1</sup>**, Z. Algaze<sup>2</sup>, V. Ranganathan<sup>3</sup>, A. Quinones<sup>4</sup>, L. Malloch<sup>5</sup>, A. Daniels<sup>6</sup>, K. Diehl<sup>7</sup>, R. P. Goin-Kochel<sup>8</sup>, A. Gulsrud<sup>9</sup>, J. K. Law<sup>10</sup>, N. Nagpal<sup>11</sup>, D. E. Sarver<sup>12</sup>, R. T. Schultz<sup>13</sup>, J. Pandey<sup>14</sup> and S. Consortium<sup>15</sup>, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Center for Autism Research at the Children's Hospital of Philadelphia, Philadelphia, PA, (3)CHOP, Philadelphia, PA, (4)University of Mississippi Medical Center, Jackson, MS, (5)Simons Foundation, New York, NY, (6)Baylor College of Medicine, Houston, TX, (7)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (8)Maryland Center for Developmental Disabilities, Maryland Center for Development Disabilities, Kennedy Krieger Institute, Baltimore, MD

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Background: Simons Foundation Powering Autism Research for Knowledge (SPARK) is a nationwide genetic study recruiting individuals with Autism Spectrum Disorder (ASD) and family members. In 2020, 6% of SPARK participants were Black and 3% were Asian, showing a clear disparity compared to national demographics (13.4% Black; 5.9% Asian; U.S. Census Bureau, 2020). Black families within the ASD community often distrust research because of the history of ethical violations, while Asian parents cite struggles with language barriers (Jones & Mandell, 2020; Roman-Urrestarazu et al., 2021). Four SPARK sites distributed surveys to local ASD community members to understand barriers to genetic research participation, with the goal of addressing racial disparities across the SPARK network.

Objectives: To (a) identify participation barriers in genetic-autism research, including the SPARK study, from the perspectives of individuals with strong ties to their local ASD communities and (b) inform the development of new recruitment strategies, especially those targeting underrepresented communities.

Methods: The SPARK team at the Children's Hospital of Philadelphia (CHOP) developed a 21-question survey to collect feedback from ASD community members regarding genetic research participation concerns and recruitment strategy opinions. Four SPARK clinical sites, CHOP, University of California, Los Angeles (UCLA), University of Mississippi Medical Center (UMMC), and Baylor College of Medicine (BCM), distributed this survey electronically to their local networks/ASD community stakeholders. Total survey responses from UCLA, UMMC and BCM were added to a random sample from CHOP and analyzed for prominent trends and themes.

Results: Most (55%) responses came from white ASD community members, followed by 21%, 13%, and 2% from the Black, Asian, and Native American communities, respectively (Table 1). Eighty percent of community members from the four sites stated that SPARK is beneficial for individuals with ASD. However, concerns about information misuse and privacy were referenced by 25% of respondents. Some community members questioned the direct benefit to their family members with ASD, as well as long delays in return of genetic results.

Priorities and concerns about genetic research differed significantly between racial groups (Tables 2 & 3). Together, 63% of Black and Asian community members preferred that research studies offer support in gaining access to services, while 54% of white community members showed interest in this. Asian community members were more interested in support groups and webinars and more concerned about logistical barriers to participation than non-Asian respondents. Black community members identified the fear of being taken advantage of and mistrust of clinical/research staff as key barriers to participation more than non-Black respondents. This may reflect "concerns about bias" and "distrust [of]... the medical community" cited by multiple Black community members. Native American community members also cited mistrust of clinical staff and information security as key concerns.

Conclusions: To increase research participation in underrepresented communities, researchers need to build trust through clear messaging about information protection and data usage, as well as providing families with the resources they need to improve their daily lives. Further comparison across racial/ethnic groups will be presented, highlighting the importance of these perspectives.

**524.026 (Virtual Poster)** Parent-Perceived Parental Stress, Relationship Closeness, and Relationship Satisfaction: Comparison of Simplex and Multiplex Families

**E. Mitchell<sup>1</sup>**, H. Onovbiona<sup>2</sup>, L. B. Quetsch<sup>3</sup>, C. Brown<sup>4</sup>, L. Aloia<sup>5</sup> and S. M. Kanne<sup>6,7</sup>, (1)Psychological Science, University of Arkansas, Fayetteville, AR, (2)University of Arkansas, Fayetteville, AR, (3)Pacific University, Hillsboro, OR, (4)Communication, University of Arkansas, Fayetteville, AR, (5)Center for Autism and the Developing Brain, White Plains, NY, (6)Weill Cornell Medical College and New York-Presbyterian Hospital, New York, NY

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Background: Parents of children with autism spectrum disorder (ASD) experience higher stress when compared to those with neurotypical youth (Hayes & Watson, 2013). However, little is known about stress may change when families have one child (simplex) versus more than one child with

ASD (multiplex). Furthermore, research rarely explores the strengths of families of youth with ASD (e.g., closeness, satisfaction) and how family composition may impact these experiences.

**Objectives:** The current study aims to examine if parental stress, relationship closeness, and relationship satisfaction differ between simplex and multiplex families.

**Methods:** Eight-six multiplex families and 86 simplex families of children with ASD between the ages of 4 to 17 years were compared. Independent samples t-tests were conducted to examine if parental stress (Parenting Stress Index: Short Form), relationship closeness, and relationship satisfaction differed between family groups.

**Results:** Analyses revealed no significant differences between the groups on parental stress ( $t(170) = -.726, p = .469$ ), parent perceived relationship closeness ( $t(170) = .129, p = .449$ ), or parent perceived relationship satisfaction ( $t(170) = -.918, p = .360$ ).

**Conclusions:** Stress, relationship closeness, and relationship satisfaction between the samples were statistically nonsignificant. Our findings suggest that families are able to connect with their children at similar levels regardless of the number of children with neurodiversity in the house. This suggests that families may experience certain levels of stress (e.g., from concerns for the child's future, family finances, autism stigma) or connection that are not impacted significantly by having multiple children with the same diagnosis (Papadopoulos, 2021). Further discussion and future directions will be presented on the poster.

**524.027 (Virtual Poster)** Perspectives of Caregivers and Youth with Developmental Disabilities on Physical Activity: A Qualitative Study  
*S. Srinivasan, A. Athreya, M. Kaba, S. S. Glenney and D. Bubela, Kinesiology, University of Connecticut, Storrs, CT*

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**Background:** Youth with developmental disabilities (DD) are more likely to be obese compared to their non-disabled peers and suffer from associated adverse physical and psychological consequences. Individuals with DD are three times more likely to be sedentary compared to healthy peers and 56% of individuals do not participate in any physical activity (PA).

**Objectives:** The present study involved focus group discussions with youth with DD and their caregivers to understand their perceptions regarding PA and identify facilitators and barriers influencing PA participation in youth with DD.

**Methods:** 13-to-26-year-old, verbal, males and females with DD (including ASD, Cerebral Palsy, Down syndrome and Intellectual Disability) and their caregivers were recruited. Two separate focus groups in each stakeholder group were conducted virtually via Webex with youth and their caregivers, with group sizes ranging from 4-8 participants. Each focus group lasted for about 1.5 hours and was audio recorded. During the focus group, an experienced moderator facilitated the discussion. For youth with DD, we asked about PA they pursued recently, frequency and duration of PA engagement, how PA made them feel, their favorite activities, barriers they face in being active, and general suggestions they had to promote PA in youth with DD. Similar questions were also posed to caregivers about their children with DD. In addition, they were asked to share perspectives about the importance of PA for their family, impact of COVID on their child's PA, and PA opportunities they plan to access for their child as they transition out of school. Focus group sessions were transcribed and three researchers read the transcripts to identify themes emerging from the discussions.

**Results:** All youth reported engaging in some PA such as recreational activities (e.g. walking, swimming, bike riding, horse riding, Unified Sports, Wii, etc.) or chores (e.g. yard work) for PA. They were more likely to engage in PA that was fun, not too challenging or competitive, and that provided opportunities for interactions with healthy peers or family. Over 90% youth also highlighted the importance of having trained personnel to motivate them and help them with the activities if needed. A majority of caregivers emphasized an unmet need for more accessible, adapted programs and facilities with flexible timings, transportation support, affordable costs, appropriate equipment, and trained empathetic personnel to help promote PA in youth. They also highlighted the dearth of state-run PA programs beyond the age of 21 years, and emphasized the burden on families to advocate for PA and scout for appropriate programs to provide their children access to PA opportunities across their lifespan. A 100% of youth and caregivers reported a significant decrease in PA during COVID-19 due to closures of programs and facilities.

**Conclusions:** Youth with DD are an underserved population especially as they transition into adulthood. There is a need for focused adult-oriented programs with trained personnel to promote PA and fitness throughout the lifespan. Our study serves to highlight family perspectives on PA and provides insights to guide the development of programs to promote PA in youth with DD.

**524.028 (Virtual Poster)** Perspectives of Clinicians and Special Educators on Physical Activity in Youth with Developmental Disabilities: A Qualitative Study  
*A. Athreya, M. Kaba, S. S. Glenney, D. Bubela and S. Srinivasan, Kinesiology, University of Connecticut, Storrs, CT*

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**Background:** Youth with developmental disabilities (DD) including Autism Spectrum Disorder (ASD) are at high risk for obesity due to lower levels of physical activity (PA) compared to healthy peers. According to the National Survey for Child Health, less than 20% youth with DD meet the PA recommendations issued by the US department of Health and Human services.

**Objectives:** This study involved focus group discussions with physical therapists and special educators working with youth with DD to understand their perspectives on PA in their clients/students and factors associated with PA participation in this population.

**Methods:** Inclusion criteria included (1) physical therapists working with youth with DD from 13-26 years in school, hospital, outpatient, or other settings, and (2) special educators/paraprofessionals working with youth within school settings. Two separate focus groups were conducted virtually via Webex with each stakeholder group, with group sizes ranging from 4-8 participants. The discussion, facilitated by an expert moderator, lasted about 1.5 hours and was audio recorded. We asked clinicians about the amount of PA they recommend for youth with DD, the types of activities that youth enjoy, strategies used to motivate them, barriers faced in getting youth to be active especially as they transition out of school systems, and suggestions on program development to promote PA in youth. Educators were additionally asked about PA opportunities offered to students in schools and the extent to which PA-related goals are part of students' Individualized Education Program (IEP) and transition plans. Focus groups were transcribed and three researchers read transcripts to identify major themes.

**Results:** The majority of stakeholders reported that youth with DD prefer activities that are fun, allow them to experience success, afford integration with peers, and are adapted to their needs (e.g. individualized based on interest and ability level, non-competitive, etc.). Although 100% clinicians recommended incorporating some form of PA daily within their client's schedule, ultimately, engagement in PA depends on multiple factors such as availability of energetic staff/healthy peers to motivate students, family values/priorities, etc. Over 75% stakeholders highlighted the need for a holistic approach to health by emphasizing both nutrition and PA. They recommended that efforts be made as part of transition programs to teach youth to access available fitness options within their local communities and different life skills/chores that will promote lifelong PA. Finally, 100% participants underscored the need for family education to ensure integration and carryover of activity habits outside school and therapy settings. Barriers identified for PA engagement included financial constraints, family beliefs, COVID-related program disruptions, lack of space and equipment, and lack of properly trained personnel and programs especially for youth over 21 years.

**Conclusions:** Clinicians and educators highlighted the critical need for programs and services to support families in the promotion of PA in youth transitioning into the adult world. Our findings call for more research on youth- and adult-centric programs to promote PA in young adults DD. Findings may have implications for policy-level changes to improve access to resources aimed at improving overall health of youth with DD.

**524.029 (Virtual Poster)** Post-Diagnostic Stress Among Parents of Children Diagnosed with Autism Spectrum Disorder: A Qualitative Study  
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**Background:** Research indicates that cultural variables influence family experiences of disability and western findings may not be able to guide policy and clinical practice in traditional and conservative nations. Research in India has seldom studied caregivers' perceptions, experiences, and needs for information after an autism diagnosis. Indeed, research in this area is dominated by evidence from the western countries and neglected in the low- and middle-income countries (LMICs) leading to a substantial gap in the literature with regard to the specific issues associated with the care of a child with autism spectrum disorder (ASD).

**Objectives:**

The present study attempts to understand the perceived barriers experienced by parents of children with autism in the context of their situation and lifeworld.

**Methods:**

Twenty-eight parents with a diagnosed child with ASD (3-8 years) was recruited from a tertiary care teaching hospital in North India. An interview guide elicited information about experiences regarding obtaining an autism diagnosis, perceived barriers and facilitators, reactions to diagnosis, post-diagnostic family and community experiences, and stress experienced by parents. The interviews were audio-recorded, transcribed, and analysed. An inductive, descriptive thematic analysis was utilized to extract broad themes and sub-themes from each of the interviews conducted. The ethics clearance was provided by the institutional review board.

**Results:** Parents discussed a range of issues, including the arduous process of getting a diagnosis, their emotional responses to diagnosis disclosure, financial and relationship struggles, lack of emotional and financial support, significant challenges of parenting a child with autism, and coming to terms with autism. Parents recalled that they were unaware that some of the early signs of autism were aberrations of normal development. Delayed development, particularly in the language sector, was generally ignored or not considered severe enough to warrant medical attention. Many parents reported a high amount of post-diagnosis stress, poorer parental functioning, greater marital conflict, family socialization difficulties, and feelings of inadequacy. Parental stress was primarily related to the burden of childcare, difficulty in managing family relationships, limited support systems, financial concerns, and stigma associated with childhood disability. Overall, nine themes were identified from the qualitative analysis of the interviews: two before the diagnosis (delayed help-seeking and experiences with healthcare), one at the time of diagnosis disclosure (heightened emotional response to diagnosis), and six themes after the diagnosis (increased stress, behavioral challenges, deterioration in family relationships, negative attitudes of the family, seeking support, and moving forward with hope for the future).

**Conclusions:** There are several barriers and gaps in the autism-related available services in the country and there is a need to provide inclusive, supportive, and culturally sensitive support to caregivers. Child health professional can play a salient role in helping parents navigate the complex health care system, weigh the pros and cons of various intervention strategies, and make decisions that best suit their individual needs. Clinical implications of the study highlight the need for more family-centred physician-parent communication that is strengths-based, sensitive to families' emotional needs, and individualized to a family's unique context.

**524.030** (Virtual Poster) The Effect of Affiliate Stigma on Family Quality of Life Among Parents of ASD Children: The Chain Mediating Roles of Social Support and Self-Compassion

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**Background:** Parents of ASD children were reported to have higher level of affiliate stigma than that parents with other disabilities (Werner & Shulman, 2015). According to a study by Afia (2012), affiliate stigma increases parental pressure and burden on caregivers of children with disabilities, hence reducing the quality of life.

**Objectives:** This study aims at investigating family quality of life among parents of ASD children and its association with other variables, including affiliate stigma, social support, and self-compassion.

**Methods:** A survey of parents of ASD children was conducted during November 2020 to February 2021. There were 506 participants enrolled, among whom 418 were mothers of children with ASD and 88 were fathers. The measures were Family Quality of Life Scale, Affiliate Stigma Scale, Self-compassion Scale, Social Support Scale. The descriptive statistics, *t*-test, analysis of variance, correlation and regression were used to analyze the data.

**Results:** There were significant gender differences on affiliate stigma ( $P < 0.001$ ), family quality of life ( $P < 0.01$ ), social support ( $P < 0.01$ ) but not on self-compassion ( $P > 0.05$ ). Self-compassion and social support play a significant role in the chain intermediary between stigma and family quality of life. In the mediation model of affiliate stigma → self-compassion → family quality of life, affiliate stigma has a significant negative predictive effect on self-compassion ( $\beta = -0.26$ ,  $P < 0.01$ ), and self-compassion has a significant positive predictive effect on family quality of life ( $\beta = 0.19$ ,  $P < 0.05$ ). In the mediation model of affiliate stigma → social support → family quality of life, affiliate stigma significantly negatively predicts social support ( $\beta = -0.36$ ,  $P < 0.001$ ), and social support predicts family quality of life significantly positively ( $\beta = 0.56$ ,  $P < 0.01$ ). In the chain mediation model of affiliate stigma → self-compassion → social support → family quality of life, self-compassion has a significant positive predictive effect on social support ( $\beta = 0.22$ ,  $P < 0.001$ ).

**Conclusions:** In summary, compared with self-compassion, social support has a large mediating effect between the affiliate stigma of parents of ASD children and the family quality of life; self-compassion and social support of parents of ASD children play a chain mediating role between affiliate stigma and family quality of life.

**524.031** (Virtual Poster) Quiet Ego and Post-Traumatic Growth in Caregivers of Special Children: A Mediating Model for Regulation

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**Background:** Previous studies showed that quiet ego reflects a quiet self-consciousness, which allows individuals to re-establish their understanding with a more positive self-attitude, thus effectively encouraging individuals to choose positive treatment and coping styles, and thus effectively promoting the development of post-traumatic growth. However, there is little research on the characteristics of quiet self and post-traumatic growth of caregivers of special children, and the mechanism of quiet self 's effect on the post-traumatic growth is not clear.

**Objectives:** The study aims to examine the relationship between quiet ego, post-traumatic growth, positive response and social support of caregivers of special children, and further investigate the mediating role of active response between quiet ego and post-traumatic growth, as well as the regulating role of social in order to provide advice for effective post-traumatic growth and positive coping strategies.

**Methods:** Two hundred and seventy-eight caregivers of special children (42 fathers, 216 mothers and 20 other caregivers) were recruited to participate an online survey during December 2020 to March 2021. The demographic information of both caregivers and their children (Male: Female = 195:83) were collected. The measures were the Quiet Ego Scale (QES), Post-traumatic Growth Inventory (PTGI), Simplified Coping Style Questionnaire (SCSQ) and Social Support Rating Scale (SSRS). The descriptive statistical analysis, the *t*-test and variance analysis are used to analyze the demographic differences. The relationship among the variables is tested by Process, and the significance of the mediating effect is tested.

**Results:** It was found that caregivers of special children had high post-traumatic growth ( $M = 62.85$ ,  $SD = 15.96$ ). The total mean score of their social support is 37.89 ( $SD = 7.76$ ) with subjective support (Mean = 22.31,  $SD = 5.12$ ), objective support (Mean = 8.56,  $SD = 2.87$ ), and utilization of social support (Mean = 7.01,  $SD = 1.83$ ). Mothers were found to have high level of quiet ego than fathers ( $P < 0.05$ ). A significant positive correlation was found between quiet ego and post-traumatic growth of caregivers of special children ( $r = 0.266$ ,  $P < 0.01$ ), positive coping style and post-traumatic growth and its subscales ( $r = 0.64$ ,  $P < 0.01$ ), social support and post-traumatic growth ( $r = 0.328$ ,  $P < 0.01$ ), quiet ego and positive coping style ( $r = 0.191$ ,  $P < 0.01$ ), positive coping style and social support ( $r = 0.437$ ,  $P < 0.01$ ). Quiet ego can not only directly predict post-traumatic growth but also predict it through the mediating role of positive coping style.

**Conclusions:** In summary, the stronger the quiet ego of caregivers of special children, the higher the ability to respond positively and the more obvious post-traumatic growth. The increase of their quiet ego and positive response level will be helpful in improving the level of post-traumatic development of caregivers of special children.

**524.032** (Virtual Poster) Neurotypical Adult Siblings' Perceptions of Pressure: Examining Birth Order and Affect Toward the Sibling Relationship

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## Background:

Neurotypical (NT) individuals who grow up with an autistic sibling face high rates of stress and negative sibling attitudes (Tomeny et al., 2017). Birth order, whether the NT individual is younger or older than their autistic sibling, may influence one's experience. Among children, NT siblings who were younger than their autistic sibling showed more behavior problems when the autistic child was older than them and had behavior problems themselves (Tomeny et al., 2014). These childhood difficulties may continue into adulthood, which could worsen mental health and sibling relationship quality.

## Objectives:

This study examined birth order differences in questionnaire-report of mental health, and frequency of affective words used during a semi-structured interview.

## Methods:

Participants were 24 NT adults ( $M_{age}=24.13$  years; 79.2% women) with at least one autistic sibling. Participants completed the Depression, Anxiety, and Stress Scale (DASS; Lovibond & Lovibond, 1995) and a 1-hour semi-structured interview wherein the researcher asked open-ended questions centered on pressures/responsibilities concerning the autistic sibling. The interview transcripts were run through Linguistic Inquiry and Word Count (LIWC; Pennebaker et al., 2015), which counts the percentage of words that reflect categories of affect/thinking styles. Participants were then grouped for analysis:  $n=7$  (29%) younger than their autistic sibling,  $n=10$  (42%) between 1-6 years older than their autistic sibling, and  $n=7$  (29%) 7 or more years older than their autistic sibling.

## Results:

Standard regression models were run on the DASS questionnaire to examine birth order differences (younger, older, and much older) in depression, anxiety, and stress. When controlling for participant sex at the first level, birth order accounted for a significant F-change in DASS anxiety ( $p=.048$ ) and stress ( $p=.037$ ). For both anxiety and stress ratings, the much older group had lower ratings than the older and younger groups (Table 1). There was no significance in birth order difference for depression ratings ( $p=.112$ ).

Standard regression models were run on the LIWC anxiety, affect, positive emotion, and negative emotion categories to examine birth order differences in the percentage of words used. When controlling for participant sex at the first level, birth order accounted for a significant F-change in the percentage of words that focused on anxiety ( $p=.039$ ), affect ( $p=.009$ ), and negative emotion ( $p=.019$ ); the much older group had lower percentage of words than the older and younger groups (Table 2). There was no significant difference in positive emotion ( $p=.362$ ).

## Conclusions:

Being much older than an autistic sibling may protect against the pressures one may face as a NT sibling. Possibly, the resourcefulness that comes from having a larger upper-age-gap with one's autistic sibling allows for better coping skills. Individuals who are either younger or less than 6 years older than their autistic sibling may be at greater risk to experience anxiety, stress, and negative attitudes toward their sibling. Future work is needed to further elucidate the resilience factors held by much older siblings, as such skills could potentially be taught to individuals closer in age to their autistic sibling to better support mental health and sibling relationship outcomes in adulthood.

**524.033** (Virtual Poster) Speech Language Pathologists' Perspective on Speech Language Communication Therapy Practices for Autism Spectrum Disorder Population: An Online Indian Survey

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## Background:

Autism Spectrum Disorder (ASD) is a growing population in the world as well as in India, estimated prevalence of autism in rural part of India is 0.11 (1-18 years) and urban part of India is 0.09 (0-15 years) (Chauhan et al., 2019). Intervention of ASD is always been a challenging task for professionals, because of its heterogeneous nature (Motttron & Bzdok, 2020). ASD children exhibits varied difficulties in terms of social interaction, communication, restricted interests, repetitive or stereotypic behaviors and sensory issues, based on the degree of severity (Waizbard-Bartov., et al 2021). Despite the fact that researchers have investigated a variety of strategies to improve speech, language, and social communication skills in children with ASD, the heterogeneous nature of autism makes it difficult to generalize one type of intervention to all autism children because it may not yield similar results. As a result, it is critical to understand the trend of speech language therapy practices followed by speech language pathologists (SLPs) in the intervention of autism. This information is likely to aid SLPs in developing a thorough intervention strategy that will have an appreciable impact on children with ASD.

## Objectives:

The objective of the study is to understand SLPs perspective on speech language communication therapy practices in India for ASD children.

## Methods:

The questionnaire's contents were validated by five SLPs with at least five years of experience working with ASD population. It was prepared in Google form and was circulated online to 150-200 practicing SLPs across India. The questions ranged from which is the best suited intervention approach, how many intervention approaches are they aware of, how intense an intervention approach should be, who should be part of an active team of professionals for intervening children with autism. The responses were obtained in Yes/No, closed set and open set format. The Yes/No and closed set responses were analyzed quantitatively by taking the mean of the responses and open set responses were analyzed qualitatively.

## Results:

Applied behavior analysis a behavioral intervention (80%), and functional communication training a naturalistic intervention strategy (68.2%) were chosen by Indian speech language pathologists as the best suited interventions for children with ASD. Literacy abilities were taught with little effort, according to 59.1% of SLPs, while social communication was the most challenging skill to master in children with ASD. PECS (85%), applied behavior analysis (80%), functional communication training (68.2%), social stories (43%), AVAZ (15%), video modeling (2%) were the interventions preferred to teach social communication skills in ASD populations. 60% of SLPs uses COMDEALL an Indian structured program for children with ASD.

## Conclusions:

Indian SLPs believed that a team of specialists (SLPs, occupational therapists, psychologists and special educators), rigorous and structured intervention in terms of time, frequency, home training, and counseling to parents or caregivers are necessary requirements for having a positive impact on overall improvement in children with ASD. Also observed, few SLPs were apprehensive in using new intervention strategies, as they were unaware regarding its implementation.

**524.034** (Virtual Poster) Speech Language Pathologists' and Psychologists' Perspective on Assessment of Autism Spectrum Disorder: An e-Survey  
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**Background:** Speech Language Pathologists (SLPs) and psychologists play a key role in the evaluation of communication and behavioral aspects of children with autism spectrum disorder (ASD). The assessment practice adopted by these professionals has considerable influence on the evaluation and intervention procedures that follow.

**Objectives:** The aim of the e-survey was to understand the different views of SLPs and psychologists in India regarding assessment and diagnosis of ASD.

**Methods:** Participants included SLPs and psychologists working with ASD clients in India. The e-survey comprised of questions on the background information of respondents, their views, and opinions on the best age for screening, assessing, and diagnosing ASD, developmental screening, early identification before two years of age, issues related to ASD differential diagnosis and prospect of a universal screening protocol for ASD in Indian scenario. Google form with the set of questions was shared.

**Results:** Though the majority of SLPs and psychologists agreed with the possibility of identifying children with a risk for developing ASD during infancy and early toddlerhood, they still preferred to make a provisional diagnosis after 2 to 3 years. This points to the fact that early identification of ASD using infant screening tools is less common than presumed in the Indian scenario. Half of the participants preferred to do a differential diagnosis of ASD from attention deficit hyperactivity disorder (ADHD) only at 3 to 4 years of age but quite a few consider making a differential diagnosis even at the age of 2 to 3 years owing to the specific and distinct features of ASD. The possibility of using parental surveillance, developmental monitoring, and behavioral analysis for early identification of ASD was supported by most of the participants. The potentiality of a Universal Screening Protocol for early identification of ASD in India was also agreed upon.

**Conclusions:** The results help to relate how diverse the Indian SLPs' and psychologists' perspective on ASD assessment and diagnosis is, from the international practicing community. The study also signifies the need to develop culturally adapted, affordable, and easy to use ASD assessment tools. Such a tool would be more popular among the professionals, could be included in universal screening programs and thereby encourage early and effective identification of ASD in low- and middle-income countries (LMIC) such as India.

**524.035** (Virtual Poster) Preparing for the Next Disaster: Lessons Learned from the Early Experiences of Autistic Adults during the COVID-19 Pandemic

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**Background:** Disasters, such as the worldwide COVID-19 pandemic, create significant disruptions for individuals and their communities. Understanding these disruptions is a first step towards planning for future events and disaster recovery. This research aims to explore how the initial COVID-19 restrictions, including lockdowns, impacted adults with Autism (ASD).



**Objectives:** To understand how community participation was disrupted from the perspectives of the individual themselves and to identify areas that could be improved with a more rapid response when a future disaster occurs, we asked the following question: 1) What Knowledge do you have about the COVID-19 pandemic?, 2) How are you getting your information about COVID-19?, and 3) How has the pandemic in real-time affected your community participation?.

**Methods:** Using semi-structured interviews to understand individuals with ASD experienced the early months of the COVID-19 pandemic. **Participants:** Twelve participants were interviewed: six individuals with ASD (ages 20-38), three parents of individuals with ASD, and three support staff for individuals with ASD. **Analysis:** Using grounded theory methods to analyze the impacts of COVID-19 based on the knowledge, challenges, activities, resources, and support needs of individuals with ASD.

**Results:** Interviews were coded. The questions generated three themes with eleven subthemes 1) COVID Knowledge: Understanding COVID, Preventative behaviors, Information resources; 2) Pre-COVID activities: social, work/day-program/school, environment, physical activities, and 3) During COVID activities: social, work/day-program/school, environment, and physical activities.

**Conclusions:** Individuals with ASD's understanding of COVID-19 is similar to the general public and display adequate, timely knowledge. They adopted new behaviors, including transitioning from structured physical schedules to less structured virtual schedules. Caregivers and support staff expressed concerns about preventative behaviors in the community.

#### **524.036 (Virtual Poster) The Effect of Siblings on Empathy in Autistic People**

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##### **Background:**

Growing up with siblings builds opportunities for social-cognitive growth for autistic children, such as shared imaginative play, handling conflicts, and practising reciprocal interaction, all associated with enhanced Theory of Mind development. Siblings may thus function as a valuable social resource and positively affect the social functioning of their autistic brothers or sisters (Ben-Ytzhak et al., 2016; Rum et al., 2020).

##### **Objectives:**

We aimed to investigate the effect of having siblings on empathic abilities in autistic children, adolescents and adults. We hypothesized that autistic people with siblings would score higher on empathy measures compared to those with no siblings.

##### **Methods:**

The Cambridge Autism Research Database (CARD) was used to retrieve previously collected data for secondary analyses. Cohorts of autistic children and adolescents ( $n=1,392$ ; 18.5% females; 3-15 years old, mean age=8.5 ( $sd=1.99$ ); 22% had no siblings); and adults ( $n=727$ ; 52% females; 18-81 years old, mean age=37,  $sd=12.42$ ; 15.3% had no siblings) were each divided into two groups: with siblings (Sibs group) and without siblings (No-sibs group). For children and adolescents, empathy was measured using the parent-reported version of the Empathy Quotient (EQ-Child and Adol). For adults, empathy was measured using the self-report version of EQ, and the Reading the Mind in the Eyes Test (RMET). For each cohort, the Sibs and the No-sibs groups were compared on each measure, with reference to sex and the interaction between group and sex.

##### **Results:**

Autistic children with no siblings scored significantly higher on the EQ than autistic children with siblings ( $t_{(350)} = 4.558, p < 0.001$ , Cohen's  $d = 0.344$ ). A 2-way ANOVA (group $\times$ sex), indicated main effects of group ( $f_{(1, 1096)} = 23.751, p < 0.001$ ) and sex ( $f_{(1, 1096)} = 7.265, p < 0.001$ ) but no interaction effect (see Figure 1). For adults, no differences were found between the Sibs and No-sibs groups on either EQ or RMET. Two-way ANOVAs revealed significant main effects for sex on the EQ ( $f_{(1, 723)} = 4.299, p < 0.05$ ) and on the RMET ( $f_{(1, 723)} = 5.687, p < 0.05$ ) (females performed better than males overall). On the RMET a significant interaction between sex and group was also found ( $f_{(1, 723)} = 3.81, p = 0.05$ ) (see Figure 2).

##### **Conclusions:**

Contrary to our hypothesis, autistic children who grow up as only children in their families were reported by their parents to be more empathic in comparison to autistic children who grew up with siblings. However, autistic adults with or without siblings did not differ in their self-reported empathy or on a performance measure of cognitive empathy, and adult males who grew up with siblings scored higher than males who grew up as only children on the cognitive empathy measure. These results indicate a positive effect of growing up with a sibling on social-cognitive functioning of autistic male adults. Autistic children's empathic abilities may be underestimated by their parents when they have siblings to whom they are compared, perhaps due to a contrast effect.

#### **524.037 (Virtual Poster) The Experience of Camouflaging in Autistic Women**

**Background:** Despite decades of research suggesting that autism is rare in women and that autistic individuals have limited theory of mind, the past decade has seen an explosion of research on camouflaging in autistic women<sup>1</sup>. Literature suggests that autistic women often camouflage their obvious autistic traits (i.e., stimming) to achieve personal goals such as more school success or employability improvements<sup>2</sup>. Although camouflaging can be beneficial in many ways, the lack of acceptance for autistic identity may promote a sense of urgency to camouflage, often resulting in experiences of exhaustion, poor mental health and increased risk of suicide<sup>3,4</sup>.

With COVID-19 impacting millions worldwide, for some, the environmental expectations for socializing with others have changed exponentially. Many neurotypical and neuro-divergent individuals camouflage regularly; however, it is challenging when environmental expectations change. Therefore, we hypothesized that changing public-health restrictions could negatively impact camouflaging routines, resulting in higher cognitive loads necessary to camouflage successfully. Additionally, we hypothesized that reducing in-person socializing could lessen the intensity and duration of camouflaging techniques, benefitting the well-being of individuals who camouflage regularly.

**Objectives:** Due to camouflaging being seldom explored in the context of COVID-19, this qualitative research study examined the camouflaging experiences of autistic women during COVID-19.

**Methods:** The study was conducted with the collaboration of an Autistic Advisory Committee (AAC). The AAC consisted of three autistic women who co-developed the study materials, objectives, and dissemination projects for the current study. The study invited four autistic women aged 18-35 to complete three journal entries of their camouflaging experiences and a semi-structured interview. We used interpretative phenomenological analysis, a qualitative research method that highlights the lived experience of the participants, to address our research objective. Specifically, participants were asked: (i) how their camouflaging experiences have changed throughout the pandemic; (ii) how the impacts of camouflaging have changed since the pandemic; and (iii) their thoughts of returning to post-pandemic social interactions.

**Results:** Thematic analysis resulted in three themes extracted from the data:

- **Reduced camouflaging:** camouflaging is consistently used in social environments where autistic individuals are encouraged to meet neurotypically social expectations. However, with an environmental shift that resulted in wearing a mask, spending more time at home, and increased social interaction done behind a screen or over the phone, the utilization of specific camouflaging strategies, such as mimicking facial expressions or body language, was significantly reduced.
- **Access to supports and services:** Before COVID-19, the accessibility of supports and services was less than ideal for the participants. Participants suggested that accessing services was still not easy but more accessible within the pandemic because social interactions focused on social distancing rather than presumed social deficits.
- **Re-learning how to camouflage:** Concerns about re-learning how to camouflage and what processes would support the successful integration of additional cognitive load post-pandemic are discussed.

**Conclusions:** The COVID-19 pandemic has brought attention to how experiences of camouflaging change when social expectations change. By hearing the participants' experiences, continued movement towards neurodiversity views within society can reduce camouflaging and alleviate concerns about re-learning how to camouflage autistic traits.

#### 524.038 (Virtual Poster) The Impact of COVID-19 on Older Autistic Adults: A Mixed-Methods Analysis

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**Background:** Autism most often persists throughout the lifespan, but little is known about the outcomes among autistic adults (Hategan, Bourgeois, & Goldberg, 2017). Increasing calls to action from the research community and advocacy bodies to focus on adults on the spectrum as they age have been amplified by the COVID-19 pandemic (Baghdadli *et al.*, 2020; Hotez *et al.*, 2021). Because individuals on the spectrum are more vulnerable to severe complications from COVID 19 (Schott, Tao, & Shea, 2021), understanding how older autistic adults are managing during the COVID-19 pandemic is critical to informing service access and delivery design to ensure older autistic adults are kept safe while also considering the whole of quality of life including socialization, community engagement, employment, and health.

**Objectives:** There has also been minimal research that has directly engaged older adults on the spectrum and their family members. The research will describe how the COVID-19 pandemic has impacted multiple life domains of older autistic adults including community engagement, employment, relationships and socialization, and health.

**Methods:** Autistic adults over 40 years old and their family members who had previously participated in the 2018 Pennsylvania Autism Needs Assessment (PANA) and consented to future contact were recruited for this study. The 2018 PANA is a large survey of autistic individuals and their family members in Pennsylvania. This study included analysis of semi-structured interviews and interviewee's survey data from the 2018 PANA. Interviews were recorded, transcribed, and uploaded into NVivo12 along with the data from the quantitative aim for analysis within the concurrent nested design. The interview data is being coded using the inductive framework without predetermining themes. Thematic analysis was designated as the coding methodology method for this study as it permits the study team to categorize the themes and subthemes that emerged from the interviews.

The quantitative data (i.e., demographic and survey data) was used as attribute data to classify each of the transcripts. This technique allows the researcher to see, demographically, which themes were more common. This aids in the transferability of the findings and enhances qualitative method as the priority and quantitative method as the supplemental information (Terrell, 2012; Watkins, 2012).

**Results:** Twenty-eight interviews were completed with autistic adults and their parents, siblings, partners, or other family members in Spring of 2020 during the COVID-19 pandemic. Data analysis for this study is ongoing, however preliminary themes have included feelings of disrupted routines, decreased community engagement, minimized social opportunities, isolation, and negative health outcomes.

**Conclusions:** Findings from this study will be impactful for the field of research on autism and aging, specifically within the context of the COVID-19 pandemic. This study provides the opportunity for older autistic adults and their family members to have their voices, perspectives, and opinions be at the forefront an exploration of this understudied area and will provide valuable insight in both the domains of research as well as policy and practice including proactive planning for needed services and supports to protect older autistic adults during the COVID-19 pandemic and beyond.

**524.039 (Virtual Poster)** The Impact of COVID-19 on the Employment and Mental Health of Adults on the Autism Spectrum and/or with Intellectual Disabilities

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**Background:** Under usual economic conditions, individuals on the autism spectrum and/or with intellectual disabilities (ID) struggle to obtain and maintain employment (Berrigan et al., 2020) and are at greater risk of developing mental health conditions that negatively impact quality of life (Croen et al., 2015; Hughes-McCormack et al., 2017). The economic, social and psychological challenges evoked by the COVID-19 pandemic may therefore exacerbate unemployment rates and mental health issues among these individuals. Most emerging research on the negative impact of COVID-19 on the employment and well-being of adults on the autism spectrum or with ID focuses on early stages of the pandemic, uses quantitative methodology, and studies many domains (e.g., school, social life, work) together. Here, we investigate how COVID-19 has impacted the employment and mental health of adults on the autism spectrum and/or with ID, and identify supports that were beneficial for this population during the pandemic.

**Objectives:** We are using a multiple case study design (n = 9) to follow participants on the autism spectrum and/or with ID over time, using data collected before (2018-2019) and during the pandemic (2021), to examine how COVID-19 has impacted their mental health, employment experience, job satisfaction, and satisfaction of employment supports, and to identify the type of supports that were available and deemed helpful to them during the pandemic.

**Methods:** Participants were employees on the autism spectrum and/or with ID receiving employment support services from a community organization in Montreal, Canada. In Phase 1 (2018-2019), employees completed two questionnaires rating their (1) job satisfaction and (2) satisfaction of employment support services received on a Likert scale. In the current Phase 2 participants will be invited to complete both questionnaires again, and participate in a semi-structured interview regarding employment experiences and mental health during the pandemic.

**Results:** Prior to COVID-19, employees assigned job satisfaction ratings of 3.89 or higher on a 5-point scale (with 1 indicating strongly disagree and 5 indicating strongly agree) for the ten positive items (e.g., my job is enjoyable), and ratings of 3 and lower for the four negative items (e.g., my job is frustrating). All employees indicated that they would recommend employment support services to other individuals with disabilities seeking employment, with 89% indicating that they were either satisfied or very satisfied on every item rated for satisfaction.

To analyze change in satisfaction, questionnaire responses obtained in Phase 2 will be compared to those obtained in Phase 1. To examine in greater depth the impact of the pandemic, semi-structured interviews will be recorded, transcribed, and analyzed through qualitative analysis to identify themes.

**Conclusions:** Data prior to COVID-19 shows high satisfaction among employees. Data collected in this study will allow us to analyze change in participant satisfaction and will shed light on the experiences of these individuals. The knowledge gained will inform the supports and services required to promote job success and well-being throughout and beyond COVID-19.

**524.040 (Virtual Poster)** The Relationship between Pivotal Response Treatment for Children with Autism Spectrum Disorder and Parental Stress  
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**Background:** Parents of children with autism spectrum disorder (ASD) present with particularly high levels of stress when compared with parents of typically developing children and parents of children with other developmental disabilities (Dumas, Wolf, Fisman & Culligan, 1991; Sanders & Morgan, 1997; Taylor & Warren, 2012). There is evidence to support the idea that effective behavioral therapies for children with autism can help to alleviate this stress (Rollins, John, Jones, & Froy, 2019). Pivotal Response Treatment (PRT) is an empirically supported and naturalistic behavioral treatment focused on improving children's social communication skills (Koegel & Koegel, 2006).

**Objectives:** This project had two objectives. First, we examined the relationship between parenting stress and externalizing behaviors in their children with ASD. Secondly, with a subset of these parents, we examined the change in parental stress following the completion of a trial using pivotal response treatment.

**Methods:** Seventy-eight parents completed a measure of parenting stress (Parenting Stress Index, PSI-4) as well as a questionnaire to assess behavioral and emotional problems in their child (Child Behavior Checklist 1.5-5 and 6-18, CBCL 1.5-5 and 6-18). A subset of these parents (and their child) ( $n = 34$ ) participated in an intervention study using PRT. The trial included 7 hours of weekly individual work with the child and parent training over 16 weeks. Parental stress and child behavior symptoms were assessed in this group at both baseline and at the end of treatment.

**Results:** Scores for parenting stress on the PSI-4 and externalizing behaviors on the CBCL were positively correlated at baseline ( $r(76) = .360, p = .002$ ). Higher externalizing symptoms were related to higher levels of stress. For the group that received PRT, there was a significant decrease in parenting stress as measured on the PSI-4 following the completion of the PRT trial (Baseline Total Stress Score,  $M = 91.15$ ) (End of Treatment Total Stress Score,  $M = 83.12$ ).

**Conclusions:** There is a significant positive relationship between child externalizing behaviors and parental stress. This is consistent with prior work, yet is an important finding, as it speaks to the need to treat social communication deficits in children, while simultaneously supporting families. Pivotal response treatment may help to achieve these goals. In this study, there was a significant decrease in parenting stress following their participation in the PRT trial. Parents who participate in PRT may feel empowered and better equipped to manage their child's maladaptive behavior, which could lead to reduced parental stress. This conclusion reinforces the importance of including parent training components in children's treatment plans.

**524.041 (Virtual Poster)** Transitioning Together: Evaluation of a Multi-Family Group Psychoeducation Program for Parents and Youth with Autism  
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**Background:** The transition to adulthood is a time when young people experience many changes across various life domains; transition-aged youth (TAY) without disabilities experience adjustments in schooling, relationships, and independence (Arnett, 2001). For TAY with autism spectrum disorder (ASD), these transitions are markedly difficult; they are intensified by challenges associated with their diagnosis (e.g., social difficulties resulting in isolation; skill losses after secondary school). Furthermore, the family is affected. Research has indicated that parents of youth with ASD experience significantly greater stress than parents of children without ASD (Smith et al., 2010), which has been shown to impact parents' well-being (Smith et al., 2012). Current research indicates that family support for TAY with ASD is critical. One empirically supported program, *Transitioning Together* (TT), is a manualized 8-week group psychoeducational program for youth with ASD and their families. The program's goal is to prepare TAY with ASD and their families for the transition to adulthood by exploring topics such as employment, self-advocacy, and relationships. Following promising results for parents and youth from their pilot study (Smith et al., 2012), researchers examined the effectiveness of the TT curriculum to improve key parent, youth with ASD, and relationship outcomes (DaWalt et al., 2018). DaWalt et al.'s (2018) effectiveness trial data indicated a significant decrease in parental depression and increases in their problem-solving and feelings of pride toward their child. While the intervention did not reduce ASD symptoms, youth were reported to experience increased social interactions (DaWalt et al., 2018).

**Objectives:** Given the promising results of the TT program to date, the purpose of the current study was to examine the effectiveness of TT at improving the parent, youth, and parent-child relational outcomes among families living in York Region, Toronto, Ontario.

**Methods:** The current study was a pre-post with a 1-month follow-up design delivered across four partnering community agencies involving 17 program facilitators. Among 38 eligible families, 29 parent-youth dyads enrolled, and 26 families completed the study. At study entry, the majority of our parent sample included mothers (88.5%;  $n = 23$ ). The majority of TAY were male (84.6%;  $n = 22$ ); with a mean age of 15.9 years (14-17;  $SD = 0.78$ ), with an average Social Communication Questionnaire (Rutter et al., 2003) score of 19.8 ( $SD = 7.0$ ). Parents and youth completed various outcome measures at baseline, post-intervention, and at the 1-month follow-up (e.g., family empowerment, life stress, depressive symptoms, well-being, social functioning, autistic symptoms, parent-child relationship).

**Results:** All data have been collected and are in the process of being prepared for analysis. A repeated measures ANOVA will be used to examine changes in parent-reported (e.g., family empowerment, parent well-being, perceived stress, depressive symptoms, resilience coping, parent-child relationship) and TAY-reported variables (e.g., youth empowerment, youth well-being, social functioning) over time.

**Conclusions:** Our findings will add to the relatively limited knowledge of empirically-based programs to support families with autistic youth transitioning to adulthood. Study implications on services for families and autistic youth transitioning to adulthood will be discussed.

**524.042 (Virtual Poster)** Underage Alcohol Use and Non-Use Among Autistic Youth  
**L. Graham Holmes<sup>1</sup>, C. B. Hologue<sup>2</sup> and E. F. Rothman<sup>3</sup>, (1)Hunter College, City University of New York, New York City, NY, (2)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (3)Community Health Sciences, Boston University, Sargent College, Boston, MA**

**Background:**

Although historically researchers assumed few autistic people developed substance use disorders (SUDs), emerging evidence suggests that autistic people without intellectual disability may be at increased risk for SUD, and alcohol use disorder (AUD) specifically, compared to non-autistic peers. Autistic youth may drink alcohol to reduce loneliness, cope with trauma, or due to co-occurring disorders. More information about why autistic youth choose to use or abstain from alcohol can inform the development of preventive interventions.

**Objectives:**

The purpose of this study was to uncover correlates of alcohol use and abstinence in a sample of U.S. autistic youth versus non-autistic youth.

#### Methods:

186 individuals participated in an online survey. Eligibility criteria were (1) 16-20 years old; (2) English-speakers; (3) diagnosed with autism by a professional or not autistic; and (4) could complete a survey without help. Half of each group (autistic, non-autistic) had  $\geq 1$  drink in the past year. Participants completed a 10-minute phone eligibility screen before completing the survey. Completers received a \$40 gift card. Table 1 includes demographics by group.

#### Results:

One fifth of underage autistic youth reported drinking in the past month ( $n=21$ ). Of these, 29% had  $>2$  drinks in a sitting. Of those who drank in the past year ( $n=47$ ), 28% reported having six+ drinks on one or more occasions (similar to non-autistic drinkers,  $p=.08$ ). In general, autistic drinkers drank less frequently than non-autistic drinkers: they were more likely to drink monthly or less frequently ( $p=.02$ ), and more likely to say that they drank only 1-2 drinks when they did drink ( $p=.01$ ).

Despite this, half of autistic drinkers had experienced a negative consequence such as hangover, vomiting, blackout, or passing out due to drinking and four (9%) felt they needed to cut down on their drinking. While autistic drinkers were less likely than non-autistic drinkers to say that they did something they regretted while drinking ( $p=.002$ ), they were as likely as non-autistic drinkers to say that they had unprotected sex while drinking (autistic 14% vs. non-autistic 8%,  $p=.37$ ). Furthermore, autistic drinkers were four times as likely to say that they seriously considered suicide while drinking (autistic 9%, non-autistic 2%).

Reasons for drinking differed by autism status. Compared to non-autistic drinkers, autistic drinkers were less likely to say that they drank for social reasons ( $p<.01$ ), to conform ( $p=.04$ ), or to enhance their experience ( $p=.04$ ). However, 64% of autistic drinkers reported feeling more socially at ease when drinking. Autistic drinkers were just as likely as non-autistic drinkers to say that they drank to cope with emotional stressors and most (66%) reported feeling more relaxed when drinking. Compared to non-autistic participants, autistic drinkers and non-drinkers were less likely to report that they abstain from drinking because they thought it would interfere in their life or cause weight gain ( $p=.04$ ), and autistic non-drinkers were less likely to report abstaining due to legal concerns ( $p=.02$ ).

#### Conclusions:

Youth alcohol prevention programs need to be inclusive of autistic youth. Prevention programs designed to address the specific drinking profiles of autistic youth are needed.

#### **524.043 (Virtual Poster)** What Is a “Good Mother of a Children with Autism”? a Comparison between the US and Japan

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#### Background:

Different cultures have expectations about mothering. Mothers of children with ASD may have different ideas about mothering their children compared to mothers of typically developing children. In addition, the construction of these ideas may be influenced by the sociocultural context of the family. Few studies have examined motherhood from the perspectives of mothers of children with ASD across cultures.

#### Objectives:

The goal of this research is (1) to compare the characteristics of “a good mother in general” (GMG) and “a good mother of a child with ASD” (GMA) according to mothers raising children with ASD, (2) to examine how mothers of children with ASD evaluate themselves as mothers, and (3) to compare the findings from these two questions between mothers of children with ASD in the US and Japan.

#### Methods:

One hundred four mothers of children ages 2 to 12 diagnosed with ASD participated in the study (US:  $n = 53$ , Japan:  $n = 51$ ). Using a semi-structured interview, we asked the mothers to describe characteristics of GMG (Q1) and GMA (Q2), and evaluate themselves as a mother of a child with ASD (Q3). We conducted a thematic analysis using MAXQDA and identified main themes. Theme frequencies GMG and GMA were compared using either Pearson’s Chi-Square Test or Fisher’s Exact Test. Finally, the frequencies of themes related to GMG and GMA between the countries were compared using either Pearson’s Chi-Square Test or Fisher’s Exact Test.

#### Results:

Fourteen main themes emerged regarding traits of a good mother (GMA, GMA) (Table 1). In the US sample, “Advocates” “Knows child well” “Seeks help” were mentioned significantly more for GMA than for GMG, while “Nurtures child” was mentioned more for GMG than for GMA. There were no statistically significant differences between themes for GMG and GMA in the Japanese sample. Comparing the frequencies of themes for GMG between the US and Japan, “Balances needs” “Guides” “Nurtures” “Is selfless” were mentioned significantly more in the US sample while “Cheerful” was mentioned significantly more in the Japanese sample. Comparing the frequencies of themes for GMA between the US and Japan, “Advocates” “Balances needs” “Guides” “Does her best” “Seeks help” “Is patient” were mentioned significantly more in the US sample. Eight themes emerged on mothers’ self-evaluation (Table 2). US mothers had higher frequencies for “I am a good mother” while Japanese mothers had higher frequencies for “It varies.” There were no significant differences between Japan and the US in negative evaluations, such as “I could have done more”, “I have failed as a parent.”

#### Conclusions:

These findings suggest that US mothers of children with ASD have distinct ideas about good mothers of children with ASD compared with their counterparts in Japan. In addition, US mothers had more positive self-evaluations. These differences may be associated with greater resources intended to support mothers of children with ASD in the US as well as with differences in values. Lower frequency of positive self-evaluation in Japan may be associated with low maternal self-efficacy and cultural norms that value modesty.

#### **524.044** (Virtual Poster) A Phenomenological Approach to Understanding the Experience of Telehealth Assessments

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**Background:** Given health guidelines onset by the global COVID-19 pandemic, many providers have considered telehealth assessments to provide diagnostic services. Across various healthcare fields, it has been theorized that telehealth may be a viable alternative to in-person appointments and make services more accessible. While availability of telehealth appears to expand access in certain contexts, less is known about the family experience navigating telehealth for assessment of children with complex needs, including ASD. As such, there is a need to evaluate the acceptability of telehealth for families seeking ASD assessment.

**Objectives:** The goal of this study focuses on a central thematic question: How do families experience telehealth assessments for ASD? To answer this overarching research question, the following questions were explored:

1. How does the use of telehealth procedures impact the assessment process?
2. What barriers impact access to telehealth assessment?

**Methods:** Participants: The current study is part of a larger study assessing the validity of telehealth and adapted in-person ASD assessments. Families were eligible if their child received an ASD diagnosis following a standard diagnostic evaluation between January-March 2020. Procedure: Participants completed a 15-item survey that explored the impact of the COVID-19 pandemic. Included were 5 qualitative about their families experience with telehealth assessment. Analysis: Data were read and coded using Interpretative Phenomenological Analysis (IPA; Smith, 1996; Smith & Osborn, 2004).

**Results:** Of 25 families who completed the larger study, n=10 completed the follow-up survey. After coding and analyzing the data, the following themes emerged as salient to participants: (1) Access, (2) Comfort, (3) Involvement, and (4) Validity.

**Access:** Participants discussed the impact of telehealth on their access to assessment and therapeutic services. Many shared examples of how telehealth reduced barriers to service such as travel, availability, and childcare, whereas others cited new barriers such as connectivity issues.

**Comfort:** Many participants expressed sentiments of comfort when discussing their experience. Given the COVID-19 pandemic, many mentioned increased feelings of safety, using telehealth services and others discussed the benefits of their child(ren) feeling comfortable in their home.

**Involvement:** Participants felt more involved in the assessment process using telehealth procedures.

**Validity:** Participants shared experiences that may impact the validity of telehealth assessments. Concerns were raised about assessment materials, focus of the children, and different behavior at home than in-clinic. Conversely, participants also mentioned that telehealth assessment allowed clinicians to see more of their child’s authentic behavior and others shared minimal concerns regarding validity because the clinician still had a presence.

**Conclusions:** This study provides initial insights into caregivers’ experience of accessing ASD diagnostic services through telehealth. While telehealth procedures may increase accessibility by making scheduling more convenient and allowing families/patients to feel more comfortable and involved in the process, more work is needed to identify and reduce additional barriers and concerns about providing access to high quality, personalized care.

**524.045 (Virtual Poster) Autism Voices: Perspectives of the Needs, Challenges, and Hopes for the Future of Autistic Youth**

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**Background:** Our understanding of the adolescent period for autistic youth has rarely relied on the first-person experiences of autistic youth. Moreover, the limited number of studies attempting to capture the experiences of autistic youth have favored a subset of the spectrum and tend to exclude minimally verbal and intellectually disabled youth. The active involvement of autistic youth in decision making is not only related to facilitating optimal transition outcomes from adolescents to adulthood, but can also be used to empower community belonging and optimize research and health policies. To broaden the inclusion of diverse autistic adolescents in qualitative research the Autism Voices protocol — a novel method suited to all language and intellectual levels — was developed in collaboration with researchers and community members.

**Objectives:** To obtain the first-person experiences of autistic adolescents with a range of cognitive and verbal abilities using the Autism Voices protocol (Courchesne et al., 2021).

**Methods:** Thirty-two autistic youths aged 11 to 18 years old (M=15.41, SD= 2.26; 81% males) were interviewed using the Autism Voices protocol. Dynamics between youth and their environments at home, school and the community were explored. Youth were questioned about their interests, plans for the future, experiences with emotions, and experience of autism. Questions were asked following universal design principles to allow participation of youth of all language and intellectual ability levels. Participants could then respond using various responses modalities suited to their abilities (writing, verbal answer, pointing to picture cards, etc.).

**Results:** Six themes emerged from the results of a thematic analysis applied on interview transcripts containing both verbal and non-verbal content: 1) autism identity, 2) thinking about the future, 3) seeking social connection on their own terms, 4) seeking autonomy, 5) school as both a stressor and social facilitator, and 6) experiences of stress and anxiety. Of the topics discussed youth identified school and the future as their primary concerns. Many described the school environment as unwelcoming, a detriment to their well-being, and a barrier to future aspirations. Despite being a stressful environment, most youth highlighted that school was enjoyable because they could meet and spend time with their peers. Similarly, while it was a stressor, most participants had considered what they wanted or did not want in their future. We identified three common pathways that guided youths' decisions about their future: practicality, familiarity and interests. Overall, youth had nuanced and complex perspectives regarding their experiences, identity and society.

**Conclusions:** This Autism Voices study highlights continuity in the challenges and aspirations of autistic adolescents and those commonly encountered by their non autistic peers (Adam & Berzonsky, 2008). Youth voiced their interests in forming social connections, their aspirations for their future, and their desire for autonomy. We discuss how these insights shared by autistic youth can facilitate active involvement in their communities, promote well-being, and optimal transition into adulthood. We further outline how the development and approaches used in the Autism Voices protocol can be tailored and applied by researchers, clinicians, and community members to partner with autistic youth

**524.046 (Virtual Poster) Reflections on Experiences in the Schools: Young Adults on the Autism Spectrum and Their Parents**

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**Background:** Although young adults (YAs) with autism spectrum disorder (ASD) have left their school days behind, many of them and their families have vivid memories and lasting concerns about experiences they had in school.

**Objectives:** To explore the past school experiences of young adults with ASD and any lasting effects.

**Methods:** Qualitative interviews were conducted with 35 parents and 12 young adults with ASD. School-focused material was segregated, then analyzed using the constant comparative method.

**Results:** Four major themes emerged. (1) **School Success and "Angels."** Success during the school years led to confidence and skills that scaffolded future achievements. Gifted teachers who "got" autism were usually involved. *The main thing was that he cared. He understood that although she was a kid who sometimes had tantrums...there was more to the picture... If she didn't turn in a paper and was supposed to go and talk to the teacher about it...he would step in...he'd help her get it to that teacher.* (2) **Dropping the Ball.** Incidents where schools had failed a student with ASD were frequently described. These ranged from playing a role in a delayed diagnosis to failing to follow an Individualized Education Program (IEP). *We always had the IEP, and it looked good on paper, but when it came to implementation, there was a gap between what they said they were going to do...and the translation of it. Or they would start off great... and then slack off. I would find out he was not getting language and speech on a regular basis.* (3) **Crises, Battles, and Exile.** Students with ASD could struggle with self-regulation or psychiatric challenges. These were sometimes misinterpreted as willfully bad behavior, followed by a non-ASD sensitive response. Crises could ensue, leading to a combative relationship between family and school. *In senior year, she was pretty much permanently suspended. This is total mismanagement on the school's part... They should have been pushing for residential treatment or another school. But they...could not afford to lose that tuition that the state is paying. So of course they are trying to do everything and they made this horrible deal where basically, we are going to give her a diploma but she is not coming back here.* (4) **Belonging vs. Isolation and Bullying.** An important theme was whether a student had felt a sense of community or isolation at school; the latter was often associated with bullying. *When he was in middle school... somebody had kicked him so hard...It left the mark of a foot. They stole his watch, flushed it down the toilet. Just anything that they could do to torment him.*

Conclusions: Children and teens with ASD spend a great deal of their time in school and receive many interventions there. It is important to understand how schools have supported or failed students with ASD, and with what long-term effects. Future research should further explore the dynamics discussed herein as well as solutions to school practices that are not serving students with ASD.

**524.047** (*Virtual Poster*) Strengths, Barriers, and Needs to Improve Acute Psychiatric Care in General Hospital-Based Crisis Settings for Autistic Persons: Findings from a Multi-Stakeholder Evaluation

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**Background:** Individuals with Autism Spectrum Disorder (ASD) are more likely to receive emergency-based care for acute psychiatric needs than the general population. Providing care in non-specialized hospital settings (e.g., emergency department, behavioral psychiatric unit) to autistic persons often results in longer hospital stays, greater healthcare costs, and staff burnout. While ASD-specialized inpatient pediatric psychiatry units are effective, few exist and are unlikely to be widely adopted by large healthcare systems. Guidelines are published for improving ASD acute psychiatric care, yet minimal research has been done to develop ASD-specific programming for hospital-based general acute-care settings..

**Objectives:** The goal of this analysis is to better understand the perceived strengths, barriers, and needs to providing high quality acute psychiatric care to autistic persons in general hospital-based settings. Utilizing qualitative interviews, we collected data from relevant stakeholders.

**Methods:** Participants from one of three types of stakeholder groups were recruited: 1) a parent of an ASD individual who previously presented to an emergency room or was admitted to a general psychiatry unit for acute psychiatric needs; 2) an autistic person who received acute psychiatric care in an emergency room or general psychiatry unit; or 3) a staff member, physician, or other allied/mental health professional working in an emergency room or general psychiatry unit providing care to an ASD person. Each participant completed a recorded 60–90-minute semi-structured Zoom interview. Participants were asked a mix of closed- and open-ended questions on perceived strengths, barriers, and needs in providing acute psychiatric care in general hospital-based settings. Targeted questions were also asked to gather information unique to each stakeholder group type. The transcribed interviews were analyzed using NVivo software. Using thematic content analysis, interview responses were examined for independent themes by each stakeholder group as well as across all stakeholder groups – first through identifying broad themes, and then subsequently differentiating subthemes.

**Results:** Thirty-two stakeholders participated: 12 parents/legal guardians, 10 ASD persons, and 10 hospital staff or providers. Key themes found across stakeholders included (1) complexity beyond usual patients seen, (2) limited knowledge of autism or appropriate interventions, (3) training and experience, (4) teamwork and communication, (5) need for more information, training, or resources, and (6) need for care coordination and system-wide changes. Stakeholder specific themes emerged highlighting the importance of ensuring that care received is uniquely matched to the needs of the patient and their family and is feasible to be embedded within face-paced and complex hospital-based patient care settings.

**Conclusions:** Outcomes suggest that the needs of autistic persons who receive non-specialized acute psychiatric care and their families, and the hospital staff or providers who render crisis care are vast but are not insurmountable. More research should be done to understand the complex structure of healthcare systems where autistic individuals receive acute psychiatric care in general crisis settings. Finally, developing and testing a focused care pathway that aligns with evidenced-based ASD-specialized care and incorporates the needs of relevant stakeholders could be a well-suited model to improve acute care for autistic individuals with significant psychiatric needs.

**524.048** (*Virtual Poster*) Using the Nominal Group Technique to Investigate Experiences of Students with ASD in Online Postsecondary Education

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Background:

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social skills and communication. Disability theorists claim that this deficit model of ASD is not helpful in advocating for or supporting postsecondary students with ASD because it allows universities to label them and their behavior as problematic. Indeed, much of the burden of orientation to postsecondary education is placed on students with ASD by asking them to assimilate to neurotypical postsecondary classroom culture. Further, due to the COVID-19 pandemic, many traditional postsecondary students, including those with ASD, were abruptly forced into online education. Despite evidence suggesting college students with ASD prefer online courses, online learners—including those with ASD—often wish that universities offered additional services (e.g., academic and social clubs, access to mental health services) to better equip them for success and diminish feelings of isolation. Research specifically investigating the challenges students with ASD face in online postsecondary education is limited, however. Therefore, it is increasingly important to examine the lived experiences of postsecondary students with and without ASD in online learning environments.

Objectives:

We aimed to investigate the challenges students with and without ASD face in online postsecondary education and the resources that would be helpful in aiding their success.

Methods:



Quantitative and qualitative data from postsecondary students with ASD ( $n = 8$ ) and without ASD ( $n = 11$ ) were gathered. To examine quantitative differences between diagnostic groups on loneliness, self-determination, and other demographic variables (e.g., age, GPA), surveys were administered and analyzed using Welch's t-tests. To examine qualitative differences between diagnostic groups regarding challenges they face and resources they need in postsecondary online education, nominal group technique (NGT) interviews were implemented.

#### Results:

While participants with and without ASD did not differ significantly in age ( $p = 0.43$ ) or GPA ( $p = 0.13$ ), participants with ASD reported significantly greater loneliness ( $p < 0.05$ ) and less capacity for, opportunities to practice, and total self-determination ( $p < 0.05$ ) than participants without ASD. Emergent themes indicated that participants with ASD face challenges with distractions, engagement, communication, and understanding and desire consistent communication and more accessible resources in their online classes. Participants without ASD reported facing challenges with forming social connections, communication, and learning and desire resources such as virtual meetings and study rooms and increased professor support in their online courses.

#### Conclusions:

These findings highlight challenges that postsecondary students with and without ASD face in online education and demonstrate supports that would be helpful in their online educational experiences. Notably, this is the first consensus-building study to identify challenges and supports experienced by postsecondary students with ASD in relation to online learning. Our hope is that the findings will spur more research in this area and ultimately facilitate optimization of online postsecondary education, particularly for students with ASD.

**524.049** (Virtual Poster) View of the Work Community and Vocational Rehabilitation Services Among Adults with Autism Spectrum Disorder  
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#### Background:

Adults with autism spectrum disorder (ASD) face unique challenges in establishing and maintaining competitive employment (Hayward et al., 2019). These difficulties may be related to the symptoms of ASD (Muller et al., 2003) or employer attitudes (Rashid et al., 2017). Although estimates differ, adults with ASD are often under and unemployed at higher rates compared to the general population (Ohl et al., 2017) and other disability groups (Chen et al., 2015). Because autistic adults often struggle with employment, vocational rehabilitation (VR) services can provide useful resources for this population to find and maintain employment (Alverson & Yamamoto, 2017). However, even those who achieve employment through VR services often earn low wages and work few hours per week (Chen et al., 2015). Few qualitative studies have examined how autistic adults find a sense of belonging in their work communities, and to our knowledge, no qualitative studies have been published regarding autistic adults' view of VR services.

#### Objectives:

The current study sought to understand: 1.) the views and preferences among adults with ASD regarding their workplace communities; 2.) how this population can be best integrated into the workplace from their perspective; and 3.) how autistic adults view VR services.

#### Methods:

Qualitative data was collected by interviewing adults with ASD in the context of a larger study examining their community integration. Two semi-structured interviews were conducted in person or online. Participants were questioned about their current and past work environments and preferences, the processes through which they integrated into the work community, and their views and experiences of VR services. Interviews were audio recorded and transcribed verbatim for line-by-line coding. As part of the analysis, two independent reviewers coded the transcripts and identified themes with high agreement between coders.

#### Results:

The sample consisted of 20 participants all of whom had an IQ above 70 and ranged in age from 28 to 62 years ( $x = 42$ ); 65% ( $N = 13$ ) were male, 60% ( $N = 12$ ) were employed at the time of study participation, and most were white ( $N = 18$ ). Qualitative analysis revealed themes related to the importance of making a contribution in the workplace, a preference for engaging in interesting work, and the importance of establishing independence. Themes related to positive working relationships and self-disclosure and advocacy contributed to feeling integrated into the workplace community. In some cases, VR services were described as providing helpful support and connections to other community agencies, and other times were described as ineffective.

#### Conclusions:

Adults with ASD prefer supportive work environments where they are confident, mentally stimulated and can self-advocate. Despite potential difficulties with social interaction at work, positive coworker and employer relationships emerged as important to feeling a sense of belonging at work. Possible areas for improvement in VR service provision include increasing the speed of service provision, providing individualized

interventions and follow-along services to explore opportunities for growth in current positions. Attending to individual preferences in the workplace can allow for successful support of adults with ASD and potentially reduce the high under and unemployment rate in this population.

**524.050** (Virtual Poster) Youth Feedback on a Virtual Mind-Body Group Intervention for Teen Siblings of Children with Autism Spectrum Disorder  
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**Background:** According to the American Psychological Association, teenagers and young adults (ages 15-21) report high levels of stress, anxiety, and depression, and overall worse mental health than any other age group. Teenage siblings of children with autism spectrum disorder (ASD) often face additional challenges and are at higher risk for social and emotional difficulties than their peers. For many teen siblings, these difficulties have been exacerbated by the COVID-19 pandemic and related restrictions. There have been few interventions focused on improving the psychosocial wellbeing of these teens. We adapted an 8-session, virtually delivered resiliency intervention (the Stress Management and Resiliency Training-Relaxation Response Resiliency Program [SMART-3RP]), for teenage siblings of children with ASD and conducted a randomized waitlist-controlled pilot trial.

**Objectives:** In order to better understand the program's acceptability, we conducted a mixed methods secondary analysis of participant feedback data. The goal of this analysis was to explore participants' feedback with respect to the intervention.

**Methods:** From May – July 2020, we enrolled teens from across the United States and randomized 40 participants to either the intervention (N=20) or waitlist control group (N=20) (51% Female, 80% White, 11% Hispanic/Latino, Mage = 15 years). We analyzed quantitative and qualitative post-intervention feedback data for all participants who completed the survey following the intervention (N=35).

**Results:**

The majority of participants reported that the intervention had the right amount of sessions (86%), the right session duration (89%), and the right amount of structure (74%). Most participants also reported that they felt comfortable during the group sessions (74%), found it helpful to learn mind-body relaxation exercises (74%), and that the intervention helped with their ability to cope with life stressors (71%). Since beginning the intervention, 80% of participants reported practicing relaxation exercises on their own at least a few times a week. Themes from qualitative feedback included satisfaction with virtual delivery and its convenience, appreciation that the intervention facilitated meeting peers with similar experiences, and desire for the program to provide additional opportunities for social connections among participants.

**Conclusions:**

The adapted SMART-3RP intervention demonstrates good potential for improving self-care skills of teenage siblings of children with ASD. The content and structure of the virtual mind-body group intervention was acceptable to teen participants, and they found it helpful in managing stress. Though they were satisfied with the opportunity to meet peers with shared experiences (and its ease in a virtual context), they emphasized the desire for the intervention to facilitate more social connection amongst participants. The results of this study contribute to the existing literature on the acceptability of content, structure, and delivery of interventions for teen siblings, and could help inform the development and administration of virtual interventions in the future.

**524.051** (Virtual Poster) Resilience in the Face of the COVID-19 Pandemic Is Associated with Age, Gender, and Coping Self-Efficacy: Insights from Children with Developmental Delays and Disabilities

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**Background:** Resilience is defined as achieving better than expected outcomes in the face of adversity. Substantial research on resilience has been conducted in cases of exposure to environmental threats. Resilience is influenced by factors like age, gender, and parenting self-efficacy. Little is known about resilience among children suspected with or diagnosed with developmental delays and disabilities (DDD) including autism spectrum disorder in the face of the COVID-19 adversity. Understanding resilience among children with DDDs can offer insights for targeting groups at highest risk to help promote optimal outcomes.

**Objectives:** We aim to identify the extent to which a resilience profile during the COVID-19 pandemic is associated with child age, gender, and parenting self-efficacy among children with DDDs.

**Methods:** We used data from the Canadian sample of the *UNICEF-World Health Organization Global Report on Developmental Delays, Disorders, and Disabilities*. An online survey was designed to assess the impact of the COVID-19 pandemic on health, wellbeing, and access to services. Data were collected during June-July 2020, resulting in a convenience sample of caregivers across Canada (n=883). Caregiver-reported changes on 12 domains of functioning (rated as 'worsening,' 'no change,' or 'improving') were subjected to latent class analysis which identified a subgroup of children consistently exhibiting improvements, labeled as 'resilient', in contrast with a stable subgroup endorsing mostly 'no change,' or one

endorsing worsening across domains. Parenting self-efficacy was indexed by parents' confidence in helping their child cope during the pandemic. Multinomial logistic regression was used to test associations between the resilience profiles and candidate predictors: child age, gender, and parenting self-efficacy.

**Results:** The resilience profile was more likely to be reported in children aged 0-5 years ( $n=194$ ), relative to older children and youth ( $OR=1.75$ ,  $p=.032$ ) and was prominently reported in relation to daily living skills, repetitive behaviour, and communication. We identified an age gradient in resilience, with each decreasing year of age associated with an increased odds ( $OR=1.01$ ,  $p=.003$ ) of belonging to the resilient compared to worsening profile and an increased odds ( $OR=1.07$ ,  $p=.039$ ) of belonging to the stable compared to worsening profile.

Parenting self-efficacy was a significant predictor of the resilience profile in the whole sample. The association was stronger in children above 6 years of age ( $OR=2.15$ ,  $p<.001$  for resilient,  $OR=1.6$ ,  $p<.001$  for stable) compared to children aged 0-5 years ( $OR=1.2$   $p=.327$  for resilient,  $OR=1.3$ ,  $p=.046$  for stable). Gender was not associated with resilience in the whole sample, but in children 0-5 years, male gender was more strongly associated ( $OR=2.30$ ,  $p=.006$  for resilient,  $OR=1.22$ ,  $p=.261$  for stable) than female gender ( $OR=2.16$ ,  $p=.086$  for resilient,  $OR=1.33$ ,  $p=.357$  for stable).

**Conclusions:** Our findings indicate that younger age, male gender, and parenting self-efficacy are associated with resilience in children with DDDs in the context of the COVID-19 pandemic. Our findings signal the importance of exploring potential factors related to decreased resilience, as well as increasing awareness of at-risk groups, addressing pandemic-related sequelae for both parents and children, and 'building-back better' after the COVID-19 pandemic.

**524.052** (Virtual Poster) Locked Down - Locked in : Understanding Experiences of Families of Children with Autism Spectrum Disorders in Delhi, India

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#### Background:

The COVID-19 pandemic and associated lockdowns since March 2020 have disrupted life for all families, including families of children with Autism Spectrum Disorders (ASD). Sangath, a not-for-profit organization, is leading an ongoing randomized control trial with families of children with ASD in the National Capital Region (NCR) in India. During engagement with these families, many primary caregivers shared their feelings of being impacted by the pandemic and reported high levels of stress during this period. Within the population of caregivers, it has been noted that parents of children with autism experience even higher parenting stress (Hayes & Watson, 2013) and psychological distress (Estes et al., 2009). Hence, detailed exploration of their experiences throughout this unprecedented period has been undertaken.

#### Objectives:

To understand the experiences of families of children with ASD during the COVID-19 pandemic and the associated lockdowns in an urban setting in India.

#### Methods:

The current study involves conducting 20 In-Depth Interviews (IDIs) with primary caregivers of children with ASD in the age group 2-10 years old. Families of children with ASD will be purposively sampled from an existing database ensuring a diversity of backgrounds and levels of ASD support required.

The contacts with the participants will include the following based on their stated preference: Contact 1: Providing information from Parent Information Sheet and sharing it electronically with the participant. Contact 2: Review of information, audio recorded consenting process and documentation of demographic information if consent is obtained. Contact 3: Conducting IDI. A semi-structured guide is being used, exploring the impact of the pandemic and lockdowns on the child with ASD with respect to daily routines, behaviors and access to services, the impact on primary caregiver's mental health and well-being and the family's experiences during the pandemic period including on employment and financial security. Interviews will be conducted until data saturation is reached and no new findings emerge. A thematic framework analysis will be conducted to identify emerging themes.

#### Results:

The themes emerging from the analysis are expected to provide insights on bearings of the pandemic and associated lockdowns on children with ASD and their families. Early themes reveal that vulnerable families have had significant impact on, 1. Routine healthcare access including management of seizures, 2. Financial security resulting in requiring loans from employers and restricting essential purchases, 3. Loss of access to special education services. However, positive influences of sibling's home schooling has allowed the child with ASD to imitate behaviours have also been reported.

#### Conclusions:

Since children with ASD and their families remain one of the most vulnerable groups in the society, this research intends to provide information to researchers, clinicians and policy makers on how best to support vulnerable families in the midst of future unexpected crises.

**524.053** (Virtual Poster) Influence of Social Support on Parenting Stress in Parents of Children with Autism Spectrum Disorders: Multiple Mediating Effect of Family Resilience and Parenting Sense of Competence

**C. Wang<sup>1</sup>** and **Y. Liu<sup>2</sup>**, (1)Department of Social Psychology, Nankai University, Tianjin, China, (2)Nankai University, Tianjin, China

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**Background:** Parents of children with autism spectrum disorder (ASD) often face greater parental pressure in raising their children than the typically developing children's parents, and the current social support system is far more enough to meet the needs of ASD families.

**Objectives:** This study aims to study the impact of social support on parental stress in ASD children and to provide recommendations for parents of ASD children to reduce their stress and reshape their healthy mental health.

**Methods:** A survey of parents of ASD children was conducted during November 2020 to February 2021. There were 443 participants enrolled, among whom 346 were mothers of children with ASD and 97 were fathers. The measures were Social Support Appraisal Scale (SSRS), Parenting Stress Index / Short form (PSI/SF), Parenting Sense of Competence Scale (PSOC), The Family Resilience Assessment Scale (FRAS). The descriptive statistical analysis, the t-test and variance analysis are used to analyze the demographic differences. The relationship among the variables is tested by Process, and the significance of the mediating effect is tested by the Bootstrap to build a parallel mediation model for multi-mediation effect analysis.

**Results:** There were significant effect of symptom severity of ASD children on parents' social support ( $F(2,440)=4.09$ ,  $P < 0.05$ ), sense of competence ( $F(2,440)=3.55$ ,  $P < 0.05$ ), family resilience ( $F(2,440)=8.26$ ,  $P < 0.001$ ) and stress ( $F(2,440)=15.20$ ,  $P < 0.001$ ). Social support ( $\beta=-0.10$ ,  $P < 0.05$ ), sense of competence ( $\beta=-0.46$ ,  $P < 0.001$ ), family resilience ( $\beta=-0.19$ ,  $P < 0.001$ ) all significantly negatively predict the parenting stress. Social support was significantly negatively associated with parenting stress ( $P < 0.01$ ), and positively associated with sense of competence and family resilience ( $P < 0.01$ ). Sense of competence was significantly negatively associated with parenting stress ( $P < 0.01$ ) and positively associated with family resilience ( $P < 0.01$ ). family resilience was significantly negatively associated with parenting stress ( $P < 0.01$ ).

**Conclusions:** The results confirm that social support affects parenting stress and family resilience, and can provide suggestions on how to reduce parenting. In the future, the government, social organizations, rehabilitation institutions, families, friends, colleagues, neighbors and other stakeholders should jointly build social support networks, providing financial, emotional and information support to ASD children's parents and help decrease the pressure on their parents and restore their mental health

**524.054** (Virtual Poster) Subjective Experiences and Felt Needs of the Adolescents with Autism Spectrum Disorder and Their Parents – an Interpretative Phenomenological Analysis

**H. Manohar<sup>1</sup>**, **J. V. S. Kommu<sup>1</sup>**, **T. Kishore<sup>2</sup>**, **P. Jacob<sup>1</sup>** and **D. Jayarajan<sup>3</sup>**, (1)Child and Adolescent Psychiatry, National Institute of Mental Health and Neuro Sciences (NIMHANS), Bangalore, Bangalore, India, (2)Clinical Psychology, National Institute of Mental Health and Neuro Sciences (NIMHANS), Bangalore, Bangalore, India, (3)National Institute of Mental Health and Neuro Sciences (NIMHANS), Bangalore, Bangalore, India

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**Background:**

There is a rising trend in the prevalence of Autism Spectrum Disorder (ASD), globally. Global interventional research on ASD has predominantly focused on early interventions, catering to the needs of young children, over the last few decades. In the Indian context, there is a substantial understanding of the experiences of the families of young children with Autism, their perception of the disorder and disability, the stress of parenting, utilization of treatment services, and felt needs.

The transition from adolescence to adulthood in individuals with ASD has unique challenges. While a life span approach for neurodevelopmental disorders is essential to provide continued support, there is a paucity of systematic research on interventions for adolescents with ASD. A systematic review reports that very few adolescents with ASD are included as research participants, and their felt needs and aspirants are less known.

**Objectives:**

The goal of the current study was to understand the i) subjective experiences of adolescents with ASD, ii) experiences of parents in raising the adolescent with ASD, challenges in navigating through the services and their felt needs in the Indian context.

**Methods:**

In-depth interviews were conducted with 11 parents (8 mothers and 3 fathers) and 5 adolescents (who belonged to the same families), to understand their subjective experiences. Interviews with adolescents focused on their experiences at home, school, peers, and expectations related to the future. Parent interviews focused on parenting experiences, experiences related to health care utilization, schooling, handling unique changes related to adolescence, transition-related concerns, and their felt needs. The interview guides were kept flexible to suit the needs and abilities of adolescents with ASD. All interviews were conducted in English; interviews were recorded and transcribed verbatim.

**Results:**

Using interpretative phenomenological analysis, the following themes were illuminated from the parental interviews 1) Parental perception about the adolescent - Having come a long way, yet a long way to go. 2) Diagnosis and process of understanding ASD 3) Challenges for parents 4) Rewarding experiences 5) Impact of ASD 6) Coping with challenges 7) Envisioning the future. The following themes emerged from the adolescent interviews 1) Awareness of the self, 2) Valued relationships 3) Feeling (un)supported. Triangulation was attempted to understand the concordance and discrepancies of experiences between the parents and adolescents, specific to parental perceptions about adolescent experiences (awareness of the differences, peer relationships).

Conclusions:

Understanding issues of relevance from the adolescent's and family's perspective and their felt needs will help design and implement developmentally and culturally appropriate interventions to cater to the needs of this population. Implications for interventions will be discussed.

## Genetics

### PANEL — GENETICS

#### 219 - Autism Genetics – Moving from Identification to Validation to Treatment

**Panel Chair: M. Daniele Fallin**, *Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD*

**Discussant: Tychele Turner**, *Department of Genetics, Washington University in St. Louis, St. Louis, MO*

**219.001 (Panel)** Sparking New Insight into Autism Genetics

**W. K. Chung**, *Department of Pediatrics, Columbia University, New York, NY*

Background:

Autism is highly heritable.

Objectives:

To identify the genetic contributions to autism and how genetic contributions are correlated with clinical characteristics.

Methods:

To capture the spectrum of ASD genetic risk, we performed a two-stage analysis of rare *de novo* and inherited coding variants in 42,607 ASD cases, including 35,130 new cases recruited by SPARK.

Results:

In the first stage, we analyzed 19,843 cases with one or both biological parents and found that known ASD or neurodevelopmental disorder (NDD) risk genes explain nearly 70% of the genetic burden conferred by DNVs. In contrast, less than 20% of genetic risk conferred by rare inherited loss-of-function (LoF) variants are explained by known ASD/NDD genes. We selected 404 genes based on the first stage of analysis and performed a meta-analysis with an additional 22,764 cases and 236,000 population controls. We identified five new risk genes (*NAV3*, *ITSN1*, *MARK2*, *SCAF1*, and *HNRNPUL2*). ASD individuals with LoF variants in the four moderate risk genes (*NAV3*, *ITSN1*, *SCAF1*, and *HNRNPUL2*,  $n = 95$ ) have less cognitive impairment compared to ASD individuals with LoF variants in well-established, highly penetrant ASD risk genes (*CHD8*, *SCN2A*, *ADNP*, *FOXP1*, *SHANK3*) (59% vs. 88%,  $p = 1.9e-06$ ).

Conclusions:

These findings will guide future gene discovery efforts and suggest that much larger numbers of ASD cases and controls are needed to identify additional genes that confer moderate risk of ASD through rare, inherited variants.

**219.002 (Panel)** Massively Parallel Approaches to Identifying Which ASD Non-Coding Variants Have CNS Consequences

**J. Dougherty**, *Genetics, Washington University School of Medicine, St. Louis, MO*

Background: Whole genome sequencing studies are identifying thousands of mutations that are unique to patients with autism, with numerous mutations identified in each individual. While deleterious protein coding mutations are relatively easily interpreted, >99% of identified mutations are non-coding, and it is unclear which of these mutations might be functional and thus potentially causal in disease. In addition, unlike protein coding mutations, the consequences of non-coding mutations are often highly specific to each cell type: since non-coding mutations alter binding sites for gene expression regulators such as transcription factors or RNA binding proteins, and these are expressed in a cell type specific manner, to identify the consequences of non-coding mutations the function of each one must be assessed in the cell types relevant to disease (e.g., neurons and neural progenitor cells).

**Objectives:** Therefore, combining massively parallel oligonucleotide synthesis, Cre-dependent adeno associated vectors, and targeted RNA sequencing we have developed assays to measure the consequences of thousands of non-coding mutations in parallel in specific cell types of the living mouse brain.

**Methods & Results:** Focusing on 3' and 5' UTR mutations, we characterize the consequences of hundreds of UTR mutations and define several from patients that strongly alter RNA abundance and/or translational profiles.

**219.003 (Panel)** Chromatin and Gene-Regulatory Dynamics of the Developing Human Cerebral Cortex at Single-Cell Resolution  
**A. Trevino, Stanford, San Francisco, CA**

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**Background:**

Genetic perturbations of cortical development can lead to neurodevelopmental disease, including autism spectrum disorder (ASD). Distinguishing disease-causing mutations from benign genetic variation remains challenging, partly due to a lack of functional genomic annotation in relevant cell types.

**Objectives:**

The objectives of the study were: (1) To identify non-coding genomic regions involved in regulating and coordinating human corticogenesis; (2) To associate non-coding genomic regions with cells, genes, and developmental pathways in corticogenesis; (3) Using the above information, to validate and prioritize de novo, noncoding mutations identified by whole-genome sequencing of ASD-affected individuals, parents, and unaffected siblings (the Simons Simplex Collection).

**Methods:**

We mapped the activity of noncoding gene-regulatory elements by generating a single-cell atlas of gene expression and chromatin accessibility both independently and jointly. Putative ASD-associated mutations were prioritized by training base-pair-resolution neural network models to predict cell-type specific chromatin accessibility patterns from DNA sequence. These models were used to predict the disruptive impact of de novo mutations on gene regulation.

**Results:**

The molecular atlas revealed waves of gene regulation by key transcription factors (TFs) across a nearly continuous excitatory neuron and glial differentiation trajectories and identified lineage-determining TFs that exhibited strong correlation between linked gene-regulatory elements and expression levels. Neural network models identified strong, cell-type-specific enrichment of noncoding mutations predicted to be disruptive in a cohort of ASD individuals, identified frequently disrupted TF binding sites, and localized predicted mutation effects to specific cell types and time points in development.

**Conclusions:**

This approach illustrates how cell-type-specific mapping of gene regulatory elements can provide insights into the programs governing human development and disease.

**219.004 (Panel)** CRISPR Based Gene Therapy for Angelman Syndrome  
**J. M. Wolter, The University of North Carolina - Chapel Hill, Chapel Hill, NC**

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**Background:** Angelman syndrome is a severe autism spectrum disorder caused by mutation or deletion of maternal allele of *UBE3A*. In neurons, expression of the paternal allele of *UBE3A* is disrupted by a long-noncoding RNA, *UBE3A-ATS*, which is transcribed in antisense orientation to *UBE3A*. Interfering with expression of *UBE3A-ATS* can “unsilence” the paternal allele to normal levels, suggesting a potential therapeutic strategy for Angelman syndrome. Indeed, antisense oligonucleotides targeting *UBE3A-ATS* are currently in Stage I clinical trials, but will likely require regular intrathecal injections.

**Objectives:** We sought to develop a CRISPR-Cas9 based approach which would disrupt *Ube3a-ATS*, permanently unsilence paternal *UBE3A*, and provide therapeutic benefit in preclinical mouse model of Angelman Syndrome

**Methods:** We performed high-throughput gRNA screening in primary mouse neuron culture, adeno-associated virus (AAV) delivery of Cas9 to an Angelman Syndrome mouse model, and testing of this Cas9 approach in primary human neuron cultures.

**Results:** We identified a region in *UBE3A-ATS* that, when targeted by Cas9, unsilenced the paternal allele of *Ube3a* in mouse and human neurons. Treating Angelman mice *in utero* with Cas9 delivered via AAV restored *Ube3a* throughout the central nervous system, and rescued Angelman associated anatomical and behavioral deficits. Mechanistically, the most common editing event in these mice was integration of the entire AAV genome at the Cas9 target site. This integration carried with it regulatory elements that caused premature transcription termination of *UBE3A-ATS*.

Surprisingly, we also found that catalytically dead Cas9 can unsilence paternal *UBE3A* by directly interfering with *UBE3A-ATS* transcription, reducing safety concerns surrounding the mutagenic activity of Cas9.

Conclusions: These studies highlight multiple therapeutic approaches, informed by basic understanding of molecular deficiencies, that can reverse Angelman associated phenotypes from a single treatment.

## ORAL SESSION - 7A — GENETICS

### 313 - Rare Genetic Variants Associated with ASD

#### **313.001** (Oral) Genomic Architecture of Autism Spectrum Disorder from Comprehensive Whole-Genome Sequence Annotation

**B. Trost<sup>1</sup>**, B. Thiruvahindrapuram<sup>1</sup>, A. J. Chan<sup>1</sup>, W. Engchuan<sup>1</sup>, E. J. Higginbotham<sup>1</sup>, J. L. Howe<sup>1</sup>, L. O. Loureiro<sup>1</sup>, M. S. Reuter<sup>1</sup>, D. Roshandel<sup>1</sup>, J. Whitney<sup>1</sup>, M. Zarrei<sup>1</sup>, M. Bookman<sup>2</sup>, M. Fiume<sup>3</sup>, R. K. Yuen<sup>1</sup>, J. Sebat<sup>4</sup>, T. W. Frazier<sup>5</sup>, N. Sondheim<sup>1</sup>, D. Glazer<sup>2</sup>, D. Hartley<sup>6</sup> and S. Scherer<sup>1</sup>, (1)The Hospital for Sick Children, Toronto, ON, Canada, (2)Verily Life Sciences, San Francisco, CA, (3)DNASTack, Toronto, ON, Canada, (4)University of California - San Diego, La Jolla, CA, (5)Psychology, John Carrol University, Cleveland, OH, (6)Autism Speaks, New York, NY

Background: Autism spectrum disorder (ASD) is extremely heterogeneous in both clinical presentation and genetic architecture. Fully understanding ASD genetics requires whole-genome sequencing (WGS), which theoretically allows the genome-wide detection of all sizes and types of variants.

Objectives: Our objective was to leverage the power of WGS to assess the contribution to ASD of a wide range of genetic variation, including common and rare, sequence-level and structural, coding and non-coding, and nuclear and mitochondrial.

Methods: We used WGS data from three cohorts: MSSNG ( $n=11,312$ , including 5,102 with ASD), the Simons Simplex Collection (SSC) ( $n=9,205$ , including 2,419 with ASD), and the 1000 Genomes Project (1000G) ( $n=2,504$  unrelated population controls). Sequence-level variants were detected using an industry-standard BWA/GATK pipeline; copy number variants (CNVs) were identified using our previously described workflow involving the algorithms ERDS and CNVnator, and structural variants (SVs) were detected using a novel pipeline involving Manta and DELLY. Polygenic risk scores (PRSs) were calculated using summary statistics from the recently published iPSYCH genome-wide association study. Whole-exome sequencing (WES) data from the SPARK and ASC cohorts were used along with the WGS data to derive a high-confidence ASD gene list using the TADA+ method.

Results: By combining all available WGS and WES data from individuals with ASD ( $>18,000$  trios plus additional cases and controls), we generated a list of 135 ASD-associated genes with  $FDR < 10\%$ . This gene list was then used to guide the interpretation of all types of variants, including CNVs and other types of SVs, in MSSNG, SSC, and 1000G. Frequently detected genomic disorder syndromes in ASD-affected individuals included 15q11-q13 duplications, 16p11.2 deletions, and 1q21.1 duplications. ASD-risk genes commonly affected by SVs included *AUTS2*, *MBD5*, *NRXN1*, *SHANK1*, and *PTCHD1-AS*. We identified several ASD-relevant SVs that could only have been characterized with WGS, including an inversion disrupting *SCN2A* and a complex rearrangement impacting *KCNQ2*. Polygenic risk was significantly over-transmitted from parents to ASD-affected children ( $p < 4 \times 10^{-7}$ ) but not to their unaffected siblings. No significant difference in mean PRS ( $p > 0.05$ ) was observed between ASD-affected children in multiplex families (where ASD is more likely to be caused by inherited rather than *de novo* variation) versus simplex, suggesting that rare inherited variation may have a more prominent role in multiplex ASD. ASD-affected individuals without a known clinically significant rare variant had significantly higher PRS. Despite these aggregate trends, PRS was not predictive at the level of individuals or families. Transmission tests involving non-coding genomic features showed that rare sequence-level variants affecting transcription factor binding sites targeting the 135 ASD-associated genes were over-transmitted to ASD-affected individuals ( $FDR < 0.1$ ) but not to unaffected siblings. Several individuals with ASD had pathogenic mitochondrial variants, but contrary to previous findings, we detected no increased heteroplasmy transmission or enrichment of particular haplogroups in ASD-affected individuals.

Conclusions: By examining many types of genetic variants, we present what we believe to be the most comprehensive analysis of genetic variation in ASD thus far, providing new insights into the genetic heterogeneity of ASD.

#### **313.002** (Oral) Optimized Fragile X Protein Analysis in Context of EEG and Single-Dose Challenge Study in Fragile X Syndrome

**L. M. Schmitt<sup>1,2</sup>**, E. V. Pedapati<sup>3,4</sup>, R. Liu<sup>3</sup>, A. Boggs<sup>5</sup>, C. Gross<sup>5,6</sup>, J. A. Sweeney<sup>6</sup> and C. A. Erickson<sup>3,6</sup>, (1)Developmental and Behavioral Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (2)Pediatrics, University of Cincinnati College of Medicine, Cincinnati, OH, (3)Psychiatry, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (4)Psychiatry and Behavioral Neuroscience, University of Cincinnati College of Medicine, Cincinnati, OH, (5)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (6)University of Cincinnati College of Medicine, Cincinnati, OH

Background: The Fragile X mental retardation 1 (FMR1) gene-specific protein product, Fragile X protein (FXP), is critical for brain development and its absence plays a causal role in full mutation Fragile X Syndrome (FXS). Elevated gamma ( $> 30$  Hz) power, thought to reflect neural hyperexcitability, is a consistent and replicated finding in FXS research across studies in mouse, human, and in vivo brain slices. Identifying the relationship between FXP levels and EEG biomarkers may be critical to better underlying pathophysiological mechanisms and treatment development and planning.

Objectives: To examine the relationship between FXP levels and EEG phenotypes in late adolescents and adults with FXS, including during an acute single-dose drug study of baclofen.

**Methods:** Forty individuals with full mutation FXS (27 males (FXS(M)) and 13 females (FXS(F)) aged 13-45 years completed blood collection for FXP processing and high-density resting state EEG. Participant whole blood samples were analyzed using an optimized Luminex-based blood spot assay that allowed us to detect very low levels of FXP. A subset of these individuals (n=16) completed an acute single-dose challenge drug study comparing baclofen and placebo on resting state EEG target engagement. Drug study participants also completed a social preference eye tracking task.

**Results:** Overall, FXP levels were higher in females than in males, and a subgroup of full mutation FXS males had trace amounts of FXP. On resting state EEG measures, lower FXP levels significantly correlated with lower peak alpha frequency and increased relative alpha1 power. In addition, correlations between higher FXP and decreased gamma1 power trended towards significance. Following single-dose baclofen, individuals with FXS with lower FXP levels demonstrated greater reductions in resting state gamma1. Among FXS(M) with trace levels of FXP, we found that greater reductions in gamma2 power were associated with greater increases in time spent looking at social compared to geometric scenes. However, this result was not found in FXS(M) without FXP, and the opposite relationship was found in FXS(F).

**Conclusions:** We provide novel evidence linking peripheral FXP levels and translational EEG biomarkers in FXS, such that increased FXP levels are associated with less severe neurophysiological phenotypes. We also found that males with FXS with trace levels of FXP may demonstrate the greater reductions in gamma1 following a single dose of baclofen, and this relationship may mediate improvement in social attention. Taken together, our findings demonstrate that optimized FXP assay has clinical utility and may be critical to treatment planning and trial stratification for future drug studies.

### **313.003 (Oral) Gene Functional Impairment and Its Correlation with the Phenotypic Profile of ASD in a National Cohort of UK Children with Intellectual Disability**

**D. H. Skuse<sup>1</sup>, M. Rallison<sup>2</sup>, J. Wolstencroft<sup>3</sup> and I. D. Imagine<sup>3</sup>,** (1)Institute of Child Health, London, United Kingdom, (2)UCL, London, United Kingdom, (3)UCL GOS Institute of Child Health, London, United Kingdom

**Background:** Monogenic *de novo* mutations (DNM) are, cumulatively, an important cause of severe developmental disorders (DD), and many are associated with an increased risk of ASD too. In this genetics-first study, participating children had been ascertained for DD of unknown origin, and whole-exome sequencing (WES) had revealed a pathogenic DNM. Previous research has categorised DNMs associated with ASD by functional group, but none has investigated whether the phenotypic profile can be distinguished by genetic etiology.

**Objectives:** The cohort under investigation was drawn from IMAGINE-ID, a national UK study of children with DD of known genetic aetiology. We aimed to test the hypothesis that there would be a significant association between specific functional groups of DNMs and the risk of ASD, and/or with ASD-related symptom clusters.

**Methods:** Children with developmental delay of genetic etiology, not associated with any recognisable clinical syndrome, were enrolled from NHS Regional Genetics Centres throughout the UK (n=3400). We identified *de novo* causal variants from WES in 808 participants, 4-19 years of age (49% female). Participating families completed a standardized child psychiatric interview, measures of functional adaptation and behavioural/emotional adjustment, and a medical history questionnaire. We focus here on 202 genes with pathogenic *de novo* mutations, categorised into five functional groups: Gene Expression Regulation (GER – 58 genes); Neuronal Communication (NC – 26 genes); Cytoskeletal (Cyt – 19 genes); Chromatin Remodelling (CR – 7 genes); Other (Oth – 92 genes). ASD phenotypic characteristics were classified into clusters: socio-emotional reciprocity (SER); non-verbal communication (NVC); developing relationships (DR) and repetitive stereotypic behaviors (RSB). Mental Age (MA) was estimated from the General Adaptive Composite (GAC) score of the ABAS-3.

**Results:** ASD was diagnosed in 191 participants (32%) for whom sufficient clinical information was available. Prevalence by functional genetic disorder was 33% (GER & Cyt), 44% (ST), 38% (CR) and 23% (Oth). Adjusting for MA revealed odds ratios for risk of ASD: 1.7 (GER), 2.5 (NC), 2.7 (Cyt) and 2.4 (CR) compared with Other gene functions. Overall, variation in gene function category was associated with just two ASD subscale scores, socio-emotional reciprocity (p<0.001) and non-verbal communication (p=0.04) as well as with mental age (p=0.02) but accounted for only a small proportion of variance. Statistically significant differences did not survive adjustment for multiple testing.

**Conclusions:** There is currently growing interest in the relevance of genomic functions such as gene expression regulation and neuronal communication to potential differences in ASD symptom profiles. Unlike previous genomic studies of ASD risk, we took a genetics-first approach to ascertainment. Our findings indicate that pathogenic DNMs in the categories NC, GER, Cyt and CR have a similar impact on the clinical features of ASD irrespective of their association with DD.

### **313.004 (Oral) Sleep Problems in Children with Rare Genetic Variants Associated with Autism and Developmental Disabilities**

**A. Holbrook<sup>1</sup>, E. Brooks<sup>1</sup>, L. Green Snyder<sup>1</sup>, J. Tjernagel<sup>1</sup> and W. K. Chung<sup>1,2</sup>,** (1)Simons Foundation, New York, NY, (2)Department of Pediatrics, Columbia University, New York, NY

**Background:** Disruptions to sleep are well known in autism (Buckley et al., 2020), and specific genetic variants have been associated with both autism and sleep disorder, with common pathways proposed (Abel et al., 2020, Missig et al. 2020, Yang et al. 2016). Although high rates of sleep problems are reported in neurogenetic syndromes (Blackmer & Feinstein, 2016; Dosier et al., 2017; Richdale & Baker, 2014; Robinson-Shelton & Malow, 2016; Smith-Hicks et al., 2021; Trickett et al., 2019) there is relatively little research on sleep across the broader spectrum of neurodevelopmental disabilities with known genetic etiologies.

**Objectives:** To examine sleep problems in children with rare genetic disorders enrolled in the Simons Searchlight study.



**Methods:** Simons Searchlight is an online research registry collecting data on genetic variants related to autism and neurodevelopmental disorders. Participants assessed included 355 children (51% male) between the ages of 2 and 18 years ( $M=9.34$ ,  $SD=4.28$ ) with pathogenic or likely pathogenic sequence or copy number variations. Gene groups with 20 or more participants who completed the Children's Sleep Habits Questionnaire (CSHQ; Owens et al., 2000) were included in this study: 16p11.2 deletion ( $n=90$ ), 16p11.2 duplication ( $n=39$ ), 1q21.1 duplication ( $n=30$ ), *CSNK2A1* ( $n=23$ ), *CTNNA1* ( $n=31$ ), *GRIN2B* ( $n=24$ ), *PPP2R5D* ( $n=30$ ), *SCN2A* ( $n=39$ ), *SLC6A1* ( $n=24$ ), and *STXBP1* ( $n=25$ ). The CSHQ is a 33-item standardized questionnaire; a total score of greater than 41 indicates significant sleep problems. The CSHQ has eight subscales reflecting medical and behavioral sleep disorders: bed-time resistance, sleep onset delay, sleep duration, sleep anxiety, night awakenings, parasomnias, sleep disordered breathing, and daytime sleepiness. Subscale thresholds are met if a participant's score is more than one SD above the community mean. Ninety-six percent of caregivers also completed the Sleep Supplement Survey, a questionnaire designed with input from members of the Simons Searchlight community, which asked about sleep hygiene and the impact of sleep on behavior problems.

**Results:** Forty-eight (16p11.2 deletion) to 80% (*STXBP1*) of children met cutoffs for risk of clinical sleep disorder on the CSHQ (Fig. 1); however, over 75% report no formal sleep disorder diagnosis. Across groups, bedtime resistance and sleep duration are most problematic. Between 44% (*STXBP1*) and 74% (*CSNK2A1*) of children exhibit increased behavioral problems the day after a night of poor sleep. In eight of the 10 genetic groups, a consistent bedtime routine was the most frequently endorsed method to address sleep problems. Medical complications impact sleep in 24% (*CTNNA1*) to 88% (*STXBP1*) of children, including gastrointestinal disorders, seizures, and medication side effects. Seizures specifically disrupt sleep in up to 64% of children (*STXBP1*).

**Conclusions:** Despite the high proportion of children at risk for clinical sleep disorders, most caregivers report no formal sleep disorder diagnosis. Many caregivers of children with rare genetic disorders utilize interventions such as sleep routines, but a large proportion of children display significant sleep problems, which are related to increased negative behaviors. Complicating this is the impact of medical conditions and medications on sleep. These findings suggest the need to address sleep problems to improve related behavioral concerns and overall quality of life.

## POSTER SESSION — GENETICS

### 412 - Genetics

**412.141 (Poster)** An Epigenome-Wide Association Study of Social Responsiveness Scale Score in the Study to Explore Early Development **E. M. Howerton<sup>1</sup>**, J. Daniels<sup>2</sup>, A. Y. Song<sup>3</sup>, K. S. Benke<sup>4</sup>, H. E. Volk<sup>5</sup>, H. Farzadegan<sup>1</sup>, A. Alexander<sup>6</sup>, A. Tapia<sup>5</sup>, G. S. Dichter<sup>6</sup>, J. Daniels<sup>7</sup>, L. A. Croen<sup>8</sup>, G. L. Wojcik<sup>1</sup>, L. Wiggins<sup>9</sup>, M. D. Fallin<sup>2</sup> and C. Ladd-Acosta<sup>2</sup>, (1)Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (2)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (4)NCBDDD, Centers for Disease Control and Prevention, Atlanta, GA, (5)Epidemiology, University of North Carolina at Chapel Hill, Chapel Hill, NC, (6)Psychiatry, University of North Carolina, Chapel Hill, NC, (7)University of North Carolina at Chapel Hill, Chapel Hill, NC, (8)Division of Research, Kaiser Permanente Division of Research, Oakland, CA, (9)Centers for Disease Control and Prevention, Atlanta, GA

**Background:** Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by impaired social communication and repetitive and restrictive behaviors and interests. Quantitative measures of ASD-related traits can provide insight into severity and impairment across the population. Previous studies have identified epigenomic variation associated with ASD diagnosis (dichotomous), but few have evaluated associations with ASD-related quantitative traits (continuous).

**Objectives:** To identify DNA methylation patterns in child peripheral blood associated with scores on the Social Responsiveness Scale, Second Edition (SRS-2).

**Methods:** We conducted an epigenome-wide association study of autistic traits in the Study to Explore Early Development, a case-control study of ASD in the United States among children born between 2003-2006 and aged 2-5 years at the time of enrollment. Peripheral blood samples were collected at an average age of 5 years. DNA methylation was measured using the Illumina Infinium Human Methylation 450K BeadChip. Quantitative autistic traits were measured in ASD cases and population controls using the SRS-2, preschool or school-age form. After robust quality control, 857 samples were included in our final analytic sample. We performed linear regression to identify DNA methylation single sites (CpGs) or differentially methylated regions (DMRs) associated with SRS-2 scores, using surrogate variables to adjust for sources of biological and technical variation.

**Results:** No single CpG site reached genome-wide significance ( $p < 1 \times 10^{-7}$ ) using established SRS-2 T-score cutoffs for ASD symptoms (none [ $\leq 59T$ ], mild [ $60T - 65T$ ], moderate [ $66T - 75T$ ], severe [ $\geq 76T$ ]) or SRS-2 T-score as a continuous variable; however, multiple CpG sites reached a suggestive significance threshold ( $p < 1 \times 10^{-5}$ ), with eight CpG sites suggestively associated with SRS-2 T-score as a categorical variable when comparing the severe versus no ASD symptom groups, and eight CpG sites suggestively associated with SRS-2 continuous T-score. A region about 3.5kb upstream of *ZFP57* on chromosome 6 was identified as differentially methylated (family-wise error rate [fwer]  $< 0.1$ ) by SRS-2 T-score as a continuous variable in the full sample ( $n = 857$ ; fwer = 0.066) and ASD-only analyses ( $n = 390$ ; fwer = 0.016). *ZFP57* encodes a transcription factor involved in imprinting regulation and maintenance, and this DMR has been previously identified as associated with ASD in post-mortem temporal cortex samples.

**Conclusions:** One DMR near *ZFP57* was associated with continuous SRS-2 T-score in the full sample and ASD-only analyses. Future directions of study include sensitivity analyses regarding the ASD case definition and SRS-2 form type, exploration of methylation quantitative trait locus annotations near *ZFP57*, and pathway analyses. Findings from our study may provide insights into the epigenomics of autistic traits, including

whether associations differ between ASD cases and controls and among ASD cases, informing the use of ASD-related quantitative traits in future epidemiologic studies.

#### **412.142 (Poster) Attention Problems and Expressive Language in Adnp Syndrome**

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**Background:** Emerging research has begun describing phenotypes in children and adolescents with activity dependent neuroprotective protein (ADNP) syndrome (Siper et al., 2021), an autosomal dominant neurodevelopmental disorder associated with autism spectrum disorder (ASD), intellectual disability (ID), speech and motor delays, and a myriad of medical comorbidities (Arnett et al., 2018; Helsmoortel et al., 2014; Van Dijck et al., 2019). One half to two thirds of individuals with ADNP syndrome present with ASD (Siper et al., 2021), and a large majority present with speech delays (98.6%) and behavioral problems (77.6%; Van Dijck et al., 2019). In one sample of individuals with ADNP syndrome, 47.4% of caregivers reported clinically significant externalizing problems, including attention problems (68.4%), ADHD (52.6%), aggressive behavior (47.4%), and oppositional defiant problems (21.1%) (Tang et al., 2020).

A larger body of literature has investigated the relationships between clinical characteristics in idiopathic ASD. Findings suggest that externalizing behaviors, including hyperactivity and aggression, are negatively associated with language ability and communication skills (Maskey, Warnell, Parr, Couteur, & McConachie, 2013; Neuhaus et al., 2020; Rattaz, Michelon, Munir, & Baghdadli, 2018; Rodas, Eisenhower, & Blacher, 2017). This information may be useful for treatment aiming to decrease externalizing behaviors in ASD. Whether this relationship holds in ADNP syndrome is unknown.

**Objectives:** This study investigated the relationship between language skills and parent-rated attention and behavior problems among children and adolescents with ADNP syndrome. Specifically, we hypothesized that child attention problems are negatively related to expressive language skills.

**Methods:** Twenty-two individuals with ADNP syndrome (10 females; age 2-17,  $m=7.18$ ,  $sd=3.92$ ; 50% ASD) participated in comprehensive clinical evaluations, including caregiver interviews and standardized assessments. Participants completed the Expressive Vocabulary Test, 2<sup>nd</sup> Edition (EVT-2) to measure expressive language skills. Externalizing problems were assessed by parent ratings on the Child Behavior Checklist (CBCL) 1.5-5 or 6-18 version, depending on the child's chronological age. Relationships between language skills and behavioral functioning were examined.

**Results:** Twelve participants were unable to respond to the EVT-2. For those participants who had EVT-2 raw scores  $>0$ , parent-rated attention problems ( $n=11$ ,  $m=68.27$ ,  $sd=5.98$ ) were significantly negatively correlated to expressive language skills ( $n=12$ ,  $m=49.83$ ,  $sd=19.18$ ,  $r=-.70$ ,  $p=.02$ ). Specifically, for children able to participate in the EVT-2, expressive language skills explained 48% of the variance in attention problems,  $R^2=.48$ ,  $F(1,9)=8.42$ ,  $p<.05$ . Step-wise ordinary least squares (OLS) regression analysis revealed that ASD diagnosis did not explain additional model variance. There was no relationship between attention problems and expressive language when including children without speech.

**Conclusions:** In this sample of children and adolescents with ADNP syndrome, attention problems were significantly negatively related to expressive language skills, for individuals with speech, even when controlling for ASD diagnosis. For children with ADNP syndrome and at least some speech, language skills may be a potential target for intervention, as decreased expressive language was linked to increased attentional problems, which may further interfere with their academic and social development. For children without speech, other avenues, such as direct behavioral targets or focusing on non-verbal communication may offer the most fruitful avenue for intervention.

#### **412.143 (Poster) Autism Spectrum Disorder and Sotos Syndrome: Which Relation Genotype-Phenotype? a PILOT Study**

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**Background:**

The clear definition of the cognitive and behavioral profile of individuals affected by genetic syndromes represents a critical research and clinical issue. Sotos Syndrome (SS) is a congenital overgrowth syndrome caused in the 90% by NSD1 (nuclear receptor binding SET domain protein1) gene mutations, with 5q35 microdeletion representing the most common described. SS is associated with a heterogeneous neuropsychological phenotype, characterized by a variable intellectual functioning and behavioral profile (impulsivity, atypical behavior) not yet well and clearly defined, particularly concerning socio-communicative skills and specifically in relation to the genetic phenotype. To our knowledge, no prior study investigated the presence of autism symptoms using the gold standard measure, Autism Diagnostic Observation Schedule-2nd (ADOS-2).

**Objectives:**

This study has been developed in the context of a project borned from the collaboration with the Italian Association of Sotos Syndrome. Main goal of the project is to evaluate whether the neuropsychological profile differs between SS individuals on the basis of their genotype: presence or absence of 5q35 microdeletion.

## Methods:

Twenty-two children and adolescents clinically and genetically diagnosed with SS were enrolled through the Italian Association of SS. All participants were genetically characterized by Fluorescent in situ hybridization (FISH), arrayCGH or DNA sequencing, and all underwent a standardized neuropsychiatric evaluation of cognitive skills (Leiter International Performance Scale-Revised), autism symptoms (ADOS-2, Social Responsiveness Scale), internalizing and externalizing behaviors (Achenbach Child Behavior Checklist [CBCL]; Conners' Parents).

## Results:

We present preliminary results on 22 participants. From a genetic point of view, 9 individuals presented a 5q35 region microdeletion; whereas 13 individuals did not have the microdeletion but others NSD1 gene specific mutations. The neuropsychological profile of all SS individuals was characterized considering two main subgroups: A) carrying 5q35 microdeletion (7 males, 2 females; age M  $8.2 \pm 2.9$  years); B) NOT carrying 5q35 microdeletion (9 males, 4 females; age M  $10.1 \pm 2.1$ ) (Fig). Statistically significant difference emerged between the two subgroups in regard to cognitive profile (IQ  $p=0.02$   $t=1.4$ ; ABAS-II  $p=0.01$   $t=2.6$ ) and socio-communicative symptoms (ADOS-2 CSS  $p=0.05$   $t=3.1$ ; SRS Total  $p=0.0092$   $t=2.9$ ; ABAS-II Social Adaptive Domain  $p=0.04$   $t=2.1$ ). Specifically, individuals carrying the 5q35 microdeletion - in comparison to participants not carrying the same deletion - showed: lower cognitive functioning in terms of Non Verbal Intellectual Quotient and adaptive skills; higher ASD symptoms at both evaluation of the examiner and parental report. No statistically significant findings emerged concerning behavioral problems (Conners' ADHD index  $p=0.08$   $t=1.8$ ; CBCL  $p=0.3$   $t=1.0$ ).

## Conclusions:

This study contributes to better define the neuropsychological phenotype of individuals with Sotos Syndrome. Preliminary results show that SS individuals carrying the 5q35 microdeletion are characterized by a worse neuropsychological profile in terms of cognitive skills, adaptive functioning and socio-communicative symptoms. In particular, ASD symptoms and attention deficit difficulties, emerged as a promising behavioral area to be longitudinally investigated within this clinical population. A clear definition of the cognitive and behavioral profile of SS children, even in relation to the genetic profile, could lead to a better take in charge and delineation of early intervention.

**412.144 (Poster)** Cognitive and Language Abilities Associated with Protein Levels Differentially in Males and Females with Fragile X Syndrome  
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**Background:** Fragile X Syndrome (FXS) is an X-linked neurodevelopmental disorder caused by triplet repeat expansion and resultant methylation of Fragile X mental retardation 1 (FMR1) gene resulting in deficient production of fragile X protein (FXP). FXS is the most common form of inherited intellectual disability and single gene cause of autism. Several studies have established a link between peripheral blood FXP levels and general intellectual functioning in individuals with FXS. However, studies exploring the relationship between FXP levels and other key aspects of cognition are limited.

**Objectives:** The purpose of this study was to investigate the relationship between blood FXP levels and cognitive and language functioning in FXS to better understand the pathophysiological basis of these deficits.

**Methods:** Twenty-three male and ten female (17-40 years old) age-matched individuals with FXS were included. Blood samples were obtained from participants to confirm FXS status and obtain FXP levels, using an optimized Luminex-based blood spot assay that allowed us to detect very low concentration levels of FXP. All participants completed a neuropsychological battery including tests of working memory, auditory attention, and expressive language. We compared sexes on neuropsychological measures and examined relationships between these measures and FXP levels.

**Results:** Verbal working memory of single words was significantly reduced in males with FXS compared to females, but memory of complex sentences were only marginally reduced in males compared to their female counterparts; however, this difference became significant after removing males with mosaicism. We found males and females with FXS did not show a significant difference in auditory attention even when removing males with mosaicism. Mean length of utterances, or syntactic complexity, was significantly reduced in males with FXS compared to females.

In males and females with FXS, higher FXP levels were related to increased syntactic complexity. Among all males with FXS, lower FXP levels was associated with increased talkativeness. Males with mosaicism demonstrated a relationship between higher FXP and increased lexical diversity, or the number of different words used. In females with FXS, higher FXP levels were related to improved verbal working memory of single words and sentences as well as to improved auditory attention.

**Conclusions:** Consistent with prior reports, females with FXS have higher verbal working memory and expressive language abilities when compared to males with FXS. On the other hand, auditory processing abilities may be more similar in males and females with FXS. One possible explanation for this is the relationship found between lower FXP levels and lower auditory processing skills in females with FXS. This suggests that auditory attention may be more closely tied to underlying FXS pathology in females, and less susceptible to suspected compensatory patterns typically arising from X-inactivation. Moreover, our findings indicate that FXP levels are associated with cognitive and language abilities differentially based on sex and mosaicism status, suggesting FXP alone may not play causal role of these key features of FXS. Together, our findings provide important new insights into underlying pathophysiological mechanisms and treatment planning.

**412.145 (Poster)** Contributive Role of C12orf57 Mutations in Autism Spectrum Disorder and Intellectual Disability

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**Background:** Genetic factors are responsible for a wide variety of intellectual disorders. C12orf57 (Chromosome 12 Open Reading Frame 57) is a gene coding protein responsible for the development of the human corpus callosum. Homozygous and heterozygous mutations in C12orf57 have been associated to multiple congenital anomalies, and further proven to be fundamental in the outcome of various forms of intellectual disabilities (ID) and neurological diseases.

**Objectives:** This study aims to highlight the importance of screening for C12orf57 mutations in families with autism spectrum disorder (ASD) to further clarify the link between C12orf57 variants and ASD.

**Methods:** Our team recruited an ASD cohort that was diagnosed and assessed clinically and further confirmed utilizing ADOS-2, ADI, and IQ test scores. Through the use of Nanopore sequencing technology, we analyzed the C12orf57 gene in 70 autistic children and their parents.

**Results:** Out of the 70 children assessed, five individuals showed novel heterozygous variants in the C12orf57 gene that have not been previously associated with ASD. They were further validated using Sanger sequencing.

**Conclusions:** Our findings sheds light on the importance of the C12orf57 gene in the development of ID and ASD.

**412.146 (Poster)** Epigenetic Aging at Birth and Risk of Autism Spectrum Disorder

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**Background:** Evidence supports an epigenetic involvement in autism spectrum disorder (ASD). Epigenomic-wide association studies have linked DNA methylation (DNAm) changes to ASD in multiple tissues. In recent years, “epigenetic clocks” or DNAm based age estimators have been developed to accurately predict biologic age across tissues. Epigenetic age acceleration has been associated with a wide range of adverse child health conditions. Currently, little is known about epigenetic aging at birth and ASD.

**Objectives:** To examine the association between epigenetic age acceleration assessed using DNAm collected at birth and risk of ASD in three prospective cohort studies: the Early Autism Risk Longitudinal Investigation (EARLI), the Markers of Autism Risk in Babies-Learning Early Signs (MARBLES), and the Boston Birth Cohort (BBC).

**Methods:** Epigenetic age was estimated using two existing epigenetic clock algorithms (Knight and Bohlin) for cord blood DNAm data. Cell-intrinsic epigenetic age acceleration/deceleration was defined as the residual of regressing chronologic gestational age on DNAm age accounting for cell type proportions. Diagnoses of ASD were made by psychologists based on clinical evaluations at 36 months of age in two cohorts (EARLI and MARBLES) or were extracted from medical records at any age for the third cohort (BBC). Children were classified as having ASD (N=160), nontypical development (non-TD, N=634), or neuro-typical development (TD, N=547). Multinomial logistic regression models were completed in three cohorts separately to examine the association of epigenetic age acceleration/deceleration at birth with ASD diagnosis adjusted for child sex, maternal race/ethnicity, study site, and maternal education.

**Results:** The two DNAm based estimates of epigenetic age, in three cohorts, all showed significant high overall correlations with chronologic gestational age (correlation ranging from 0.50 – 0.75). For Knight and Bohlin epigenetic age estimates, we computed accelerated/decelerated epigenetic (biologic) age in each study and tested for associations with ASD diagnosis. No significant associations were observed between accelerated/decelerated aging at birth and ASD risk; however, effect estimates for the 2 clocks in all 3 studies suggest decreased ASD risk with accelerated biologic aging. For example, nonsignificant decreases in odds of ASD were observed for 1-week increase in biologic age relative to gestational age at birth (aOR=0.85, 95% CI = 0.67, 1.07) using the Bolin clock in one cohort. In secondary analyses comparing non-TD to TD separately in three cohorts, we did not find evidence for associations with epigenetic age at birth.

**Conclusions:** Overall, we did not observe significant associations of cell-intrinsic epigenetic aging at birth with clinical ASD diagnosis. Future research is needed to further investigate cell-extrinsic aging, a measure of immune system aging that incorporates cell counts, and its impact on child neurodevelopment. We did show that DNAm based estimates of epigenetic age accurately predicts gestational age at birth using 2 clock algorithms in all 3 birth cohorts with diverse race/ethnicity, which offers a valuable molecular tool for assessing gestational age in a range of life course research.

**412.147 (Poster)** Gender Effect on the Severity of Developmental Phenotype in Children with Rare Autosomal Genetic Mutations

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**Background:** Since more whole exome sequencing is performed during the workup for autism and intellectual disability, more rare genetic disorders are discovered as etiology.

**Objectives:** To examine gender differences in the presenting symptoms and severity of autism spectrum and developmental disability among children with rare autosomal genetic mutations, specifically language, gross and fine motor delay, age of acquiring independent walking ability, age of diagnosis of Autism Spectrum Disorder (ASD) and severity, and age at the first concerns and referral to a medical profession. We assumed that we will find differences, even though the examined mutations are autosomal and not sex-linked.

**Methods:** We will compare developmental domains in 32 children with a rare genetic mutation characterized by a developmental disability, evaluated between 2012- 2021 at Keshet Center. 11 girls with autism related disorder due to a rare genetic mutation as compared to 21 boys with autosomal mutations and we assessed developmental trajectories and risk factors.

**Results:** An initial analysis of the results showed that the paternal mean age at the birth of the child was 37.2 while the mothers' mean age was 33.5. The heredity was de novo in 53% of cases, in 6.3% maternal inheritance, the same percentage as a paternal inheritance. In 34.4% of cases, the heredity was recessive, inherited from both parents, or unknown. At the first point of time examined, only 31.2% of the children were diagnosed initially with autism spectrum disorder. At the second time point 71.9% received an ASD diagnosis. Only one girl was not diagnosed initially with autism in our research, compared with eight boys (9.1% vs. 38.1% respectively) but the age at first diagnosis was higher in girls.

**Conclusions:** This study is in progress, however initial results show older paternal age linked to autosomal rare mutations and to accumulation of ASD signs and symptoms with age. Although the mutations are not gender related, male gender is predominant, pointing to a delayed diagnosis in females or to a milder phenotype due to epigenetic influences.

**412.148 (Poster)** Identifying Shared and Divergent Transcriptional Dysregulation across Brain Regions in Adult *Chd8* Haploinsufficient Mice  
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**Background:** De novo mutations in the chromatin-remodeling factor *CHD8* (Chromodomain-Helicase DNA-binding protein 8) are strongly associated with autism spectrum disorder (ASD) and more generally with neurodevelopmental disorders (NDDs). Mice with heterozygous germline loss-of-function mutations in *Chd8* exhibit genomic, neuroanatomical, and behavioral pathology. While recent efforts have focused on investigating how *Chd8* haploinsufficiency impairs early brain development, less is known about the impacts of *Chd8* mutations and its cellular role in the postnatal brain.

**Objectives:** Using mice harboring a heterozygous *Chd8* mutation that present behavioral deficits relevant to ASD and ID, we aimed to map and compare the transcriptomic landscape across three brain regions from *Chd8* mutants and wild type mice. Our goal is to identify the molecular consequences of *Chd8* haploinsufficiency in the postnatal brain, leading to better understanding of ASD etiology.

**Methods:** We used RNA-sequencing in cerebral cortex, hippocampus, and cerebellum from *Chd8* adult gender-balanced cohorts of heterozygous mutants and wild-type littermates. Using differential expression and weighted gene co-expression network analysis (WGCNA), we tested for genes and modules that are dysregulated and. Western Blot and histology were applied to validate findings.

**Results:** We identified differentially-expressed genes (DEGs) that were altered across all three brain regions, as well as region-specific signatures. We detected perturbation to neuroinflammatory, metabolic, and synaptic pathways. Our findings reveal a small set of genes that are consistently perturbed across brain regions here and also identified across a number of independent studies. We also identified a module of sex-specific DEGs that may be relevant to reports of differences between male and female mutation carriers.

**Conclusions:** Our findings show that decreased *Chd8* dosage alters gene expression in adult brain both via shared pathways, and in region-specific and sex-specific manners. In ongoing work, we aim to resolve specific cell types and functional consequences of these effects. Our results present a systems-level characterization of molecular and cellular pathways that are disrupted in adult *Chd8* mutant brain and reveals new insights to the molecular and cellular underpinnings of severe NDDs.

**412.149 (Poster)** Immune-Phenotyping and Transcriptomic Profiling of Peripheral Blood Mononuclear Cells Based on Severity from Children with Autism Spectrum Disorders  
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**Background:** Transcriptomic profiling using total RNA-sequencing has been one of the most utilized approaches to link protein levels and genetic information at the molecular level. The transcriptome apprehends a molecular genomic complexity that the DNA sequence solely does not. Some mutations alter a gene's DNA sequence but do not necessarily change expression and/or protein function. Recent studies using transcriptome profiling of peripheral blood mononuclear cells (PBMCs) from individuals with autism spectrum disorder (ASD) revealed several differentially expressed transcripts compared to controls. Moreover, changes in gene expression in individuals with ASD were simultaneously differentially expressed in the different tissues, brain, intestinal biopsy samples, and PBMCs. This enhances detection specificity in different types of samples, and thus blood transcriptome-wide signature could be used to understand ASD transcriptome. To date, reliable biomarkers to diagnose ASD or molecular

mechanisms to define its severity do not exist. A transcriptomic map of the PBM network could identify relationships between genes with enriched expression in ASD based on different symptomatology.

**Objectives:** To define a transcriptomic map based on ASD severity and use it to investigate relationships between genes with enriched expression in ASD.

**Methods:** EDTA whole blood samples were collected from 38 children with ASD, and 8 age- and gender-matched controls and PBMCs were extracted using Ficoll density gradient. The 38 ASD subjects were divided into 20 children, who expressed more symptoms of ASD (severe) and 18 who expressed fewer symptoms of ASD (mild). Whole transcriptome sequencing of PBMCs was performed using TruSeq total RNA Ribo-Zero Library preparation kit. To discover DEGs at the biologically functional level the Ingenuity Pathway Analysis IPA was used. To identify functional pathways influenced by the combinatorial effects of the long noncoding RNAs analysis, the LncPath package in R was used.

**Results:** An average of 97.75% of reads from each sample was uniquely mapped to the human genome. From 47,314 genes, 19,939 protein-coding genes and 27,375 non-coding genes were identified in the children with ASD and healthy controls. We defined the genes expressed in PBMCs isolated from different ASD children identified with different symptomatology (severe and mild) vs. controls. We further defined a PBMC transcriptome signature, a profile of genes with enriched expression in PBMCs, and discovered novel genes and molecular programmes that control regulation of cytokine production and neuroinflammation. Moreover, a functional enrichment analysis demonstrated that differentially expressed genes were significantly enriched in inflammation/immune response, mitochondrion-related function, and oxidative phosphorylation. The biological processes associated with these genes are involved in cytokine stimulation and signaling, immune system development, cell communication, and regulation of cellular response. PBMC transcriptome signature genes are shown to be (i) highly enriched for genes that cause severe symptoms and (ii) significantly over-represented with susceptibility miRNAs identified previously by our group. Furthermore, lncRNAs that were previously identified as key regulators of the inflammatory response were found to be increased in individuals with severe symptoms of ASD.

**Conclusions:** This study provides a new insight of understanding the etiology of ASD neuroinflammation and the possibilities of developing interventions based on severity

**412.150 (Poster) Leveraging Family Structure to Parse the Genetic Architecture of Autism Spectrum Disorder Endophenotypes**

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**Background:** The genetic architecture of Autism Spectrum Disorder (ASD) is multifaceted and unresolved, with few common variants reliably associated with the diagnosis status despite consistently high estimates of heritability. A posited hypothesis for this lack of discovery is that there are several etiologically distinct forms of ASD and grouping these distinct forms under one diagnosis status obscures the genomic elements relevant to each etiology.

**Objectives:** The purpose of this work is to estimate the degree of genetic influence on the endophenotype of the subdomains described by Autism Diagnosis Interview-Revised (ADIR) and the closely related Social Communication Questionnaire (SCQ) in the two largest family-based ASD cohorts; the Autism Genetic Research Exchange (AGRE) collection and the Simons Foundation SPARK (SPARK).

**Methods:** We modeled the subdomains with differential causal exposures for the distinct sibling pair types of monozygotic twins, dizygotic twins, full siblings, and half siblings. Additionally we regressed the subdomain scores against the degree of genetic material shared between siblings (Identity-by-Descent) to confirm genetic influence on a subdomain and localize the relevant genomic regions.

**Results:** In the AGRE cohort only the Reciprocal Social Interaction (RSI) subdomain was consistent with exclusively genetic influence, whereas the Restricted Repetitive and Stereotyped Behavior (RRSB) subdomain was consistent with exclusively environmental influence, and the Communication (COM) subdomain was consistent with both genetic and environmental influences. For the SPARK cohort the RSI subdomain of the SCQ was again the subdomain under strongest genetic influence, but the RRSB subdomain also showed significant genetic influence.

**Conclusions:** Different subdomains of the ADIR and SCQ are under different degrees of genetic influence. By regressing on the subdomain severity scores we recovered sufficient statistical power to localize chromosomal regions with a direct and specific effect on the subdomain of RSI in AGRE, and RSI and RRSB in SPARK. While the primacy of genetic influence on the RSI subdomain was replicated in both cohorts, the divergent results for RRSB suggest that the SPARK cohort contains a broader array of ASD subtypes than AGRE.

**412.151 (Poster) Maternal Cortisol Predicts Child Cortisol in Autism Spectrum Disorder and Fragile X Syndrome**

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**Background:** The hypothalamic-pituitary-adrenal (HPA) axis is a biological pathway implicated in stress regulation and anxiety, wherein cortisol is released during stress. Relative to typically developing (TD) peers, children with Autism Spectrum Disorder (ASD) and Fragile X Syndrome (FXS) have abnormal salivary cortisol responses (Hessl et al., 2002; Scherr et al., 2016; Taylor & Corbett, 2014). Children with ASD and FXS also experience increased anxiety (Cordeiro et al., 2011; White et al., 2009), and their mothers report elevated stress and anxiety (Bailey Jr et al., 2008; Baker-Ericzen et al., 2005). Further, HPA axis regulation is heritable (Federenko et al., 2004), and parental stress is epigenetically linked to child stress responses (Bowers & Yehuda, 2016). Although parental cortisol is associated with TD child cortisol through physiological attunement (Hibel

et al., 2015; Spratt et al., 2016), little is known how parent-child cortisol associations differ in ASD or FXS, despite maternal and child high vulnerability to stress.

**Objectives:** To determine if maternal cortisol predicted ASD, FXS, and TD child cortisol.

**Methods:** Salivary cortisol was collected from 97 mother-child dyads before and after assessments measuring temperament, developmental skills, and ASD. Thirty-five children had ASD ( $\bar{x}$  = 44.64,  $s$  = 6.11 months), 28 had FXS ( $\bar{x}$  = 44.22,  $s$  = 6.29 months), and 34 were TD ( $\bar{x}$  = 44.22,  $s$  = 34 months). Salivary cortisol was collected via salivettes at approximately the same time of day. Cortisol values were natural log transformed and outliers  $>2$  SD were removed (Adam & Kumari, 2009; Hanrahan et al., 2006). Three regression models assessed the relation between maternal and child cortisol. Models included interactions between child diagnosis and maternal cortisol, controlling for nonverbal IQ and saliva collection time. Three models examined child cortisol levels pre-assessment (T1), post-assessment (T2), and cortisol regulation (T2-T1), using the corresponding maternal cortisol levels as predictors.

**Results:** Maternal cortisol significantly predicted child cortisol across groups ( $b$  = 0.594,  $p$  = 0.010; figure 1A) at pre-assessment but not at post-assessment ( $b$  = 0.139,  $p$  = 0.516; figure 1B). Across all groups, maternal cortisol regulation significantly predicted child cortisol regulation ( $b$  = 0.721,  $p$  = 0.001), and there were two significant group effects. Relative to the TD group, a 10% increase in maternal cortisol regulation predicted a 7.19% decrease in child cortisol regulation for the ASD group ( $b$  = -0.719,  $p$  = 0.007). Likewise, relative to the TD group, a 10% increase in maternal cortisol regulation predicted a 7.37% decrease in child cortisol regulation for the FXS group ( $b$  = -0.737,  $p$  = 0.016; figure 1C).

**Conclusions:** Initially, maternal cortisol predicted child cortisol across groups, suggesting that children were attuned to their mothers' cortisol levels. However, this relation ceased for children with ASD and FXS, as they showed a similar lack of cortisol regulation attunement, suggesting that while TD children took cues from their mothers regarding stress, children with ASD and FXS struggled to do so. This finding expands the HPA axis dysregulation literature in children with ASD and FXS from individualistic to dyadic via parent-child cortisol misattunement.

#### 412.152 (Poster) Neurowes-Macedonia: Gene Discovery and Precision Medicine in Ndd

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**Background:** Neurodevelopmental disorders (NDD) are a broad group of conditions which includes Autism Spectrum Disorders (ASD), intellectual disability (ID), language delay, and epilepsy. NDDs are genetically heterogeneous, with all possible inheritance patterns involved. Paralleling the genetic heterogeneity, there is a huge clinical diversity that is a major confounding factor when analyzing whole exome sequencing (WES) data

**Objectives:** To improve WES diagnoses in NDD cases exploiting a detailed clinical characterization, X-chromosome inactivation (XCI) profiles, epigenetic signatures and cellular models

**Methods:** We collected and deeply phenotyped 212 pediatric NDD cases from Macedonia (NeuroWes-Macedonia) affected by ASD/ID (82/212; 39%), complex syndromes (74/212; 35%), and isolated ASD (55/212; 26%) and performed trio-WES within the international network of Autism Sequencing Consortium (ASC). We performed XCI using an in-house protocol. Epigenetic signatures will be tested in blood, in collaboration with the EpiSign consortium (Ontario, Canada). We are using stem cells from deciduous teeth (SHED) as an *in vitro* cellular model, and a yeast strain lacking *AARS1* orthologue

**Results:**

Currently, we analyzed 151 NDD trios. We found pathogenic/likely pathogenic variants in 39 (26%), with the highest diagnostic rate among syndromic cases (21/44; 47%), and the lowest in isolated ASD/ID cases (3/31; 9%).

To increase the diagnostic yield, we tested XCI skewing in unsolved affected females and mothers of affected males. In a three boys (3/15; 33%), whose mothers were 100% skewed, we found variants in strong novel gene candidates, previously overlooked by trio-WES analysis, such as *ZMYM3*:R441Q, *PDZD4*:K730N, and *AMOT*:G343R. We used a combination of cDNA/minigene analyses to verify the effect of several splicing variants on transcripts, such as *WDFY3*: c.8098-1G>C, which led to activation of cryptic splice site, and *KIAA1109*: c.9283-8T>G which caused an exon skipping; notably this latter variant did not change splicing scores, and was evaluated only because of the strong phenotypic association with the *KIAA1109* gene.

In cases (9/46; 19%), where causative or variants of uncertain significance are in genes encoding proteins of chromatin-remodeling pathways, we planned to test their "epigenetic signature" in blood. We aim at confirming the functional role of variants in exceedingly rare disease-associated genes such as *HIST1H1E*, *EZH2*, *HDAC8*, and *PHF6*.

Notably, we found two cases with a dual multilocus molecular diagnosis, and one family with two different *de novo* variants, as *TRIP12*:L1044Ffs\*3, and the recurrent *FBN*:A1728V in two similarly affected brothers.

Beyond known genes, we have also found strong novel candidate genes: *PHLPP1* (\*609396), encoding a phosphatase inhibiting the AKT-mTOR pathway. Using patient derived SHED, we initially proved a functional alteration of the AKT-mTOR pathway. A second candidate was *AARSD1* (\*613212), encoding an alanyl-tRNA editing activity protein, highly related to brain myelinations processes. A yeast model proved a growth impairment associated with the missense variant found in our patient

Conclusions: Trio-WES analyses are greatly improved by a deep phenotyping which can reveal overlooked pathogenic variants, dual molecular diagnoses, and novel NDD-associated genes. Our experience also suggests that the use of XCI, blood episinature and cellular models is a key strategy to solve undiagnosed NDD cases and overcome clinical complexity

#### **412.153 (Poster)** Obesity and Genetic Predisposition in Individuals with Complex Neurodevelopmental Phenotypes

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Background: Obesity remains a growing public health concern and research continues to demonstrate the interplay between genetic and environmental contributions to its etiology. Higher rates of obesity are reported in populations with autism spectrum disorders (ASD)<sup>1</sup>. While several well-established monogenic causes of obesity are also linked to autism, a knowledge gap remains on genetic determinants of obesity in neurodevelopmental phenotypes.

Objectives: Identify genetic predispositions in individuals with complex neurodevelopmental phenotypes associated with obesity.

Methods: A cohort of individuals that underwent a genetic evaluation between 2000-2018 with a peak age distribution between 1-5 years presenting with developmental delay/ID and/or autism were assessed. In the total sample, the proportion of males was 69% compared to 31% females. We identified 25% of individuals with a body mass index (BMI) or weight percentiles greater than 95%. Of these cases, those with genetic variants on testing (Fragile X, chromosomal microarray (CMA), clinical exome sequencing (CES), single gene/panel) were analyzed for novel and established genetic predisposition to obesity phenotypes.

Results: Within the total cohort, the completed testing breakdown was: 42% CMA, 24% Fragile X, 14% karyotype/FISH, 10% CES, and 10% single gene testing. The proportion of rare variants varied across testing modality for Fragile X (0%), CMA (30%), CES (56%) and other testing (26%). The genetic variants identified included well-established genetic predispositions associated with obesity, including uniparental disomy and microdeletion of 15q11.2 (Prader-Willi syndrome), 17p11.2 deletion (Smith-Magenis syndrome), 7q11.23 duplication, 22q11.2 deletion, XYY, and variants in *ATRX*, *LRP2*, and *TUBA1A*. In addition, we identified rare variants not previously associated with obesity. These include single variants within *KCND3*, *LMTK2*, *GNB1*, *DYNC1H1*, *NLGN1*, *TCF12*, *PTEN*, and *IDH2* and CNVs (Xp22.33 duplication, 8p11.21p11.1 duplication, 10q23.31 deletion, 14q11.2 microdeletion, 20p12.3 deletion, 2q13 deletion, 15q13.1q13.2 deletion, 8q23.1 duplication, 2q24.3 deletion, partial tetrasomy in chromosome 21) not previously associated with obesity.

Conclusions: We confirmed previous associations between genetic variants and obesity in individuals with ASD and/or developmental delay and reduced the knowledge gap of novel rare genetic variants associated with obesity. We demonstrate the utility of elevated BMI as a phenotypic marker for identifying individuals with neurodevelopmental differences and likelihood of a genetic etiology. While barriers in access to genetics care are evident, our findings present opportunities for providing personalized care interventions that promote the physical health of individuals with neurodevelopmental phenotypes and obesity through inclusion of a genetic evaluation.

1. Zheng Z, Zhang L, Li S, Zhao F, Wang Y, Huang L, et al. Association among obesity, overweight and autism spectrum disorder: a systematic review and meta-analysis. *Scientific Reports*. 2017;7(1):11697.

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#### **412.154 (Poster)** Pupillary Light Reflex As an Objective Biomarker in Children with Phelan-Mcdermid Syndrome and Autism Spectrum Disorder

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Background: Phelan-McDermid syndrome (PMS) is a neurodevelopmental disorder caused by terminal deletion or sequence variation affecting chromosome 22q, resulting in haploinsufficiency of the *SHANK3* gene. Individuals with PMS are at high risk for developing autism spectrum disorder (ASD); the *SHANK3* pathway, which codes for a protein found in the postsynaptic density of excitatory synapses, may be relevant to other forms of ASD (Costales & Kolevzon, 2015). Both individuals with idiopathic ASD and individuals with PMS show signs of sensory reactivity abnormalities. Pupillary Light Reflex (PLR) is an acetylcholine-mediated response that has been studied as a possible metric for the cholinergic



system, which plays a role in excitatory-inhibitory (E/I) balance (Nyström et al., 2018). Previous research has found evidence of differences in PLR in infants at risk for ASD and children with ASD (Nyström et al., 2015; Daluwatte et al., 2015).

**Objectives:** This study used an eye-tracking paradigm to explore PLR as a potential measure of E/I imbalance and sensory abnormalities in PMS and ASD. Based on previous research implicating E/I imbalance in PMS and ASD, we hypothesized that PLR would be different in individuals with ASD and PMS relative to typically developing controls.

**Methods:** Forty-four children participated, including 17 children with ASD ( $M_{age}=7.29$  years; 3 Female), 14 with PMS ( $M=8.07$ ; 10 F), and 13 typically-developing (TD) controls ( $M=9.06$ ; 9 F). The task used an Eyelink 1000-Plus eye tracker and measured pupil response to a brief (100ms) flash of light across 16 trials. Peak pupil contraction and latency of reflex onset were the primary measures.

**Results:** Peak pupil contraction was significantly smaller in PMS ( $M=-3.01$ ,  $SD=22$ ) relative to TD controls ( $M=-3.13$ ,  $SD=.10$ ;  $p=.03$ ). Peak contraction in ASD was not significantly different than in TD controls ( $p>.1$ ), but it did trend toward being smaller (Cohen's  $d=.46$ ). Peak contraction in PMS trended toward being smaller than in ASD ( $M=-3.08$ ,  $SD=.11$ ; Cohen's  $d=.47$ ) although this difference did not reach statistical significance ( $p>.1$ ). No significant differences were found in latency of reflex between any groups ( $p>.1$ ).

**Conclusions:** These results support prior findings of E/I dysregulation in individuals with PMS and suggest that PLR may be a useful metric in measuring these imbalances in PMS and similar disorders affecting the glutamatergic systems. Smaller peak contraction might indicate that sensory abnormalities in PMS and ASD are associated with decreased cholinergic modulation. The lack of significant results in ASD may indicate changes in PLR from infancy to childhood and suggests that more research is needed to fully understand the reflex in this population. Given that eye-tracking is non-invasive, measures of PLR may have the potential to be a biomarker used to study treatment of PMS, genetic disorders with high susceptibility to ASD, and other neurodevelopmental disorders.

#### **412.155 (Poster) Stochastic Epigenetic Mutation Burden in Autism Spectrum Disorders**

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**Background:** Despite the relative abundance of genomic data in autism spectrum disorders, little is known about the impact of epigenetic modification. Most studies focused on general differences in methylation levels in specific genes expressed in the brain and encoding protein that interacts with those involved with the development of ASD. To the best of our knowledge, there is no data on stochastic epigenetic mutations, that are extreme differences in DNA methylation levels that are not shared among subjects.

**Objectives:** The present study aims to evaluate epigenetic drift and stochastic epigenetic mutation (SEM) burden in ASD.

**Methods:** We selected epigenome-wide association studies (EWAS) data available in the literature from samples originated from different human tissues (blood and buccal tissues). The distribution and variability of methylation levels in the studied data samples were studied using Box-and-whiskers plots in order to identify SEMs. For each probe, whenever the methylation level of one subject extremely differed from the rest of the population, we considered the outlier sample as epimutated for that locus. Thus, for each locus epimutated subjects were identified as the extreme outliers with methylation level exceeding three times interquartile ranges  $Q1-(3 \times IQR)$  and  $Q3+(3 \times IQR)$ . SEMs were calculated on 96 individual buccal tissues and on 102 blood samples.

**Results:** The burden SEMs was divided into hypo or hypermethylated groups and compared between ASD subjects and controls. The ASD group showed a significant higher number of total SEMs and of hypomethylated SEMs compared to controls both in the mouth tissue and in blood. This finding was still significant after correction for age and gender.

**Conclusions:** ASD subjects presented a higher number of epimutations compared to controls. This could represent a marker of early aging in this group.

#### **412.156 (Poster) Investigation of Genetic Factors Contributing to the ASD Subphenotype Disproportionate Megalencephaly**

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**Background:** Among autistic individuals, a subphenotype with brain enlargement disproportionate to height (autism with disproportionate megalencephaly – ASD-DM) seen at 3 years of age is associated with co-occurring intellectual disability and poorer prognoses later in life. However, little is known about the genetic factors contributing to ASD-DM.

**Objectives:** In this study we aim to identify additional ASD-DM associated genes to better define the genetic etiology of this subphenotype of autism.

**Methods:** We identified *de novo* variants potentially contributing to ASD-DM using trio and quad whole genome sequencing data including 11 families from the MIND Institute's Autism Phenome Project (APP) and 89 families from the Simon's Simplex Collection (SSC) cohorts. We validated a subset of proband-identified loss-of-function variants on head-size phenotypes by generating knockout zebrafish using CRISPR gene-editing technology and automated morphometric imaging and analysis enabled by the VAST Bioimaging System.

Results: Through this analysis we have identified multiple genes previously associated with ASD-DM including CHD8, PTEN, and KMT2E. Identified loss-of-function variants include 16 SNVs and 1 duplication, overlapping a total of 18 genes. These genes are enriched for GO biological processes known to be disrupted in ASD, including cell cycle processes and histone proteins. To date, we have tested six putative ASD-DM genes using this pipeline, including *PAX5*, *SCP2*, *RPS6KA*, *YTHDF2*, *HEPACAM2*, and *FAM91A1*. Through screening thousands of larvae, we found two out of six putative ASD-DM genes tested show a head-size phenotype in our model system. This includes the gene *YTHDF2*, which we identified as partially duplicated in an ASD-DM proband, and inversely found that a deletion of this gene in a zebrafish knockout model leads to microcephaly.

Conclusions: The genes identified in this study represent promising putative candidate genes, enabling further advancement in the identification of relevant disease pathways, potential genetic therapy targets, and early detection markers in ASD-DM.

## VIRTUAL POSTER SESSION — GENETICS

### 512 - Genetics --- (V)

**512.099** (*Virtual Poster*) Association between Imputed Gene Expression for Selected Brain Tissues and IQ in Individuals with Autism Spectrum Disorder

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Background: To date, gene expression studies for autism spectrum disorder (ASD) have identified major gene pathways, including synaptic function and WNT signalling, involved in ASD mechanisms (Quesnel-Vallières et al. 2019). However, there are major barriers in ASD research using the gene expression approach: one is the small sample size of available gene expression data, and the other is the difficulty in obtaining gene expression data from brain tissues.

Objectives: The purpose of this study is to explore the relationships between the imputed gene expression levels for five selected brain tissues and IQ using ASD individuals. General cognitive ability, as measured by IQ, is one of the ASD-related phenotypes because many ASD patients also have intellectual disability. The genes for IQ scores may overlap with the genes that affect the severity of ASD.

Methods: This preliminary study used ~35,086 genetic markers from chromosome 9 (generated using the Illumina Human 1M-single Infinium BeadChip or Human 1M-duo BeadChip) and three IQ measures (verbal, performance and full scale IQ scores based on the Wechsler Intelligence Scale for Children-III) in 1,157 cases with European descent from the Autism Genome Project (AGP) Consortium.

Genotype imputation was conducted using the Sanger Imputation Service with the Haplotype Reference Consortium data as the reference panel. The imputed and original genetic markers were then matched with the expression quantitative trait loci (eQTL) from the Genotype-Tissue Expression Database (GTEx v8). Five brain tissues, caudate (basal ganglia), cerebellum, cortex, frontal cortex, and hypothalamus, from GTEx were selected. The expression levels of genes for our AGP data were predicted using the overlapping GTEx eQTL weights and the program PrediXcan ((predict.py). The predicted gene expression levels were associated with IQ using PrediXcanAssociation.py.

Results: Of the 1,157 ASD cases, 85% are male with mean IQ scores of 82-86 (range 23-155 for 481-711 individuals) for the three different IQ measures. After genotype imputation and quality control, 292,852 genetic markers with minor allele frequency >1% were used to match with the GTEx eQTLs.

For the five brain tissues, we were able to match 52-54% of the eQTLs and obtained the imputed gene expression levels for 359 to 395 genes. After correction for multiple testing, one long intergenic non-protein coding RNA (LINC01235) which was expressed in the cerebellum was significantly associated with verbal IQ ( $p=0.00001$ ). For this gene, as the expression of LINC01235 in the cerebellum increased, the verbal IQ score decreased.

Conclusions: LINC01235 was previously associated with tumour progression and worse prognosis in gastric and breast cancer. The role of LINC01235 in ASD or intellectual disability is unknown. The results from this study show that LINC01235 could be a new gene for IQ in ASD individuals. Further investigation is needed to validate the relationship between LINC01235 and IQ and between LINC01235 and ASD using an independent dataset.

**512.100** (*Virtual Poster*) Autism Symptoms in Children and Adolescents with Fragile X, Angelman Syndrome, Tuberous Sclerosis Complex and Neurofibromatosis Type 1: A Cross-Syndrome Comparison

**K. Lubbers<sup>1,2</sup>**, **G. C. Dieleman<sup>1,2</sup>**, **E. M. Stijl<sup>1,2</sup>**, **D. A. Hagenaar<sup>1,2</sup>**, **L. W. ten Hoopen<sup>1,2</sup>**, **J. S. Legerstee<sup>1,2</sup>**, **P. F. de Nijs<sup>1,2</sup>**, **A. B. Rietman<sup>1,2</sup>**, **K. Greaves-Lord<sup>1</sup>**, **M. H. J. Hillegers<sup>1</sup>**, **B. Dierckx<sup>1,2</sup>** and **S. E. Mous<sup>1,2</sup>**, (1)Child and Adolescent Psychiatry/Psychology, Erasmus MC-Sophia Children's Hospital, Rotterdam, Netherlands, (2)ENCORE expertise center, Erasmus MC-Sophia Children's Hospital, Rotterdam, Netherlands

Background: Autism spectrum disorder (ASD) is a common comorbid disorder in various genetic syndromes. The etiology of ASD remains unclear, due to its heterogenic genetic origin and the heterogeneity in symptoms across individuals.

Objectives: This study aims to compare ASD symptomatology in syndromes with a known genetic origin, in order to reveal syndrome specific vulnerabilities that may serve as targets for early intervention and provide insight into the genetic pathways that underlie ASD.

**Methods:** We assessed ASD symptom severity in four groups of children/adolescents (aged 2-26 years) with syndromes that have high ASD comorbidity: Fragile X Syndrome (FXS, n=53), Angelman Syndrome (AS, n=74), Neurofibromatosis Type 1 (NF1, n=254) and Tuberous Sclerosis Complex (TSC, n=97), using the Autism Diagnostic Observation Schedule (ADOS) and the Social Responsiveness Scale (SRS). Assessments were part of routine clinical care and performed in all children seen at the ENCORE expertise center in Rotterdam, the Netherlands. We compared the syndrome groups to an idiopathic ASD group on total severity scores and subscale scores using a MANCOVA.

**Results:** Total scores and the percentage ADOS and SRS ASD classifications were highest for the FXS-group and lowest for the NF1-group. When including individuals with an ASD classification only, overall ASD severity was higher in the FXS and TSC groups than in the AS-group. Syndrome specific strengths and weaknesses included a relative weakness in AS for the creativity/play subscale (highest of all groups) and the reciprocal social interaction subscale (higher than NF1). Contrarily, the AS group showed a relative strength in the Social cognition, communication and motivation domains of the SRS compared to the FXS and TSC groups. NF1 showed a relative strength on the restricted interests and repetitive behavior scale (lowest of all groups).

**Conclusions:** Comparing the groups at subscale level revealed syndrome-specific strengths and weaknesses that would have gone unnoticed by looking solely at classifications or summary calibrated severity scores. Our findings underline the relevance of comparing ASD symptoms across syndromes and highlight the need for syndrome-specific ASD interventions.

#### **512.101 (Virtual Poster) Evaluation of Polygenic Risk Score Performance for ASD in High Risk Sibling Cohorts**

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#### **Background:**

Longitudinal High Risk Sibling cohorts for Autism Spectrum Disorder (ASD) capture etiologically relevant developmental periods, and are likely to result in an enhanced number of observed cases, boosting statistical power. Incorporation of polygenic risk scores for ASD (ASD-PRS) in high-risk cohort studies can improve etiologic insights and prediction. Yet, ASD-PRS, derived from well-powered ASD GWAS results, have only been applied in the general population. Performance in high familial risk cohorts has yet to be investigated.

#### **Objectives:**

We derived ASD-PRS across three enriched-risk cohorts: the Early Autism Risk Longitudinal Investigation (EARLI) study, the Infant Brain Imaging Study (IBIS) and the Markers of Autism Risk in Babies Learning Early Signs (MARBLES) Study. All three are part of the Baby Siblings Research Consortium (BSRC). We use a pruning and threshold approach, and pooled studies to evaluate performance with ASD. We also associated ASD-PRS with the Mullen Scale or Early Learning (MSEL), a measure of childhood learning and IQ, and total score on the Social Responsiveness Scale (SRS), a measure of social ability in the general population.

#### **Methods:**

Genotyping was performed on 5M Illumina arrays for EARLI and IBIS, and the Mega Illumina array for MARBLES. After QC procedures, we imputed via the UMichigan server to the 1000G v5 reference panel. ASD-PRS was derived using PGC\_iPSYCH discovery results,<sup>1</sup> scored in PLINK for a range of discovery p-value thresholds, and standardized within each cohort. Associations with ASD status were assessed by logistic regression, accounting for sex, genetic ancestry, maternal education, maternal age at birth, and cohort membership. For MSEL and SRS, we combined ASD and typically developing siblings to perform linear regression, adjusting for the same covariates and including a term for ASD status.

#### **Results:**

Pooling data for high familial risk siblings across the three enriched-risk cohorts (71 ASD and 375 unaffected siblings), we find a suggestive association for ASD-PRS (discovery p-value threshold=0.10) with ASD. Contrasting the highest quintile for ASD-PRS with the bottom four quintiles, the increased odds for ASD is 1.7 (95%CI: 1.3,2.2; p=0.076). Combining the ASD and unaffected sibs while adjusting for ASD status, we also found a significant association of ASD-PRS at this same discovery threshold level with total score on the Mullen Scales of Early Learning (MSEL), such that an increase of one standard deviation unit in the ASD-PRS results in an average decrease of 2.1 points on the MSEL (95%CI: -3.6, -0.47; p=0.0114). No significant or suggestive results were found for SRS.

#### **Conclusions:**

We harmonize an ASD-PRS in three enriched-risk cohorts and show that it behaves intuitively as a tool for predicting ASD risk in this context, though we are underpowered due to sample size. Future efforts will expand our sample to include ASD probands and additional high familial risk siblings from other BSRC sites. Our increased sample size will also allow us to explore non-typically developing siblings and we plan to consider other ASD related traits, including behavioral and cognitive measures.

**512.102 (Virtual Poster)** Examining Quantitative Behavioral Phenotypes and Likelihood of Neurodevelopmental Conditions in Individuals with and without NRXN1 Gene Variants

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**Background:** Neurexins are presynaptic membrane proteins that are important to synaptic organization and function in the brain. Of the three neurexin genes in humans, *NRXN1* has been associated with several neuropsychiatric and neurodevelopmental disorders, including autism spectrum disorder (ASD) (Cuttler et al., 2021). Previous studies of human *NRXN1* variants have focused on categorical phenotypes (presence or absence of a diagnosis or behavior) (Bena et al., 2013; Dabell et al., 2013; Shehhi et al., 2019). Variability in *NRXN1*-associated phenotypes may be better captured using quantitative (dimensional) behavioral measures, in addition to categorical diagnoses.

**Objectives:** We aimed to characterize the phenotypes of individuals with *NRXN1* variants in a preliminary sample across several ASD-related behavioral dimensions as well as with likelihood for several common neurodevelopmental conditions.

**Methods:** Through the Autism Spectrum Program of Excellence, we have recruited individuals with *NRXN1* variants and their family members without *NRXN1* variants. In this preliminary sample, we identified 106 individuals with *NRXN1* variants based on either external genetic reports or by whole genome sequencing in our study. For family members (n = 22), their membership in the *NRXN1* variant / non-variant group was confirmed by internal whole genome sequencing only. All participants completed a battery of questionnaires covering multiple ASD-related dimensions, including overall ASD traits, social anxiety, executive functioning, the broad autism phenotype, and self-reported medical conditions and psychiatric diagnoses. Quantitative phenotypes for those with *NRXN1* variants and their family members without *NRXN1* variants were compared using the non-parametric Wilcoxon signed rank test. The impact of *NRXN1* variants on risk for selected psychiatric diagnoses (ASD, speech delay, motor delay, and epilepsy) was evaluated using chi-squared tests.

**Results:** While individuals with and without *NRXN1* variants (including intronic deletions, exonic deletions, and single nucleotide variants) appear to differ in quantitative phenotypes (Figure 1), none of these differences were significant in our preliminary sample. However, the difference in neurodevelopmental diagnoses was clear. Those with a *NRXN1* variant were more likely to have ASD ( $\chi^2(1, N = 120) = 11.28, p < 0.001$ ), speech delay ( $\chi^2(1, N = 120) = 16.12, p < 0.001$ ), and motor delay ( $\chi^2(1, N = 120) = 10.82, p < 0.01$ ). They were not more likely to have epilepsy ( $\chi^2(1, N = 120) = 2.18, p > 0.05$ ) than their family members without a *NRXN1* variant.

**Conclusions:** In our preliminary sample, categorical differences in psychiatric diagnoses based on *NRXN1* variants were clear, but quantitative differences in ASD-related phenotypes were not yet significant. Recruitment and data collection are still ongoing, and our goal is to balance the sample sizes to have greater power to identify quantitative phenotype differences. This ongoing study promises to provide further insight into aspects of the ASD phenotype that are associated with *NRXN1* variants.

**512.103 (Virtual Poster)** Inheritance Matters: Comparing Risk of Familial and De Novo CNVs for ASD

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**Background:**

Intellectual disability (ID) is characterised by significant limitations in cognitive functioning and adaptive behaviour and is often associated with behavioural and mental health problems at all life stages. Copy number variants (small structural chromosome changes; CNV) account for 14% of ID and some are associated with increased risk of psychiatric illness. CNVs can be newly occurring (*de novo*) or inherited (familial). ASD is associated both with ID and with genetic anomalies such as CNV.

**Objectives:**

This study compares the behavioural phenotype of children with ASD, recruited in a national UK study of ID of genetic aetiology, by genetic variant inheritance (*de novo*/familial).

**Methods:**

IMAGINE-ID is a national UK study of children with ID of known genetic origin that aims to identify genotype-phenotype risk. Our focus here is on those children (4-19 years) whose condition is due to a pathogenic Copy Number Variant (CNV). Children and young people (5 -19 years) were

ascertained from NHS Regional Genetics Centres, to which they had been referred for microarray testing because of early developmental delay. The Development and Wellbeing Assessment (DAWBA), the Strengths and Difficulties Questionnaire (SDQ) and the Adaptive Behaviour Assessment System (ABAS-3) were administered to caregivers. The DAWBA is a comprehensive diagnostic interview, which has been used in several national studies of children's mental health in the UK. The reliability of diagnostic decision making was established in collaboration with the national study team.

#### Results:

1,634 IMAGINE-ID children with a CNV participated in this analysis. 30.1% variants were *de novo*, 32.4% variants were familial and 37.5% variants were of unknown inheritance. For those where inheritance could be determined (n=1021) 58% were male and the mean age at ascertainment was 8.8 years (SD 3.8).

The proportion of children meeting diagnostic criteria for an ASD was substantially higher among those with a familial CNV (45.7%) compared to those with a *de novo* CNV (28.7%; RR 1.6;  $p<.0001$ ). We compared these subgroups in terms of their physical health, adaptive function, behavioural difficulties and co-occurring neuropsychiatric disorders. Measures of physical disability and adaptive function were similar in the two groups of children, but those whose ASD was associated with a familial CNV had significantly more behavioural/emotional difficulties (SDQ total scores) than those with a *de novo* variant ( $p<.0001$ ). Children with a familial variant were also more likely to have a conduct disorder than those with a *de novo* variant ( $p=.02$ ). No difference in the co-occurrence of emotional disorders or hyperactivity disorders by inheritance was observed.

#### Conclusions:

Familial CNVs that cause intellectual disability are significantly more likely to be associated with ASD than *de novo* CNVs. ASD associated with a familial variant has greater comorbidity in terms of behavioural difficulties and conduct disorders. The aetiology of this increased risk is not known, but the observation has important implications for management and genetic counselling.

#### **512.104** (Virtual Poster) Molecular Functions of ID/ASD-Associated MYT1L in CNS Development

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**Background:** Human genetic studies have identified heterozygous mutations on Myelin Transcriptional Factor Like 1 (MYT1L) as the cause for ID/ASD-related MYT1L Syndrome. MYT1L is a pro-neuronal transcriptional factor whose overexpression along with BRN2 and ASCL1 can directly reprogram fibroblasts into neurons. Although many *in vitro* studies suggest that MYT1L mainly suppresses non-neuronal gene expression and cell proliferation to facilitate neuronal differentiation, recent *in vivo* studies utilizing the MYT1L knockout mouse model propose an opposite role for MYT1L as primarily an activator. Given that most MYT1L DNA binding studies have been performed in the overexpression system and limited data were generated *in vivo*, MYT1L's targets and how it regulates these target genes' expression under physiological conditions are largely unknown. Furthermore, MYT1L's molecular functions across different developmental time points and the mechanisms underlying MYT1L Syndrome etiology have not been well established.

**Objectives:** This study aims to identify ID/ASD-associated MYT1L targets *in vivo* and explore how MYT1L regulates the expression of target genes in different developmental time points and brain regions. Meanwhile, utilizing the MYT1L knockout mouse, the study tries to understand how MYT1L loss of function (LoF) contributes to disease pathogenesis.

**Methods:** We adapted Cleavage Under Targets and Release Using Nuclease (CUT & RUN) technique to map MYT1L DNA binding sites in mouse embryonic cortex, adult prefrontal cortex, and adult hypothalamus. Then, we compared MYT1L targets with published or newly generated RNA-seq and ATAC-seq on MYT1L knockout mouse datasets from corresponding time points and brain regions. This comparison allows us to dissect MYT1L's direct and indirect impacts on gene expression and shed light on mechanisms underlying disease phenotypes.

**Results:** We identified highly confident MYT1L DNA binding targets in the mouse embryonic cortex, adult prefrontal cortex, and adult hypothalamus. Although MYT1L appears to have many distinct targets at different developmental time points and brain regions, it shares some common ones related to neurodevelopment. Utilizing the MYT1L knockout mouse line, we also found MYT1L LoF alters its targets chromatin accessibility and corresponding genes expression. We further demonstrated such dysregulation affects cellular and circuit functions potentially associated with many disease phenotypes.

**Conclusions:** Our study revealed ID/ASD-associated MYT1L's molecular functions across development and brain regions in terms of DNA binding, chromatin accessibility, and transcriptional regulation *in vivo*. Meanwhile, we provided insights into the mechanisms by which MYT1L LoF leads to various phenotypes related to human MYT1L Syndrome.

#### **512.105** (Virtual Poster) Visual and Ocular Phenotypes in Neurodevelopmental Genetic Syndromes Associated with Autism Using Electronic Health Records

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**Background:** Atypical visual perception, such as ‘seeing the trees instead of the forest’, has been frequently documented in autism spectrum disorder (ASD) and is generally attributed to atypical brain function. However, relatively little research has characterized optometric anomalies in ASD, which may indicate atypical morphology or function of the eye, rather than the brain. Increased prevalence of refractive errors and optic nerve abnormalities in ASD have been found in a few studies with small sample sizes. One study used medical claims and electronic health record (EHR) data in a large sample and reported increased prevalence of ocular abnormalities in ASD patients. However, this one previous study determined ASD diagnoses from the EHR, rather than confirming ASD diagnoses with a clinical team with expertise in ASD diagnosis.

**Objectives:** In the current study, we establish visual and ocular phenotypes in patients with diagnoses conferred at an autism and neurodevelopmental clinic that is housed within an integrated health system. An integrated health system promotes coordinated care, facilitated by a shared EHR, and allows patients to receive general and specialty care within one system. We leverage these comprehensive patient EHRs to assess visual anomalies using existing optometry and ophthalmology records in a cohort of patients with confirmed ASD diagnoses, including clinical genetic screening results.

**Methods:** We evaluated the presence of atypical ocular features via manual chart review of EHR data in 563 patients (ages 3-21) across 3 groups: n=210 neurodevelopmental probands with a genetic syndrome associated with ASD (ND-ASD; e.g. 16p11.2 deletion, 15q11.2-q13.1 duplication and 22q11.21 duplication), n=156 with ASD diagnoses with no known genetic cause, and n=197 age and sex matched healthy controls (HC). We characterized ocular symptoms using a rubric based on the presence/absence of ocular features including including visual acuity, near visual function, refractive errors, atypical accommodation, stereopsis/oculomotor function, retinal function/structure, and photosensitivity/pupil response.

**Results:** Associations between ocular features and diagnostic group was assessed via Chi-squared with appropriate follow-up tests for group comparisons. See results reported in Figure 2. We find increased documentation of ocular features in ND-ASD probands as compared to both ASD and HC, including amblyopia, astigmatism and features of atypical accommodation ( $p$ 's<0.0140); strabismus ( $p$ 's<0.0008); and esotropia ( $p$ 's<0.0032). Additional analyses will focus on exploring whether individual differences in ocular impairment are associated with quantitative differences in ASD behaviors across diagnostic groups and describing ocular phenotypes within genetic syndromes in our patient cohort.

**Conclusions:** Results indicate that ocular and ophthalmologic anomalies are more frequently present in children with known genetic causes of ASD and neurodevelopmental features, with increased prevalence of specific ocular concerns of refractive errors and atypical oculomotor function. These results emphasize the importance of vision assessment in children with ASD, specifically in those pediatric patients with neurodevelopmental genetic syndromes. Our curation and description of specific ocular phenotypes in neurodevelopmental genetic syndromes may also lay the groundwork for linking brain-gene-behavior relationships and identification of ASD subtypes. Further, our results highlight the feasibility of retrospective chart review and the use of EHR data for discovering novel phenotypes associated with ASD.

#### **512.106 (Virtual Poster) Whole Exome Sequencing of Indian Autism Spectrum Disorder Simplex Families Identifies Increased Burden of Inherited Variations**

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**Background:** Prevalence of Autism Spectrum Disorder (ASD) among Indian children below 10 years is varyingly estimated to be 1 in 88 to 1 in 400. ASD research in India has been limited to screening of few single nucleotide polymorphisms (SNPs). Globally, >10,000 ASD families have been sequenced contributing to the current knowledge on >1000 ASD associated genes. Despite displaying high inheritance, sequencing studies have emphasized *de novo* mutations (DNMs) as causal factors of sporadic ASDs. Studies addressing inheritance were conducted on concordant variants identified in multiplex families

**Objectives:** We hypothesized that subtle ASD traits in parents may accumulate overtime and cumulatively produce effects on probands. Thus, we performed the first trio Whole Exome Sequencing (WES) of 15 Indian simplex families of male ASD probands on Illumina HiSeq-platform with 100X coverage.

**Methods:** Data was processed in BWA, GATK and VarScan. Variants called were classified as DNMs or inherited/transmitted variants and annotated using VEP. To narrow-down on neuro-functional genes we devised a novel two-phased filtering strategy at the level of: (i) ‘variants’ to retain only truncating and splice variants, additionally non-synonymous SNPs predicted as damaging by more than 60% of the 25 SNP-effect prediction tools use; (ii) ‘genes’ to prioritize them based on their evolutionary and mutational sensitivity using a weighted scoring method involving Essential gene classification, Haploinsufficiency scores, Residual Variation Intolerance Score and Loss-of-Function scoring. Subsequently, functional enrichment, semantic similarity with high-confidence autism genes, protein-protein interaction and brain tissue expression analysis was performed to identify neuronally relevant genes.

**Results:** A total 17 DNMs across 17 genes were identified in 9 probands including previously known ASD genes- *TSC2*, *DEAF1*, *BRSK2* and *KCNK1*. Our custom weighted scoring picked novel strong-candidate DNM genes-*DOPEY1*, *ADCY1*, *RRS1* and *INO80* with neuronal functions. A total of 754 inherited genes were prioritized including 589 neuronal and behavioural genes, averaging 61 damaging genes per individual- although parents having passed Autism Quotient test. Probands carried an average of 6 strong-evidence ASD genes. Genes *USP45*, *HKDC1*, *CRAT* and *LRP2* carried variations in four subjects, 78 genes were recurrently mutated in more than two probands. Prominent PPI hubs were identified within gene-sets. Our robust genotype to phenotype correlation analysis has identified prominent behaviour genes- *CNTNAP2*, *WFS1*, *ANK3*, *CHD7*, *MYO7A*, *GABRB3* and *SPAST*. Sensory and motor function genes were frequently affected and were commonly inherited paternally. Brain tissue expression

analysis identified cluster of 95 prenatally up regulated genes enriched with neurodevelopmental roles such as axonogenesis, neurogenesis, neuron projection morphogenesis, synapse assembly etc., whereas post-natally over expressed genes were predominantly involved in neurotransmission, synaptic signaling, neurotransmitter receptor localization to postsynaptic specialization membrane etc.

Conclusions: Indian ASD families are heavily burdened by inherited variants than DNMs warranting further genetic studies in larger cohorts and investigation into broad autism phenotypes in ASD parents.

#### **512.107 (Virtual Poster)** 1M Genome Arrays May Not Provide High Quality Coverage for Some Top ASD Hits

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#### Background:

Genome-wide association (GWA) for ASD, in the Danish iPSYCH+PGC samples<sup>1</sup>, has identified 5 genome-wide significant loci among 88 top ranked sites that were carried forward for replication. Several smaller studies in populations of European ancestry have used these findings to derive a polygenic risk score (PRS) for ASD (ASD-PRS) and associate with ASD and related traits. However, information about top hits and genome-wide discovery variant representation are not provided, making interpretation difficult.

#### Objectives:

We determine coverage for the top 88 ASD hits from the iPSYCH+PGC GWA results among three enriched-risk cohorts of European and mixed ancestry samples: the Early Autism Risk Longitudinal Investigation (EARLI) study, the Infant Brain Imaging Study (IBIS) and the Markers of Autism Risk in Babies Learning Early Signs (MARBLES) Study. We report pooled single variant associations and information loss genome-wide for the ASD-PRS in these cohorts, based on 1000 genomes European data.

#### Methods:

The Mega (MARBLES) and 5M Illumina (EARLI, IBIS) SNP arrays were used for genotyping. After standard QC procedures, we imputed via the UMichigan server to the 1000g v5 reference panel. Coordinates and names for the 88 top discovery variants were pulled from Grove et al.<sup>1</sup> supplementary material. We used Ensembl to search for proxy SNPs ( $LD\ r^2 \geq 0.80$ ) and assessed for overlap with the clean array and imputed (filtered for  $r^2 > 0.80$ ) data for each study. The top discovery variant or proxy association with ASD was then tested in each cohort using logistic regression, adjusted for genetic ancestry, sex, maternal age and maternal education.

To determine potential loss of information in the ASD-PRS from unrepresented variants across the genome, we created a score in the 1000g samples using the full variant panel, and then created a cohort-specific score, again in the 1000g samples, but instead using only the variants surviving each cohort's post-imputation QC. We report correlations between the full and cohort-specific scores.

#### Results:

Coverage for 5M arrays (see Table 1) is about 60% and improves to 100% with imputation. The Mega array showed only 32% coverage, which improved to 93% with imputed data, leaving 6 of the 88 loci unrepresented. We successfully replicated rs78298487 (logodds=-1.05; pval=0.023) and rs4750990 (logodds=-0.50; pval=0.017); the latter SNP was also identified in a SPARK+iPSYCH meta-analysis.<sup>2</sup> Generally, limiting to samples of European ancestry improved power. The correlations between the full and cohort-specific scores range from 0.87 to 0.90.

#### Conclusions:

We show that coverage of top ASD variants is moderate on measured genotype arrays, but can be recouped for dense 5M chips; however, some loci remain unrepresented with smaller 1M chips, even with imputation. Two of the top ASD variants were successfully replicated in all cohorts. We also provide a metric to represent coverage for a genome-wide ASD-PRS, and show that coverage is high across 1M and 5M arrays, though there is some information loss due to lack of representation of discovery variants even with the imputed data. Current work examining PRS coverage for iPSYCH, GDA and GSA arrays will also be presented.

#### **512.108 (Virtual Poster)** Children with Sexual Chromosome Trisomies: Linguistic or Socio-Communication Impairment?

**Background:** Sex Chromosome Trisomies (SCTs) are genetic syndromes characterized by an additional sex chromosome. Individuals with SCT present a variable physical and neuropsychological phenotype with a high frequency of language delays or impairments. There is mixed evidence of increased rates of social-communication difficulties akin to the core symptoms of Autism Spectrum Disorder (ASD). However existing data are limited to self-report and parent-report measures in individuals over 4 years of age often recruited from clinical samples and therefore potentially prone to referral bias.

**Objectives:** The study examined autistic traits in SCTs, employing for the first time a direct observational measure of social-communication difficulties in toddlers with a prenatal diagnosis to minimise bias.

**Methods:** Participants were 15 children with prenatal diagnosis of SCT (4 males with Klinefelter syndrome, 5 males with XYY syndrome and 6 females with Triple X syndrome) and 15 typically developing (TD) children (9 males and 6 females) assessed at 18 and 24 months. A free play caregiver-child interaction with a standard toy kit suitable for a range of developmental play levels was videorecorded and ten consecutive minutes were rated with the Brief Observation of Social Communication Change (BOSCC). To check agreement, 22% of the corpus was independently rated by a second observer. The inter-rater reliability on the double-coded videos was good on the Total score (intraclass correlation coefficients, ICC = .71). Expressive language and developmental quotient (DQ) were assessed respectively with the MacArthur-Bates Communicative Development Inventory (MCDI) and the Griffiths Mental Development Scales (GMDS).

**Results:** Children with SCT did not differ from TD children for levels of autism symptoms on the BOSCC Total Score at 18 ( $p=.567$ ) or 24 months ( $p=.056$ ), but had significantly lower expressive vocabulary skills on the MCDI both at 18 ( $p=.035$ ) and 24 months ( $p=.008$ ) and a significantly lower DQ on the GMDS both at 18 ( $p=.003$ ) and 24 months ( $p=.001$ ). Table 1.

**Conclusions:** Our findings of lower linguistic and global developmental skills in children with SCT than in TD children are consistent with previous evidence. However, in our study children with SCT did not show a higher prevalence of autistic traits, when compared with TD children. The inclusion criteria (age and prenatal diagnosis of SCT) which should have reduced the referral bias and the use of a direct observation measure arguably explain our findings, which are in contrast with previous evidence of increased rates of ASD-like symptoms in this population. The results must be interpreted cautiously due to the small sample size. In conclusion, while evaluating the skills of children with SCT, possible social communication difficulties should be distinguished from linguistic impairments.

#### 512.109 (Virtual Poster) Kbg Syndrome: Prospective Videoconferencing and Use of AI-Driven Facial Phenotyping

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#### Background:

KBG syndrome is a rare condition affecting approximately 200 individuals to date, with potentially several others remaining undiagnosed due to its nonspecific and rare nature. Patients have genetic variants in the Ankyrin Repeat Domain 11 (ANKRD11) gene and present with skeletal abnormalities including short stature, intellectual disability, and various cardiac, neurological, and endocrine abnormalities. While those with KBG syndrome share similar facial phenotypic traits, the overall features are non-distinct, and the recent development of artificial intelligence facial recognition software can be considered as an adjunct to diagnosis.

#### Objectives:

We expand on a cohort of 25 individuals from 22 families with molecular diagnoses of KBG syndrome (20 truncating mutations and five with missense mutations). We present eight additional individuals, all with truncating mutations of the ANKRD11 gene. The focus is on quantifying the presence of disease phenotypes in each individual, ranging from neurological abnormalities (i.e., seizures) to abdominal migraines, with the goal of providing better recommendations to families and improving detection and treatment of KBG syndrome.

#### Methods:

All 33 participants gave IRB approved consent and were prospectively interviewed by a single physician over the course of eight months via videoconferencing. All interview videos and clinical charts provided by the families were analyzed for human phenotype ontology terms that were input into an open-source database, Human Disease Gene website. Face2Gene (F2G) and GestaltMatcher, two leading genetic facial recognition algorithms, were used to analyze the facial features of all 33 participants for evidence of KBG syndrome.

#### Results:

A vast majority presented with skeletal (94%), neurologic (94%), and gastrointestinal (85%) abnormalities, typical of KBG syndrome. In our cohort, 20% had diagnoses of autism spectrum disorder (ASD) as well; however, the presentation appears to be mild or atypical since several were interactive, social and maintained good eye contact during videoconference. Other notable findings included three of seven with a cardiac murmur or



arrhythmia and an additional individual reporting pain insensitivity. Overall, six of 33 (18%) report impaired pain and tactile sensation. Another case of absence seizure was reported (32% total), along with two additional reports of EEG abnormalities (19% total). Lastly, half of the patients had a triangular face with a broad forehead and pointed chin, common to the disorder, and two additional individuals reported microcephaly – an uncommon finding, increasing the total in our cohort to 9%. When facial photos were analyzed by F2G, KBG syndrome was ranked amongst the top three most likely disorders in six of eight cases, and all had KBG in the top six.

## Conclusions:

Characterizing and quantifying phenotypes is imperative to the process of developing guidelines for management and treatment of KBG syndrome. Treatment plans can be complicated by the presence of additional diagnoses, such as ASD. Several unique findings were elucidated within our cohort, including the presence of microcephaly, abdominal migraines, presence of concurrent infections and hearing loss, and an increased prevalence of seizures. Future work will focus on retrospectively and prospectively analyzing the impact of seizures on later development in order to guide screening practices.

**512.110 (Virtual Poster)** Microdeletion of Chromosome 2 at q33.1 to q33.3 with Co-Occurring Autism Spectrum Disorder in a 14 Year Old Female **J. Hangauer<sup>1</sup>** and **T. Driscoll<sup>2</sup>**, (1)Psychology, Johns Hopkins All Children's Hospital, St Petersburg, FL, (2)Institute for Brain Protection Sciences, Johns Hopkins All Children's Hospital, St Petersburg, FL

**Background:** Microdeletion of chromosome 2 at q33.1 to q33.3 is an extremely rare chromosomal anomaly syndrome affecting an unknown number of individuals worldwide. Current case reports detail 20 confirmed cases in the literature and unique characteristics of affected individuals is still emerging in the literature including the intersection of the microdeletion and neurodevelopmental disorders including autism spectrum disorder and intellectual disability. A wide variety of abnormalities with physical features (e.g., hand and feet abnormalities; craniofacial disfigurement) as well as learning difficulties (e.g., learning disabilities, intellectual disability) have been found depending on the specific deletion extent. To date, the vast majority of empirical studies and case reports focus on medical complications such as craniofacial patterning rather than developmental and neuropsychological functioning. This case report details the unique characteristics of a 14-year-old female patient with confirmed microdeletion of chromosome 2 at q33.1 via chromosomal microarray (array-CGH) and co-occurring autism spectrum disorder (ASD) requiring substantial support with moderate intellectual disability and co-occurring attention-deficit/hyperactivity disorder. The patient has a history of behavioral challenges, cleft palate, seizure disorder, and apraxia. The patient is non-verbal and communicates using an augmentative communication device. The patient experiences longstanding sleep disturbance. Additionally, significant hyperactive and impulsive behaviors have been present with increasing behavioral challenges.

**Objectives:** To contribute to the growing body of literature on the 2q33.1 to q33.3 microdeletion phenotype as small interstitial deletions are not widely reported in the extant literature and co-occurring disorders (e.g., autism spectrum disorder in females and attention-deficit/hyperactivity disorder) identified through comprehensive psychological or neuropsychological evaluation even less so.

**Methods:** Parent consent was obtained. Patient assent was unable to be obtained secondary to functioning level. Patient completed a comprehensive psychological evaluation consisting of the ADHD-5, ADOS-2, BASC-2, BRIEF-2, Leiter-3, SCARED, SCQ, SRS-2, and Vineland-3. All measures were administered and interpreted by a licensed psychologist with significant experience assessing for autism spectrum disorder and intellectual disabilities. Prior chromosomal microarray analysis (4x180K G3 CGH+SNP) was completed by a physician board certified in clinical genetics confirming presence of microdeletion at 2q33.1 to q33.3 deletion.

**Results:** Patient met DSM-5 diagnostic criteria for autism spectrum disorder requiring substantial support with accompanying intellectual disability, moderate severity and language disorder. Additionally, DSM-5 criteria for attention-deficit/hyperactivity disorder was met. The results of the evaluation provided additional information for the patient's caregivers informing transition planning, additional therapies, and additional supports.

**Conclusions:** The results of the present case study correlate with extant results of previous findings related to microdeletion of the 2q33.1 to 2q33.3 emerging phenotype detailing the wide variation in symptomology that may be present. This case study provides further information to assist in gaining a more clear understanding of the effects of microdeletions on overall functioning from a neuropsychological standpoint and contributes to the literature on autism spectrum disorder in females and co-occurring rare genetic disorders for which there is a paucity of information while informing treatment recommendations.

## International and Cross-Cultural Perspectives

### PANEL — INTERNATIONAL AND CROSS-CULTURAL PERSPECTIVES

#### 206 - Identifying Interdisciplinary and International Approaches to Address Inequities in Criminal Justice System Contact Among Autistic Individuals

**Panel Chair: Lindsay Shea, A.J. Drexel Autism Institute, Philadelphia, PA**

**206.001 (Panel)** Global Criminal Justice Survey: Initial Scale Development and Validation

V. Gibbs<sup>1</sup>, A. M. Love<sup>2</sup>, T. W. Benevides<sup>3</sup>, M. C. Mogavero<sup>4</sup>, K. Hooven<sup>5</sup> and I. Basketbill<sup>6</sup>, (1)Aspect Research Centre for Autism Practice, Autism Spectrum Australia, Sydney, NSW, Australia, (2)Aspect Research Centre for Autism Practice, Autism Spectrum Australia (Aspect), Melbourne, VIC, Australia, (3)Occupational Therapy, Augusta University, Augusta, GA, (4)Department of Criminal Justice, Anthropology, Sociology & Human Rights, Georgian Court University, Lakewood, NJ, (5)Autism, Services, Education, Resources, & Training Collaborative (ASERT), Philadelphia, PA, (6)Philadelphia Autism Project, Philadelphia, PA

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#### Background:

Core features of autism can place autistic individuals at increased risk for interactions with the criminal justice system and may also place them at a disadvantage at each step of the criminal justice process (Shea et al., 2021). Several studies have found that Autistic adults are largely dissatisfied with their treatment by police and report ongoing feelings of fear and distrust of police (Crane et al., 2016; Gibbs & Haas, 2020; Salerno & Schuller, 2019). Similarly, autistic people who have been involved in legal proceedings report communication and sensory challenges in the court environment along with difficulties navigating the court process (Helverschou et al., 2018; Maras, 2017). Criminal justice professionals, including police, legal personnel and corrections officers have been found to lack knowledge and confidence when interacting with autistic people (Crane, 2016; George et al., 2018), but little is known about criminal justice interactions on a global scale.

#### Objectives:

We aimed to evaluate international perceptions and experiences of criminal justice interactions between criminal justice professionals, autistic people, and parent/carers of autistic people. This presentation will describe the collaborative development process of a comprehensive international stakeholder survey and the results of the initial psychometric analyses.

#### Methods:

We used a clear and standardized scale development process to support the intended use of the multidimensional survey (AERA, APA, & NCME, 2014). Different aspects of reliability and validity including evidence for test content and internal structure were gathered using expert reviews, cognitive interviewing, a survey workgroup, pilot data collection ( $n = 48$ ), and a final data collection effort ( $n = 1661$ ). Experts who participated in the development process included 25 researchers, six criminal justice professionals, and people from the autistic community (six autistics, three carers). Experts were from ten countries to ensure diverse perspectives were considered during development. The survey was translated into 15 languages and forward- and backward-translation occurred to ensure scale reliability across countries.

#### Results:

This study produced initial psychometric evidence for the Global Criminal Justice Survey (GCJ). The GCJ is a dynamic survey with item totals responsive to the individual experiences of the survey respondent. The GCJ includes items for caregivers (GCJ-CG), criminal justice professionals (GCJ-P), and Autistic adults (GCJ-A). The survey measures four primary constructs: 1) perceived autism knowledge and 2) autism knowledge (for criminal justice professional respondents) and 3) perceived procedural justice and 4) police legitimacy (for autistic adults and parent/carers respondents). Results of this study will include a summary of contributions from stakeholders during the development phases and internal structure and reliability for each of the four constructs following data collection.

#### Conclusions:

This study demonstrates a process of collaborative scale development that can be replicated by other researchers provides reliability and validity evidence for the newly designed survey. Knowing more about the perceptions and experiences of interactions between criminal justice professionals, autistic people and parent/carers of autistic people will assist in developing comprehensive policy recommendations aimed at improving interactions between autistic people and the criminal justice system.

#### **206.002 (Panel) Autism in Courtrooms: A Scoping Review of Court Opinions in Criminal Cases Involving Autism**

D. Cooper<sup>1</sup>, E. B. Zimmerman<sup>2</sup>, J. Hyatt<sup>3</sup> and L. Shea<sup>4</sup>, (1)AJ Drexel Autism Institute, A.J. Drexel Autism Institute, Philadelphia, PA, (2)Drexel University Thomas R. Kline School of Law, Philadelphia, PA, (3)Department of Criminology and Justice Studies, Drexel University, Philadelphia, PA, (4)A.J. Drexel Autism Institute, Philadelphia, PA

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#### Background:

Research demonstrates that autistic individuals interact with the justice system at relatively high rates (Rava et al., 2017; Tint et al., 2017), and are at increased risk of victimization (Weiss and Fardella, 2018). However, questions remain regarding the experiences of autistic individuals and outcomes that take place within courtrooms. Studies have shown that that autistic individuals find courtrooms to be challenging and lack opportunities for meaningful participation (Helverschou et al., 2018). In order to identify interventional opportunities for autistic individuals within courtroom settings, a thorough understanding of their experiences is needed. For example, little is known about charges that result in autistic individuals being present in courtrooms and if autism influences the circumstances of their outcomes. Examining court opinions in criminal cases that mention autism reveals common trajectories into the justice system, foundational information on how judges and court personnel perceive and respond to autistic individuals, and an accounting of how autism shapes court proceedings and decisions.

#### Objectives:

The purpose of this study was to systematically review court opinions in criminal cases involving autism in the United States to identify common charges, courtroom encounters, experiences, and outcomes.

#### Methods:

This review was conducted by systematically searching Westlaw and LexisNexis databases for court opinions in criminal cases that mentioned autism, Asperger's, or autism spectrum disorder at least five times between June 23, 2017, and June 25, 2020. This number was chosen after piloting the search strategy and reasoning that in cases where autism was raised fewer than five times, autism was quickly dismissed and likely had no substantive impact on the case. A data management toolkit was developed to collect key opinion information including, but not limited to, the context in which autism was raised, demographic information of the autistic individual, criminal charges, and the decision and sentencing from the court. At least two independent reviewers double-coded information from each included opinion and data was organized into a single spreadsheet for analysis. Descriptive data were employed to explore key factors in court opinions in criminal cases involving autism.

#### Results:

The search strategy identified 70 eligible opinions that took place during the study period. A majority (n=50) were at the state level and occurred across 24 states. Ohio had the highest number of opinions (n=11). Analysis of the included opinions is ongoing and will be completed by the INSAR 2022 annual meeting.

#### Conclusions:

Autistic individuals engage in courtroom proceedings in a multitude of ways, including as criminal defendants, complaining witnesses, and witnesses. These results will provide a much-needed perspective on this landscape. Findings will reveal how autism is raised in courtrooms and the ensuing responses by judges and court personnel, which can pinpoint opportunities for accommodations that yield more meaningful participation for autistic individuals in courtrooms and appropriate dispositions of criminal cases. Further, results will highlight areas for targeted interventions prior to entering a courtroom, including potential opportunities for diversion, by identifying commonly alleged charges and specific victimization experiences against autistic individuals.

**206.003** (*Panel*) Accommodating Persons with Complex Communication Needs in South African Courts

**D. Msipa and J. Bornman**, *Centre for Human Rights, University of Pretoria, Pretoria, South Africa*

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#### Background:

Persons with disabilities are at higher risk of experiencing various forms of violence and abuse compared to non-disabled persons (World Report on Disability., 2011). The prevalence of such violence and abuse is even higher for persons with complex communication needs that make it difficult for them to report this violence and abuse (Saxton et al., 2001). Communication needs may result from various types of disabilities such as autism, intellectual disabilities, physical disabilities, or sensory disabilities (McConnell and Talbot., 2013). Irrespective of the cause, all persons with complex communication needs may find it difficult to access justice on an equal basis with others when they have been violated and abused.

In South Africa, witnesses typically give oral testimony in open court (Bekker., 1994). Persons with complex communication needs may, however, find it difficult to participate effectively in court because they have challenges with verbal communication. Consequently, few cases involving persons with complex communication needs are taken to court due to this communication barrier. However, with the right communication accommodations, persons with complex communication needs can participate effectively in court.

#### Objectives:

To describe and rank the ten most important communication accommodations needed to enable persons with complex communication needs to testify in court as perceived by legal practitioners in South Africa.

#### Methods:

The nominal group technique (NGT) will be used. NGT provides an opportunity for group brainstorming in a time-efficient manner whilst promoting input from all members, and preventing individual participants from taking over the discussion (Manera et al., 2019). Five to seven legal practitioners from Pretoria, South Africa, will be recruited to participate in the study. Prior to participation in the study, participants will be required to complete a consent form, a biographical questionnaire, and read the proposed court accommodation guidelines as background reading (White, 2021). Participants will first be asked to generate as many communication accommodations as possible. Thereafter, the complete list of accommodations will be reviewed, duplicates removed and similar accommodations grouped together. Subsequently, participants will be asked to rank these accommodations using group consensus.

#### Results:

During the preparatory phase, an extensive list of all court accommodations was compiled (White., 2021). This document will constitute background reading for the participants. It is therefore expected that the participants will be able to generate some accommodations and provide an opinion about which ones they deem to be the most important. Data for the main study will be collected in early 2022.

#### Conclusions:

A large number of persons with complex communication needs are abused and have a need to testify in court, yet very few of these cases go to court. One of the reasons for this is the fact that there is insufficient knowledge about how to accommodate persons with complex communication needs in court. This study will create awareness and open up possibilities for this to happen in future. It will also empower legal practitioners to accommodate these individuals in court.

#### **206.004 (Panel) Investigative Interviewing with Autistic People: Moving Towards Best Practice**

**R. Bagnall and K. L. Maras, Psychology, Centre for Applied Autism Research, University of Bath, Bath, United Kingdom**

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#### Background:

Investigative interviews are a crucial evidence-gathering stage within the criminal justice system (CJS), yet they are also socially and cognitively demanding for interviewees. Social and cognitive differences experienced by autistic people mean that investigative interviews are especially challenging for this population. For example, understanding others' mental states, interpreting social contexts, recalling personally experienced events from memory, and engaging in reciprocal social communication are all often difficult for autistic people. These characteristics constitute significant barriers to autistic adults providing credible, accurate and reliable interview statements during criminal investigations unless a more enabling environment is provided.

In this presentation, we will discuss the key issues faced by autistic adults and CJS professionals during investigative interviews; and introduce our emerging research findings with autistic witnesses and suspects.

#### Objectives:

Our ongoing series of studies are separated into two distinct research strands:

(1) Investigative interviewing with autistic witnesses; (2) Investigative interviewing with autistic suspects

Across these two research strands, we aim to better understand:

1. How communication and cognition in autism impacts ability to provide accurate and reliable information during investigative interviews
2. How autistic adults' truthful and deceptive verbal behaviour during investigative interviews may be perceived
3. How autistic people and police interviewers experience and describe the challenges of investigative interviewing
4. How interviewing practice can be adapted to support social cognitive characteristics of autism

#### Methods:

Across research strands a, b, and d our primary research methods are robust experimental studies with age- and IQ-matched autistic and non-autistic interviewees. Here, autistic and non-autistic adults undertake (witness and suspect-relevant) tasks upon which they are subsequently interviewed using either standard interviewing practice or adapted methods, tailored to the social cognitive needs of autistic adults. We also employed qualitative methods to examine the challenges of investigative interviewing with autistic adults (c). Qualitative analyses of real-life police suspect interview transcripts with autistic adults alongside large-scale online surveys examined the investigative interview experiences of autistic adults and police interviewers.

#### Results:

Our current and emerging findings indicate that, when questioned using current (unmodified) witness and suspect interviewing practice, autistic people can have greater difficulty providing crime-relevant information that is accurate, detailed, and specific. Our findings also indicate that, even when providing truthful accounts, autistic interviewees can display verbal cues associated with deception. Further, autistic adults and police interviewers describe significant social and cognitive challenges in their experiences of investigative interviewing. However, the use of investigative interviewing models that are adapted to the needs of autistic adults can help to improve interview performance.

#### Conclusions:

The pathway through the CJS for autistic victims, witnesses and suspects provides numerous challenges and barriers to inclusivity and justice. The investigative interviewing stage is no exception. Our research demonstrates an urgent need for investigative interviewing models that are responsive to the social cognitive needs of autistic victims, witnesses, and suspects. Our findings describe directions for future research, and crucially provide clear recommendations to support the move towards best practice investigative interviewing with autistic people.

## PANEL — INTERNATIONAL AND CROSS-CULTURAL PERSPECTIVES

### 224 - Understanding and Addressing Family Needs in Very Low-Income Contexts: Perspectives from Sub-Saharan Africa

**Panel Chair: Rosa Hoekstra**, *Department of Psychology, King's College London, London, United Kingdom*

**224.001 (Panel)** Empowerment of Caregivers Raising Children with Autism and Other Neurodevelopmental Conditions in Ethiopia  
**Z. Szlamka<sup>1</sup>, I. Ahmed<sup>2</sup>, B. Gebru<sup>1</sup>, M. Kinfe<sup>3</sup>, C. Hanlon<sup>4</sup> and R. A. Hoekstra<sup>5</sup>**, (1)King's College London, London, United Kingdom, (2)Addis Ababa University, Addis Ababa, Ethiopia, (3)Department of Psychiatry, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia, (4)Addis Ababa University and King's College London, Addis Ababa, Ethiopia, (5)Department of Psychology, King's College London, London, United Kingdom

#### Background:

The global burden of neurodevelopmental disorders (NDDs), including autism spectrum disorder affects low-and middle-income countries disproportionately: access to support programmes is largely unequal, usually favouring families from educated, urban-dwelling backgrounds and higher socio-economic status. Given the relative powerlessness of families raising a child with a NDD, their empowerment has long been in focus in global health service development.

#### Objectives:

We explored ways in which service development can include empowerment approaches for families raising a child with a NDD and their communities in Ethiopia. We did so by looking at perceptions, experiences and expected outcomes of empowerment.

#### Methods:

We conducted a qualitative, phenomenological study to explore the variety of views of stakeholders. Sixty-three semi-structured qualitative interviews were conducted in Amharic (n=19) or English (n=44) with: 1) caregivers of children with NDDs (n=15); 2) community health workers (n=5); 3) representatives of non-governmental organisations (NGOs) working with families and children with NDDs (n= 17); 4) school leaders and teachers (n=7); 5) clinicians (n=11); and 6) representatives of local health, education, and social care authorities (n= 8). Interview guides were developed iteratively and separately for each participant group. Interviews were conducted in capital Addis Ababa, and rural towns Butajira and Bahir Dar. All interviews were transcribed and those in Amharic were translated to English. Data were analysed thematically using NVivo 12.

#### Results:

Overall, four main themes were developed: The impact of poverty on the quality of life of families with NDDs; Caregiving from a gendered perspective; The experiences of single mothers; and Experiencing violence, abuse or discrimination based on gender.

All caregivers discussed how difficult they find it to make ends meet: many cannot work as they are the ones taking care of the child with an NDD. When talking about caregiving, most participants agreed that in Ethiopia it is generally considered a women's task. Clinicians mentioned that it is typically the mother who brings the child to the hospital, while the father considers key family-related decisions. Professional participants mentioned that they frequently come across mothers who are single as their partner left, often because of having a child with an NDD, or because the pregnancy was unplanned. For some mothers separating from their husband was a choice to avoid abuse and improve their children's life conditions. Several mother participants disclosed they faced domestic violence and described how this affected their everyday life. Some thought that they could not ask for help from the community as speaking negatively about their husband would be discouraged; some mothers thought their husband's abusive behaviour may be the cause of their child's NDD.

#### Conclusions:

Mothers and especially single mothers face unique challenges when raising children with NDDs in Ethiopia. Service development and empowerment approaches should include addressing poverty, potential domestic abuse, and gender-based discrimination and violence to support the quality of life of families.

**224.002 (Panel)** Service Provider and Caregiver Expectations for Children with Autism or Intellectual Disabilities in Ghana  
**M. Washington-Nortey<sup>1,2</sup>, Z. Serpell<sup>1</sup> and A. Anum<sup>3</sup>**, (1)Psychology, King's College London, London, United Kingdom, (2)Department of Psychology, Virginia Commonwealth University, Richmond, VA, (3)Department of Psychology, University of Ghana, Accra, Ghana

**Background:** It is well known that teacher expectations for children with autism spectrum disorders (ASD) or intellectual disabilities (ID) can inform their instructional goals and teaching strategies (Padeliadu et al., 1998). Recent studies from the African continent also indicate that, even after receiving specialized training in developmental disabilities, health officers in Ethiopia have low expectations for children with ASD (Tilahun et al., 2019). However, few studies have critically explored the service providers' expectations for children with autism or other developmental disabilities

on the African continent or compared these expectations to caregiver expectations. An investigation into service provider expectations is necessary to inform strategies to improve quality of life outcomes among children with ASD or ID, especially in low-resource African settings.

Objectives:

- (1) To investigate service providers' (i.e., teachers and health officers) expectations for children with ASD or ID in Ghana.
- (2) To examine differences between service providers' and caregivers' expectations of Ghanaian children with ASD or ID.

Methods: To assess service provider expectations, we used a mixed-methods exploratory sequential design (Creswell & Plano Clark, 2011) that included qualitative concept mapping (Kane & Trochim, 2007) followed by quantitative survey data collection. In the concept mapping phase, teachers and health officers ( $n=9$ ) shared their expectations for children with ASD or ID. Subsequently, a larger group of teachers ( $n=39$ ), health officers ( $n=38$ ), and caregivers ( $n=51$ ) of children with ASD or ID rated these shared expectations on two criteria: the importance of the expectation and the likelihood of occurrence. We analysed the data using hierarchical clustering procedures and Multivariate Analysis of Variance (MANOVA).

Results: Concept mapping results evidenced unique culture-specific expectation clusters and other more universal expectation clusters for children with ASD or ID. The expectation clusters were labelled independence, *love and acceptance*, *equal social rights and opportunities*, *vocational rights and protections*, *educational rights and opportunities*, *educational policy and practice*, *government policy and involvement*, *involvement of religious institutions*, and *professional and caregiver training* (see Figure 1). MANOVA results from the quantitative follow-up showed there were significant differences between parents, teachers, and health officers in their perceptions of the importance (Wilks'  $\Lambda=.528$ ,  $F_{(18,124)}=2.60$ ,  $p=.001$ , partial  $\eta^2=.274$ ) and likelihood (Wilks'  $\Lambda=.608$ ,  $F_{(18,150)}=2.351$ ,  $p=.003$ , partial  $\eta^2=.220$ ) of a child with ASD or ID attaining these expectations. Post-hoc analysis revealed significant differences between parents and service providers on the likelihood criterion of almost all expectation clusters and a few significant differences on the importance criterion (see Table 1). However, there were no significant differences between service providers on any cluster's importance or likelihood criteria.

Conclusions: Findings show that whereas expectations reported in extant Western literature focuses only the child (e.g., Ivey, 2001), Ghanaian service providers conceptualize child expectations within a broader ecology. The differences between stakeholder groups highlight the importance of open conversations when planning interventions for specific children. Additionally, clusters like *professional and caregiver training* represent calls for action and denote areas of need, consistent with gaps identified in prior Ghanaian-based studies (Wireko-Gyebi & Ashiagbor, 2018).

**224.003 (Panel)** Findings of a Brief Caregiver Well-Being Programme for Caregivers of Children with Developmental Disabilities in South Africa **L. Schlebusch<sup>1</sup>, N. Chambers<sup>2</sup> and P. J. de Vries<sup>3</sup>**, (1)Centre for Autism Research in Africa, Division of Child and Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa, (2)Centre for Autism Research in Africa, Division for Child and Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa, (3)Centre for Autism Research in Africa, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa

Background: The complexities of disability, limited psycho-social support, poverty, and stigma can negatively impact caregivers - leaving them distressed, isolated, and fatigued. Caring for caregivers' well-being and mental health is a first step in supporting their capacity to provide nurturing care for their children. Interventions in this area are lacking, especially in low-resource settings. The World Health Organization developed a caregiver skills training programme (WHO CST programme) for families of children with developmental delays, disorders and/or disabilities (DD) to be suitable for use in low-resourced settings. Included in the WHO CST package is an optional 3-session caregiver well-being programme. The programme is based on Acceptance and Commitment Therapy – a mindfulness-based behavioural therapy that can help caregivers of children with a range of psychological and physical difficulties to accept what is out of their control and commit instead to values-driven actions that enrich their lives.

Objectives: Our study investigated whether this ultra-brief, 3-session programme was feasible when delivered to caregivers of children with DD in a rural South African town.

Methods: First, we adapted the WHO CST intervention to the South African context. The programme was then delivered by trained facilitators who met once a week for three weeks with a group of caregivers. The two-hour sessions included stories, exercises and group discussions to convey key messages and skills. We used mixed methods, including several measures and multiple informants (caregivers, facilitators, and independent observers) to assess the programme's feasibility and acceptability.

Results: **Caregivers:** Eleven Black South African caregivers (ten mothers and one grandmother) participated in the study. Just over half the caregivers were single parents, just under half had no university education, and only two had full-time employment.

**Children:** The WHO does not require a diagnosis for a DD to participate in their programme, and in this sample, eight children were reported to have a confirmed diagnosis, which included intellectual disability, autism spectrum disorder, communication disorder, ADHD, cerebral palsy, epilepsy and tuberous sclerosis.

**Feasibility:** The overall acceptability and feasibility impressions of participants were overwhelmingly positive as reflected in the sessional feedback forms completed by facilitators, observers and caregivers, as well as individual interviews with all caregivers following the programme. The programme shows promise of being successful with the intended population. Before the programme, caregivers reported high levels of psychological distress, depression and anxiety. After the programme, caregivers showed positive improvements in the expected directions on all quantitative measures. We noted statistically significant changes on the Generalized Anxiety Disorder Scale ( $t=-1.54$ ,  $p<.036$ ,  $d=.73$ ), Multidimensional Scale of Perceived Social Support ( $t=0.65$ ,  $p<.037$ ,  $d=.72$ ), and Family Impact of Childhood Disability Scale ( $t=5.54$ ,  $p<.021$ ,  $d=.83$ ). This indicates that

caregivers reported less anxiety, and noticed improved social support from others, and more positive impacts about their child with a disability following the programme.

**Conclusions:** Our study found that the WHO Caregiver Well-being programme shows promise as a feasible and acceptable intervention for improving caregiver mental health and well-being in South Africa, with the potential for rapid dissemination and scale-up.

**224.004 (Panel) Acceptability and Feasibility of the World Health Organization 's Caregiver Skills Training Programme for Developmental Disabilities Delivered By Non-Specialists in Rural Ethiopia**

**T. Z. Kebede<sup>1</sup>, B. T. Tekola Gebru<sup>2</sup>, M. Kinf<sup>3</sup>, K. N. Koly<sup>4</sup>, R. Abdulrahman<sup>5</sup>, F. Girma<sup>3</sup>, C. Hanlon<sup>6</sup>, P. J. de Vries<sup>7</sup> and R. A. Hoekstra<sup>2</sup>,**  
(1)Department of Psychiatry, University of Cape Town, Addis Ababa, South Africa, (2)Department of Psychology, King's College London, London, United Kingdom, (3)Department of Psychiatry, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia, (4)Health System and Population Studies Division, International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), Dhaka, Bangladesh, (5)Department of Psychiatry, Yekatit 12 Hospital Medical College, Addis Ababa, Ethiopia, (6)Addis Ababa University and King's College London, Addis Ababa, Ethiopia, (7)Centre for Autism Research in Africa, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa

**Background:** Autism and other developmental disabilities are common in low- and middle-income countries (LMIC). However, services to address the needs of this group in LMIC are almost non-existent. The World Health Organization (WHO) developed a Caregiver Skills Training (CST) programme that can be delivered in global contexts. The WHO-CST programme was previously adapted for Ethiopia and pre-tested in an urban Ethiopian clinical setting, facilitated by specialists, indicating good acceptability and feasibility. Given the lack of specialists and Ethiopia's largely rural population, delivery by non-specialist providers and in rural settings is an important next topic of investigation.

**Objectives:** To explore the acceptability and feasibility of delivery of the WHO-CST by non-specialists in rural Ethiopia.

**Methods:** A qualitative study design was used. In-depth interviews were conducted with caregivers of a child with a developmental disability who participated in two rural pilots of the WHO-CST programme (n=19). Additionally, four focus group interviews were conducted with non-specialists (n=9) who facilitated these pilots. Seven facilitators were interviewed twice, once after the first and once after the second pilot. Topic guide questions centred around informants' positive and negative experiences with the programme and included questions relating to programme content and delivery structure. Data were analysed using framework analysis.

**Results:** Four themes were developed, mapping onto the framework created for this analysis. 1) Programme content: All participants found the adapted programme content acceptable and relevant to their contexts. Facilitators identified that some illustrations from the participant booklet were contextually incompatible with the rural setting and not all toys suggested in the booklet were available to families. Facilitators indicated that some concepts and techniques were challenging and required extra practice and time to explain to caregivers. An additional challenge for facilitators was tailoring content to meet the participants' different literacy levels. 2) Programme facilitation: Caregivers found programme facilitation by non-specialists acceptable, and using local non-specialists was essential to ensure caregivers who were more comfortable speaking local languages could participate. 3) Training Modalities: Participants indicated that the training modalities, including home visits, group training and ongoing supervision, were acceptable and feasible. Caregivers raised long travel distances and lack of childcare as barriers to attending sessions. Facilitators also spoke of challenges travelling to families' homes. Caregivers were hesitant to engage in role-plays during the training. Practising homework between sessions was difficult for caregivers. 4) Overall programme perceptions: Participants uniformly indicated the programme addressed a need and showed interest in future use of the programme. Participants recommended follow-up training for the sustainability of benefits. Caregivers emphasised how the programme helped them understand their child's problems and improve their skills to support their child. Facilitators highlighted having acquired new knowledge and skills relating to developmental disabilities. The absence of educational provision for children with developmental disabilities in rural Ethiopia remains an important unmet need.

**Conclusions:** The WHO-CST programme delivered by non-specialists is acceptable and feasible in rural Ethiopia, with the inclusion of some modifications and simplification of the programme content. These findings may have relevance to low-resource contexts worldwide.

**PANEL — INTERNATIONAL AND CROSS-CULTURAL PERSPECTIVES**

**225 - The Impact of the COVID-19 Pandemic on Families with Children with ASD Around the World**

**Panel Chair: Linda Dekker,** Department of Psychology, Education & Child Studies, Erasmus University Rotterdam, Rotterdam, Netherlands, Rotterdam Autism Consortium (R.A.C.), Rotterdam, Netherlands, Department of Psychology, Education & Child Studies, Erasmus University Rotterdam, Rotterdam, Netherlands, Rotterdam Autism Consortium (R.A.C.), Rotterdam, Netherlands

**225.001 (Panel) Psychiatric Outcomes and Models of Care in the United States for Children with Autism Spectrum Disorder during the COVID-19 Pandemic**

**R. A. Vasa,** Kennedy Krieger Institute, Baltimore, MD

**Background:** Children with autism spectrum disorder (ASD) are at elevated risk for psychiatric problems in response to the COVID-19 pandemic. Factor contributing to this risk include high rates of pre-pandemic psychiatric comorbidities and difficulties accessing psychiatric care, as well as the pandemic's disruption to routines and access to necessary psychiatric, educational and developmental services.

**Objectives:** The goals of this talk are to: 1) understand the psychiatric and behavioral outcomes of children and adolescents with ASD in the United States during the pandemic and how this may vary based on sociodemographic factors; 2) describe adaptations to clinical service models developed in the United States to address the mental health needs of children and adolescents with ASD during the pandemic.

**Methods:** The presenter will provide an evidence-based review of the current research on psychiatric and behavioral outcomes, which will include both strengths and limitations of current studies, and a comparison with other studies across the globe. The presenter will also describe innovative and adapted clinical mental health models that serve children and adolescents with varying levels of ASD severity who present with a wide variety of psychiatric and behavioral presentations. This will include a discussion on how to effectively conduct telepsychiatry visits, diagnose and treat common psychiatric disorders, and prevent and address mental health crisis. The presenter, who is the director of a psychiatric program of a major university-affiliated ASD center and has extensive experience working with this population, will also infuse the presentation with clinical and program building experiences. Clinical and administrative challenges of implementing these models will be discussed. Case examples will be included.

**Results:** Attendees will gain knowledge about the current literature on psychiatric outcomes of children with ASD during the COVID-19 pandemic in the United States. They will also be able to identify opportunities to improve their current models of psychiatric care for the ASD population, with the goal of delivering coordinated and collaborative psychiatric care for this population both now during these difficult times and in the future.

**Conclusions:** Children and adolescents with ASD are vulnerable to the effects of the COVID-19 pandemic. It is critical that every clinician working with children with ASD population is attuned to the psychiatric impact of the pandemic on the ASD population, and that psychiatric programs continuously strive to deliver best-practice care.

**225.002 (Panel) The Impact of the COVID-19 Pandemic on Emotional Well-Being and Educational Well-Being in Autistic Children**

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**Background:** The extent to which a child with autism spectrum disorder experiences problems in daily life depends on a combination of child characteristics and environmental factors. Pre Covid-19, little was known about the role of the environment on autism. No child with autism is the same and will react the same to their environment. Due to the radical change in the world, we were able to determine the level of emotional well-being as well as their educational well-being of children with autism before and during the COVID-19 pandemic. In addition, we draw attention to subgroups of autistic children.

**Objectives:** We addressed the question whether emotional well-being and educational well-being in autistic children in the Netherlands changed over time, pre-COVID-19 (T0) during COVID-19 wave I (T1) and COVID-19 wave II (T2). In addition, we aimed to determine effects of sociodemographic, psychosocial and parenting predictors on well-being. Finally, we aimed to define subgroups of autistic children that show positive changes in well-being during the COVID-19 pandemic.

**Methods:** Pre COVID-19 data from the Netherlands Autism Register (NAR)- a longitudinal register- is combined with data from adult participants (caregivers of children with ASD) who completed questionnaires about their child regarding the COVID-19 context of their family, emotional problems in their autistic child during the COVID-19 pandemic that may have occurred, child's fear of contracting COVID-19, how the COVID-19 measures are experienced, educational well-being, how education during COVID-19 is experienced and parental stress during the pandemic.

**Results:** Over time, a significant decrease in total experienced difficulties was found, which remained significant after adjustment for sociodemographic characteristics such as age and gender. Significant additional factors were psychosocial problems, social contacts satisfaction and worry about getting a COVID contamination. This was reproduced only in subdomains of hyperactivity, problems with peers and prosocial behavior.

The change in total amount of experienced difficulties, as well as in emotional problems could best be described by six different response patterns. Three patterns showed a decrease of reported difficulties since and during COVID, albeit at a different rate or at different base level. Other patterns showed either no change or increase. Changes in hyperactivity, peer problems and prosocial behavior were best represented by respectively eight, four and five distinct response patterns, with similar interpretations as for the total difficulty score.

Educational wellbeing and parental stress showed no change during COVID. In either wave it could not be significantly predicted by household size, working status, being in a crucial profession nor by parental efficacy to aid in the child's (home) education.

**Conclusions:** The COVID-19 pandemic has revealed differential reactions in autistic children in the Netherlands. Children showed on average a positive response to the pandemic situation through lower reported difficulties, both at aggregated and at subdomain level. Some children were however seemingly unaffected or negatively affected. Factors uniquely associated with changes in wellbeing were psychosocial problems, social contact satisfaction and worrying about COVID contamination. Parental stress was high and showed no change nor predictive household or professional factors during the pandemic home situation.

**225.003 (Panel) Coping with COVID: Autistic Traits and Mental Health Symptoms of Autistic Youth Early in the Pandemic**

**C. McMorris<sup>1</sup>, K. Turner<sup>2</sup>, J. A. Weiss<sup>3</sup>, S. J. Howe<sup>2</sup>, H. D. Sanguino<sup>2</sup>, C. M. Kerns<sup>4</sup> and M. Ames<sup>5</sup>, (1)Department of Paediatrics, University of Calgary, Calgary, AB, Canada, (2)University of Calgary, Calgary, AB, Canada, (3)Psychology, York University, Toronto, ON, Canada, (4)University of British Columbia, Vancouver, BC, Canada, (5)Department of Psychology, University of Victoria, Victoria, BC, Canada**

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**Background:** Autistic youth are at heightened risk for experiencing mental health issues, and pandemic-related stressors pose a threat to their wellbeing. Indeed, autistic youth are experiencing worsening sleep related problems and decreased emotional and social wellbeing during the pandemic. Similarly, caregivers have reported significant disruptions to services that have severely impacted their youth and family, with autistic youth showing more prominent autistic traits and their families experiencing moderate distress during the pandemic. Despite early reports and anecdotal evidence outlining that autistic youth may be especially vulnerable to reduced wellbeing during the pandemic; no study has examined what factors may contribute to increased symptomology and poorer overall mental health

**Objectives:** This study investigated how autistic youth are coping by 1) describing caregiver-reported youth mental health prior to and during the pandemic; and 2) using the developmental-ecological framework to explore individual, caregiver, and environmental factors associated with autistic traits, social-emotional symptoms, and overall mental health.

**Methods:** 582 caregivers ( $M_{AGE} = 36.9$  years,  $SD = 6.4$ ) of autistic children ( $M_{AGE} = 8.4$  years,  $SD = 3.3$ ) completed an online survey between June and July 2020. Caregivers provided information on demographics, retrospective reports of their child's pre-COVID and current mental health, and their child's autistic traits and social-emotional symptoms, along with their own perceived stress. Caregivers also rated the degree of COVID-related household and service disruption.

**Results:** Descriptive statistics were calculated to summarize demographic information about caregivers and youth, as well as a series of hierarchical linear regressions for each of the primary outcomes of interest (i.e., autistic traits, social-emotional symptoms, caregiver-reported youth overall mental health). For each regression, the following variables were included in each step: 1) demographics (i.e., child age and gender, household financial status); 2) child variables (i.e., pre-existing mental health condition, autism trait severity); 3) caregiver perceived stress; and 4) environmental variables (i.e., household and service disruption due to COVID-19).

Respondents reported their youth experienced increased autistic traits (51.7% - 54.3%), behaviour problems (49.8%), anxiety (50.5%), and low mood (49.7%) during the pandemic. Caregivers also reported that autistic youth demonstrated poorer overall mental health during the pandemic. Increases in autistic traits were associated with older youth age, experiencing household financial difficulty, higher caregiver perceived stress, and greater household and service disruption. These same variables, plus being female and the youth having a pre-existing mental health condition, were associated with increased social-emotional symptoms. Lastly, less household financial difficulty, youth having no pre-existing mental health condition and less severe autism, lower caregiver stress, and less service disruption was associated with better overall youth mental health.

**Conclusions:** More than half of autistic youth in this study experienced increased autistic traits, behaviour problems, anxiety, and low mood. Poorer overall youth pandemic mental health was also reported. We found several developmental-ecological factors associated with increased symptomology and poorer pandemic mental health, which could be leveraged to target support services to those autistic youth who are most vulnerable to poorer mental health. Strategies to support the autistic community during unprecedented crisis should be developed and implemented.

#### **225.004 (Panel) Care and Informational Needs of Parents of Children with ASD during the COVID-19 Pandemic**

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**Background:** The COVID-19 pandemic is challenging for everyone. Parents, especially in case they care for children with special needs like autism, may find themselves particularly challenged. Next to organizing their own life, their job and managing their own emotions and worries, parents are also responsible for the wellbeing of their children. With most parents of children with ASD carefully constructing routines and coping strategies for everyday life, the sudden and all-encompassing turmoil created by the COVID-19 pandemic challenged the parents and families. Never before was there such large-scale life event in which we were able to identify care and informational needs that families may have when dealing with life-events. Information regarding the care and informational needs of caregivers of individuals with ASD may inform policy and facilitate protocols as well as aid professionals in how to best care for and support families with children with ASD.

**Objectives:** The aim of the current study was to examine the care and informational needs of the caregivers of children with ASD during the COVID-19 pandemic by means of in-depth semi-structured interviews.

**Methods:** In collaboration with three mental healthcare institutions specialized in autism in the region of Rotterdam all families who received care in the year prior to the pandemic were invited to partake in the current study (n=200). At T1 (2<sup>nd</sup> lockdown, 01/2021-05/2021) 27 parents/caregivers of children and adolescents with ASD took part in an in-depth interview. T2 (lenient/less restrictive period; 09/2021-12/2021) interviews are currently being conducted to assess long-term impact and deepen knowledge as gathered at T1.

**Results:** Final data collection is currently ongoing. Preliminary results indicate that parents would have appreciated a more conservative approach in policy, the children seem to prefer face-to-face mental health care over online, parents would appreciate more information available for children/lower IQ and parents prefer being informed proactively by schools etc. about the impact of policy changes. Full results are expected by early 2022.

Conclusions: Although many parents understand the special circumstances the pandemic has caused, and understand the difficult position many institutions (e.g., schools and mental health care facilities) are in, they have some specific suggestions for how we may improve care and information transfer. Qualitative research adds valuable information and allows for a deeper understanding as parents can freely discuss the most pressing issues they encounter.

## ORAL SESSION - 6B — INTERNATIONAL AND CROSS-CULTURAL PERSPECTIVES

### 312 - Autism across Communities: Screening and Intervention

#### 312.001 (Oral) First-Generation South Asian Immigrants and Navigating Their Child's Autism

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**Background:** Parents are the primary support network for a child with autism. Research on parental experiences of having a child with autism have emphasized appreciation and personal growth. In addition to these positive factors, parents can experience difficulties in navigating their child's challenging behaviour, feel a lack of social support, and have frustration accessing health services. These caregiving challenges have largely been understood from a Western perspective which fails to account for cultural factors and perceptions of disability.

Furthermore, immigrants face unique stressors such as language barriers, cultural differences, inadequate access to health care, social isolation, and socio-economic challenges. A particularly fast growing immigrant population in Canada and the United Kingdom is the South Asian community. Literature on South Asian immigrant experiences in navigating their child's autism is scarce. A deeper insight on the experience of South Asian immigrant parents of children with autism is critical for support services, clinicians, and health policymakers to best support the South Asian immigrant community.

**Objectives:** The goal of this study was to explore the experience of first generation South Asian parents of children with autism. Specially, we were examining (1) perceptions of autism, (2) stressors, and (3) coping methods.

**Methods:** This study involved: (1) a systematic review to explore the current literature on South Asian experiences of children with autism and (2) a qualitative interview with first-generation South Asian parents of children with autism in the UK. For the systematic review, key search terms were autism, Asperger's, pervasive developmental, South Asia, India, Sri Lanka, Nepal, Afghanistan, Pakistan, Bhutan, or Maldives. We employed a broad search strategy due to the limited research available. Our search revealed 113 studies. Of which, 60 duplicates were removed and 53 studies underwent abstract and title screening according to the inclusion and exclusion criteria. From 53 studies, 11 studies were deemed irrelevant. A full text review was conducted for 42 studies, to which 24 were deemed relevant. A narrative analysis of common themes was conducted for the 24 studies, with a special focus on the distinct experience of first-generation immigrants. For the qualitative part of this study, we recruited first-generation South Asian parents of a child with autism in the UK for semi-structured interviews exploring perceptions of autism, stressors, and coping methods.

**Results:** Common perceptions of autism for first-generation South Asian immigrants included: their child being a gift from god and that the experience of parenting their child was test from a higher power. Common stressors included dissatisfaction with the treatment their child receives in their current country. Coping methods primarily included religious practices.

**Conclusions:** The results of this study suggest first-generation South Asian immigrants face unique experiences in navigating their child's autism. Future research in large sample sizes is required to better understand perceptions, stressors, and coping strategies this community faces. This information can inform the personalized design of healthcare programs and support services to best support the South Asian immigrant community.

#### 312.002 (Oral) Parental Perceptions of Autism in New Delhi, India

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Background:

Our understanding of Autism Spectrum Disorder (ASD) is currently based on research conducted in Western high-income settings. However, we know that differing socio-cultural norms impact the process of identifying symptoms and healthcare seeking around the globe.<sup>1,2,4</sup> There is need for greater diversity and a global perspective in autism research.<sup>1,2,4</sup> Specifically, we need a better understanding of the perspectives of autism from different settings, to explore how help-seeking pathways are impacted by these perceptions, and how a diagnosis impacts families. By comparing perspectives between parents in two groups (mothers with a child diagnosed with ASD, compared to Intellectual Disability (ID)), and also to those from mothers of typically developing (TD) children in New Delhi, India, we take a step towards closing this gap in our understanding.

Objectives:

We aim to investigate: 1) how cultural norms, awareness and competing priorities impact parental recognition of symptoms between ASD and ID groups; 2) how the interpretation of symptoms differ between groups of parents; and 3) how a diagnosis of a developmental disorder impacts the family.

## Methods:

Thirteen semi-structured interviews with mothers of children in three groups: mothers of a child diagnosed with ASD, mothers of a child diagnosed with ID, and mothers of a child meeting developmental milestones. This was a nested qualitative study within a larger case-control study conducted in community and healthcare settings in New Delhi. Thematic analysis was conducted on the transcribed and translated (Hindi to English) interviews.

## Results:

Thematic analysis identified five key themes: Recognition, Interpretation, Reporting of symptoms, Impact of a diagnosis, Social Support. Differences were found between groups in the perceived recognition, interpretation of symptoms and reporting of symptoms. In the ASD group, the perceived barriers to reporting symptoms included stigma, disbelief that symptoms were autism, and a maternal lack of agency, e.g., *“It seemed to me that there was some problem. But no one in the society listens to us ladies, no matters how much educated we are.”* In comparison, the ID and TD group perceived barriers were logistical or financial. The impact of an ASD diagnosis on the mother was highlighted, with perceived stigma, disempowerment and lack of social support being prominent: *“Society isolates you. No one wants to talk to you.”* These were not observed in the ID or TD groups. The mothers in the ASD group also highlighted the importance of being able to talk to others, and the support they received from their child.

## Conclusions:

This study found distinct differences in the perception of autism, and the perceived impact of a diagnosis between groups. This work highlights the social isolation and stigma experienced by mothers of a child diagnosed with ASD, and the lack of support being received by wider family and communities. We emphasize the need for increased awareness of autism in community settings, and improved diagnostic pathways for parents that include greater family support post-diagnosis.

## References:

1 de Leeuw et al., 2021; 2 Durkin et al., 2015; 3 Rice & Lee., 2017; 4 de Vries, 2016

### **312.003 (Oral)** Towards Naturalistic Developmental Behavioural Interventions for Autism in Africa: Content and Contexts of Caregiver-Child Dyadic Interactions in Low-Resource South African Environments

**M. Ndlovu<sup>1</sup>, Z. Dawood<sup>2</sup>, N. Seris<sup>1</sup>, N. Shabalala<sup>1</sup>, M. Harty<sup>3</sup>, M. Viljoen<sup>1</sup>, L. Franz<sup>4</sup> and P. J. de Vries<sup>1</sup>,** (1)Centre for Autism Research in Africa, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa, (2)Division of Communication Sciences and Disorders, University of Cape Town, Cape Town, South Africa, (3)Department of Health & Rehab Sciences, University of Cape Town, Observatory, Cape Town, South Africa, (4)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC

**Background:** Caregivers can be taught to use Naturalistic Developmental Behavioural Intervention (NDBI) strategies during interactions with their young child with autism spectrum disorder (ASD). However, NDBI research predominantly comes from high-income countries. The evidence-base for NDBI in low/middle-income countries (LMIC) and across cultures is lacking. To understand the ‘fit’ of an NDBI approach in LMIC, it is crucial to quantify the strategies and behaviours of caregivers and autistic children during caregiver-child interactions, and to identify daily routines in which caregiver-child interactions occur.

**Objectives:** To describe the caregiver-child interactions and daily routines of young children with ASD living in low-resource South African environments.

**Methods:** Children with ASD (18-72 months old) and their ≥18-year-old caregivers were recruited under a larger project. Interactions of 21 caregiver-child dyads were video-recorded at baseline using two standardized 6-minute free-play sessions (Part 1: child explores the room and available toys while the caregiver remains seated. Part 2: caregiver leaves their chair and interacts with their child as they would at home). Videos were rated by research-reliable raters, using 16 items from the Joint Engagement Rating Inventory (JERI), a 7-point Likert scale behavioural coding system. Descriptive statistical analyses were conducted. To explore common daily routines, structured interviews were conducted with caregivers (n=10) using the Parent Survey of Home and Family Experiences, adapted for the South African context. Frequency and content analyses were performed.

**Results:** For caregiver-child interactions, observer agreement for 11 of 16 items was reasonable, with weighted Kappas (within 1 scale point) of 0.66–1 and estimated accuracy 88–99%. There was a range of ratings for all items across parts 1 and 2, without ceiling effects. Two items in part 1 and four in part 2 showed floor effects. Caregiver item ratings were all at the midpoint of the scale (*Mdn*=4), suggesting moderate ability of caregivers to support child performance and communication during interactions prior to intervention. Changes in the range of ratings for three items (object engaged, expressive language, attention to caregiver) between part 1 and part 2 (with and without caregivers during play) showed the utility of JERI codes as potential markers of change. Regarding daily routines most children participated in routine activities (e.g., bathing, washing hands, family meals) and play activities (e.g., playing with toys, water, cell phone games) on a daily basis with mothers as the main partners. Most children in the sample never participated in spiritual activities, community activities, and chores.

**Conclusions:** Results suggest the JERI may be applicable to quantify caregiver-child interactions of families with a young autistic child in low-resource South African environments. Caregivers already use some strategies targeted by NDBI coaching to support their young autistic child during interactions, suggesting a degree of ‘fit’ between NDBI approaches and the South African context. Changes in attention to caregiver between parts 1 and 2 suggest caregiver presence supports attentional shifts in children. The common daily routines identified here provide contextual data of activities into which NDBI strategies could be embedded to support child generalization of skills in South Africa.

**312.004 (Oral)** Is Forward-Back Translation Sufficient? Comparing Two Translation Methods for a Parent-Report Autism Screening Tool  
**M. DuBay<sup>1</sup>, J. Sideris<sup>2</sup> and E. Rouch<sup>3</sup>,** (1)School of Education and Human Development, University of Virginia, Chapel Hill, VA, (2)Mrs. T. H. Chan Division of Occupational Science and Occupational Therapy, University of Southern California - T.H. Chan Division of Occupational Science and Occupational Ther, Los Angeles, CA, (3)University of Virginia, Charlottesville, VA

Background:

Health disparities experienced by many of the world’s populations cause substantial differences in ASD diagnostic rates, age of diagnosis, and access to ASD-specific services (Mandell et al., 2009), especially among non-English speaking populations (Baio et al., 2018; Chamak et al., 2011; Morales-Hidalgo et al., 2018).

Currently, the most feasible way to identify children with ASD symptoms at a young age is to screen children universally for common early ASD behavioral markers, typically in a parent-report format (Thabtah & Peebles, 2019). Many ASD screening tools are being translated into other languages. Most frequently, the translation “forward-back” (FB) approach is used, where a single forward translation is followed by a back-translation and same-language review (El-Behadli et al., 2015). However, the FB approach may not be sufficient to retain psychometric properties between the original screener and the translated version (Ben-Sasson & Carter, 2012; Guthrie et al., 2019; Pomés et al., 2016).

An alternative rigorous translation with cultural adaptation (TCA) approach involves a forward translation by a team of trained translators from a range of backgrounds, systematic examination of the forward translation quality, collaborative revisions, and pretesting with target population members (Acquadro et al., 2008; Hagell et al., 2010). After completion, the final version is administered to a large community sample to determine population-specific norms and psychometric properties (Beaton et al., 2000; DuBay & Watson, 2019).

Objectives:

We aim to directly examine the impact of translation methodology on psychometric properties by administering two translations of the *First Years Inventory version 3.1* (FYI; Baranek et al., 2013), a parent-report ASD screening tool for 8-16 month-old children. One version will be translated using the traditional FB approach, and the other using the TCA approach (DuBay et al., 2021).

Methods:

Approximately 450 US-based Spanish-speaking caregivers of children 8-16 months of age will complete a Spanish FYI. Participants will be randomly assigned to complete one of the two translations. Patterns of responses from each translation will be compared using a measurement invariance approach.

Results:

Thus far, 330 US-based Spanish-speaking caregivers have completed the FYI. Those born outside the US, having lived in the US for 9 years on average (range 1-39 years), immigrated from 15 countries spanning North, Central, and South America and the Caribbean. Preliminary analyses indicate that compared to participants who received the TCA version, participants who received the FB version are more frequently responding to the scale using only three response options rather than choosing from all five response options ( $p < .000$ ), reducing the variability in the data for the FB version and possibly negatively impacting validity. Further, 23% of items showed significant differences in mean responses between groups ( $p < .05$ ), which could indicate differential item interpretations across translations. Measurement invariance will be analyzed when all data collection is complete.

Conclusions:

Examining the impact of translation methodology on the validity and reliability of an ASD screening tool will help to inform future translations across languages and screening tools, improving early identification of a range of developmental conditions for numerous cultures and populations.

## POSTER SESSION — INTERNATIONAL AND CROSS-CULTURAL PERSPECTIVES

### 425 - International and Cross-Cultural Perspectives

**425.077 (Poster)** Adaption and Evaluation of the Program Parents Taking Action (PTA) for Parents of Pre/Adolescents with Autism Spectrum Disorder in Colombia  
**M. Garcia, UIC, Chicago, IL**

## Background:

The prevalence of autism spectrum disorder (ASD) has increased in recent decades around the world. In Colombia, there is not a clear statistic about the prevalence of ASD, but it is estimated that 16% of the population under 15 years old has some type of developmental disability (National Administrative Department of Statistics-DANE, 2015). Unfortunately, the lack of research and information about supports for people with ASD and their families limits the services and supports available for this population. While there are emerging supports for families of young children with ASD in Colombia, there is a need to support families of youth with ASD, particularly around topics of puberty, sexuality, and adolescence development.

**Objectives:** The aim of this study was to evaluate the efficacy of the program Parents Taking Action for parents of preadolescents with ASD in Bogota, Colombia using a quasi-experimental design with a control group.

## Methods:

We recruited 38 Colombian parents of pre/adolescent youth with ASD between the ages of 10 – 17 in Bogota, Colombia through community-based organizations. Three groups were selected based on parents' availability to participate (two different times were offered). One of these groups served as a delayed control group. Knowledge, Self-efficacy, empowerment, and Use of Strategies were assessed before and after the intervention, as well as a follow-up interview and goal setting.

## Results:

Intervention participants significantly improved in Knowledge ( $t=4.37$ ,  $p<.001$ ), Self-Efficacy ( $t=7.15$ ,  $p<.001$ ), Use of Strategies ( $t=4.29$ ,  $p<.001$ ), and Family Empowerment ( $t=3.82$ ,  $p<.005$ ) between baseline and post-test. When comparing to control group, differences were significant as the control group did not improve on any of the outcome measures. Interviews supported these findings by showing that parents continued to use the information and strategies after the program finished. Also, parents met their goals as expected.

## Conclusions:

The youth version of *PTA* demonstrated efficacy in the outcomes measured using a quasi-experimental design in Colombia. Parents of preadolescents with ASD in the intervention group increased knowledge, use of strategies, self-efficacy, and empowerment with respect to the topics related to puberty, adolescence and sexuality compared to the control group. The program has potential for high impact as information is scarce and parents do not have resources related to the complicated developmental stages of pre/adolescence. The program shows promise as an efficacious tool for community organizations and health providers to provide extra support to families of youth with ASD.

## **425.078 (Poster)** Barriers to Access Health and Educational Services for Venezuelan Autistic Children. Caregivers Priorities in a Humanitarian Crisis

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**Background:** Autistic children might have a higher level of service needs than other individuals with developmental disabilities. Such services are usually costly and need the coordination of caregivers, family schedules, and budgets. Caregivers **worry about finding health and educational services** for their children, adding to the stress. Parenting an autistic child is a challenging experience in many areas and at different levels. These experiences become even more challenging in countries with a lack of infrastructure, trained professionals, and general awareness of ASD. **In** Venezuela, as in many other Low- and Middle-Income Countries (LAMIC), the mental health expenditure per person and the number of mental health professionals is below standard. Despite having universal health coverage, the Venezuelan public health system is administered in overbooked facilities with few trained professionals and long waiting lists.

**Objectives:** This study aims to identify caregivers' perceptions regarding (a) access to health and educational services for their children, (b) impact on family daily life, and (c) challenges and priorities of caregivers of autistic children

**Methods:** A total of 114 Venezuelan caregivers of autistic children completed the Caregivers Needs Survey. The questionnaire comprises four sections: (1) Sociodemographic characteristics of the family, (2) Characteristics of the person with ASD, (3) Use of services and treatments, (4) Perception of parents/caregivers about barriers to access, challenges, priorities, and impact on the family. This study is part of a larger multisite study comprising samples from six countries of the Latin American Network for Autism (REAL): Argentina, Brazil, Chile, Uruguay, Venezuela, and the Dominican Republic.

**Results:** At the time of the study, speech therapy was the most commonly used service (70.27%), followed by occupational therapy (65.77%) and behavioral therapy (45.95%). In terms of educational services, 70.18% of the sample were without school support services. The impact of having a child with autism was evident in 47.37% of caregivers that reported financial problems, and 55.26% cut work hours to care for the autistic child. Communication (50.71) and social interaction difficulties (45.43%) were the main challenges endorsed by caregivers. In addition, having access to good educational services (90.64%) and health services (59.67%) were their most frequent priorities.

**Conclusions:** This study highlights the barriers experienced by caregivers of autistic children in Venezuela. The most commonly endorsed services (ST and OT) are not specific to ASD and have low-to-moderate evidence of effectiveness but are widely available in public and private institutions, usually in outpatient mental health contexts. Parents looking for health or educational services encountered overbooked facilities, waiting lists, and a scarcity of trained professionals. In addition, caregivers indicated limited resources to pay for services and financial difficulties. Venezuela is experiencing a sustained sociopolitical conflict, extreme poverty, and humanitarian crises that have affected every facet of everyday life, adding strain to the availability and accessibility of services for ASD. Our findings emphasize the need for programs that target underserved groups and children living in Third-World countries and their families.

**425.079 (Poster)** Behavioral and Psychological Changes Experienced By Autistic Individuals during Covid-19 Pandemic in Latin America  
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**Background:** Covid-19 pandemic brought an increased incidence of concern in the world at large. For those in regions with large economic disadvantages and wide systematic issues (e.g., Latin American countries) the pandemic hit with an added force. Due to autism spectrum disorder core features, autistic individuals might have experienced increased difficulty adapting and preparing to environmental changes and thus making them a particular vulnerable population. Because of these challenges, autistic individuals are expected to experience a variety of behavioral challenges.

**Objectives:** The present study assesses demographic characteristics and contextual factors' impact on dysregulated behaviors, preoccupation with getting sick, and overall setbacks experienced among autistic individuals during the COVID-19 pandemic in 7 Latin American countries as perceived by their caregivers.

**Methods:** The present study conducted a series of linear regressions and a Kruskal-Wallis test to determine contextual factors' (e.g., country of residence, coexistence, crowded conditions) and individuals' characteristics (e.g., gender, and age of individual) effect on dysregulated behaviors, preoccupation with getting sick, and overall setbacks of autistic individuals as reported by caregivers.

**Results:** The Kruskal-Wallis H test, run to determine differences in scores assessing preoccupation with getting sick, overall setbacks, and internalizing behaviors between countries. Country of residence had a small effect on preoccupation with getting sick,  $X^2(6)=23.23, p=0.001$ ,  $\epsilon^2=0.013$ , on dysregulated internalizing behaviors,  $X^2(6)=49.61, p=0.000$ ,  $\epsilon^2=0.029$ , and on overall setback,  $X^2(6)=75.21, p=0.000$ ,  $\epsilon^2=0.044$ . Pairwise comparisons revealed statistically significant differences in preoccupation with getting sick scores with Brazil and Chile showing increased preoccupation with getting sick compared to remaining countries. Concerning dysregulated internalizing behaviors, Dominican Republic had statistically significant lower scores. Overall setback was lowest in the Dominican Republic. Linear regression established that size of house ( $F(4, 1742)=4.24, p<0.05$ ) and type of coexistence ( $F(4, 1703)=3.67, p<0.05$ ) significantly predicted preoccupation with getting sick, with those residing in a larger house leading to a .296 to .305 decrease in preoccupation with getting sick, whereas better coexistence led to a .212-.426 decrease. Moreover, coexistence but not house size predicted changes in overt behaviors in children  $F(1,97)=38.98, p<0.005$ . Additionally, those that indicated a better coexistence showed a .791-1.193 decrease in dysregulated internalizing behaviors in autistic children. For overall setback, house size and type of coexistence predicted overall setbacks ( $F(1,97)=16.87, p<0.005$ ).

**Conclusions:** For caregivers that had been able to create a comforting routine for autistic individuals who have difficulty adapting to change, the initial stages of the pandemic were especially difficult. During this period many autistic individuals and their families indicated feeling ignored since many protocols aimed at protecting them did not come until later and were limited in usefulness. The present study presents a cross-cultural understanding to predictors in dysregulated behaviors increments, setbacks and preoccupation with getting sick. This information is relevant to inform policies aimed at protecting vulnerable populations when confronted with environmental changes of large magnitude.

**Keywords:** ASD, Latin America, Caregivers, COVID-19, Pandemic, Behaviors, Preoccupation.

**425.080 (Poster)** Changes in the Perception of Age of Diagnosis and Access to Services in Caregivers of Autistic Individuals in Argentina.  
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## **Background:**

In the last years, Argentina has developed public health initiatives to protect those with disabilities and developmental concerns. However, as in many Low and Middle-Income countries, the needs of autistic individuals in Argentina are still short of being fulfilled. In specific, there is no universal access to diagnostic and treatment services, or school supports, among others.

## **Objectives:**

To evaluate changes across two different points in time in terms of ASD diagnosis (e.g., type and age), first developmental concerns (e.g., age of first concern and person noticing concern), services barriers and accessibility, and priorities as perceived by caregivers of autistic individuals.

## Methods:

Two independent samples of caregivers of autistic individuals were surveyed by the Red Espectro Autista Latinoamerica (REAL)(n=763) and the World Health Organization (WHO) (n=422) at two different time points (2015 and 2020, respectively). Similar items in both surveys were compared through descriptive, inferential analysis, and chi-square tests of independence.

## Results:

For the 2020 sample, caregivers reported both an earlier age of first concerns observed by caregivers and an earlier professional diagnosis. 22.7% more caregivers noticed developmental concerns by 18 months of age compared to the 2015 sample, while 10.8% more had a professional diagnosis before three years of age. For both samples, there was an association between the person first noticing a developmental concern and the age of diagnosis, with family members predicting an earlier age of diagnosis when compared to teachers and doctors. When family members noticed the first concern, their children were more likely to be diagnosed at 0-3 years old. On the contrary, if teachers noticed the first developmental concern, autistic individuals were more likely to be diagnosed at 4-8 years of age. For the 2020 sample, caregivers reported fewer service barriers (e.g., limited availability, waitlist, costs, etc.) and decreased priorities for receiving social support and better health services. However, rates of caregivers indicating a need for more rights for autistic individuals and greater protection of existing rights increased. Additionally, there was no change in the reported rate of family members who stopped working to care for the autistic individual.

## Conclusions:

The five years that separate both samples show a decrease in the age of diagnosis and improvement in several areas of services such as community awareness, type of diagnosis being provided, and fewer barriers to access services. These results suggest that the changes in public policies and awareness campaigns have impacted access to services. Nonetheless, a similar proportion of family members reported ceasing working to care for autistic individuals and perceived that the fundamental rights of their autistic children needed to be protected. Taken together, such results suggest that despite better care pathways in Argentina, there are still gaps to meet the needs of autistic individuals and their families.

### **425.081** (Poster) Culture, Tortuous Pathways, and the Case for Ameliorating Autism Burden in Nigeria and South Africa

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**Background:** The aetiological basis of Autism Spectrum Disorder (ASD) is still being explained by supernatural causes in some parts of Africa (especially among the low and middle-income countries) due to poor education and awareness about the disorder, and sometimes to avoid stigma and elevated stress. In a bid to seek healing or lessen burden for autistic individuals, some parents embark on tortuous pathways such as seeking help from diviners, spiritualists, or traditional clinical practitioners. Such decisions may stem from the cultural beliefs and practices of many people that surround autistic individuals. Many parents possess beliefs regarding divination, spiritual and/or traditional power in their society, and they might have in one time or the other sought solution to their personal problem using such pathways. Because of this, they may hold the same belief that ASD can be cured using these pathways.

**Objectives:** This study aimed to examine the role that cultural beliefs and practices play in how parents seek help and other interventions to cure or reduce burden for autistic children in Abeokuta and Ibadan, Nigeria, as well as those in Empangeni and Durban, South Africa.

**Methods:** The study adopted a qualitative approach, and data was collected using semi-structured interviews. Using purposive sampling, 5 parents were recruited from different areas in Abeokuta, and 9 in Ibadan. In Empangeni, 3 parents were recruited, and 7 parents were recruited in Durban. The data was analysed using thematic content analysis, and the study strictly adhered to ethical considerations.

**Results:** Most parents (n=17) had visited the orthodox clinicians/traditional healers, spiritualists, or diviners to seek help about the possibility of curing their child with ASD. Many parents (n=19) mentioned the strong influence that their cultural beliefs and practices such as ability of the gods, and the spiritual world to heal and wade off one's problem exerted on being willing to pursue such interventions. It was found that parents were eager to see improvement in their child's functioning, which had the potential to reduce their stress, and stigma in some cases.

**Conclusions:** Culture exerts greater influence on what parents and caregivers believe, practise, and other actions they take to reduce the burden their children with ASD experience, as well reduce their own stress. Government and stakeholders need to create more awareness targeted at parents and other caregivers about what help is needed, and where to obtain it after an individual has been diagnosed with ASD. Parents should refrain from taking self-sought solutions, review their cultural beliefs and stick to those that can genuinely help their children with ASD improve.

### **425.082** (Poster) Early Screening of ASD with the RITA-T in a Culturally Diverse Community

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## Background:

Early recognition of autism spectrum disorder (ASD) is pivotal to start intensive treatment but continues to be delayed especially in diverse and underserved communities. We have published already on a pilot model using the Rapid Interactive Screening Test for Autism in Toddlers (RITA-T) with an Early Intervention (EI) program in a culturally diverse community to improve early access and identification of ASD. Approximately 35% of families in Worcester speak a language other than English, and close to 40% are non-White, with a range of Immigrants and refugees from South America, Nepal, Vietnam, Ghana, Nigeria, and Iraq. We continued the partnership with more EI programs and primary care providers after the initial pilot and integrated this into clinical practice.

## Objectives:

Study the generalization of a pilot model that included two-level screening with the RITA-T into clinical model and partnerships with Early Intervention and Primary Care in a culturally diverse community to improve early access, screening, and identification of ASD

## Methods:

Over the last 3 years (2018-2021), we trained university based and community based Primary Care Providers, pediatric residents and 4 more Early Intervention (EI) programs in central MA on the RITA-T. The RITA-T training is, on average, three hours long to establish reliability, and its administration and scoring is approximately 10 minutes. The RITA-T does not rely on language. When a child is suspected to have ASD, they administer the RITA-T, discuss concerns with families, and refer them to the evaluation. Evaluation includes then: review of signs and symptoms of ASD; observation of play and administration of the ADOS-2 or the CARS-2, and application of DSM-5 criteria.

This is a retrospective review of referrals and evaluations of children younger than 3 years for evaluation for ASD to our center. We compared: wait time between those referred without a RITA-T screening vs. those referred through this model. We also looked at the correlation of the RITA-T with final diagnosis.

## Results:

Although numbers of referrals of those younger than 3 years remained stable over the last 3 years, referrals through RITA-T model increased gradually and reached a total of 304 toddlers. Ages varied between 18 and 36 months and close to 50% identified as non-white. Wait time varied between 1-4 months for the RITA-T model (average 2 months) vs. 3-7 months for those without RITA-T (average 5 months). RITA-T correlated strongly with final diagnosis: score > 16 for ASD and score < 12 for non ASD. In addition, visits from the RITA-T model were 1 hour shorter than visits for those referred without RITA-T.

## Conclusions:

Generalization of the RITA-T model in clinical care is feasible in this culturally diverse community. This model has reduced the overall wait time for those at risk for ASD in addition to strengthening the network with EI and Primary Care providers.

### **425.083 (Poster)** Employment for Individuals with ASD in Russia – Experience, Opportunities, and Obstacles

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**Background:** People with ASD and/or Intellectual Disabilities (ID) can and want to work, this is important for mental and physical health, their family's wellbeing and can bring significant benefits to business and whole society. At the same time, they are often discriminated and socially stigmatized. Also, the number of adults with officially established ASD diagnosis in Russia is generally negligible, although in large cities this number is slowly increasing but remains very low. Successful and stable employment requires support programs and services. There is rich international supported employment (SE) experience but in Russia, however, such initiatives are still rare.

**Objectives:** This study will expand on the limited knowledge on situation with SE for people with ASD or/and ID in Russia and provide more information on job seekers, their families, and employers SE knowledge and experience.

**Methods:** Study Design: 23 in-depth interviews with parents/caregivers of the adults with ASD and ID and 4 interview with self-advocates in Moscow, St-Petersburg, and Nizhny Novgorod. 144 questionnaires completed online by parents/caregivers of adults with ASD or/and ID from across Russia. 10 semi-structured interviews with state and non-governmental service providers; 5 focus groups with employing organizations representatives. Focus groups and interviews were carried out within our guidelines by "O+K Research". Participants: Parents/caregivers of the adults with ASD and/or ID (18 to 40 yo). 4 self-advocates with ASD. There is a need to stress that majority of respondents didn't have officially established ASD diagnosis, so we used self-definition of young adults or their family's opinions which of course limited this study. 95 respondents had a label in their social-rehabilitation plan "severe disability"; 49 had "moderate disability".

**Results:** Majority of respondents didn't consider employment opportunities as real. At the same time only 25% of "severe disability" group believe that members of their family are incapable of any kind of work. Among the parents of "moderate disability" group, a similar opinion was expressed by 1 person out of 49. "Severe disability" group participants have almost no previous work experience. About 30% of "moderate disability" group are employed, another 18% have previous work experience, but only third work full-time, two-thirds have a shorter working day or week. Majority of the



employed respondents work at charitable sheltered workshops, 20% work in the private sector. Their jobs are most likely associated either with art-shops (decoration, drawing), or with simple operations (packaging, cargo works). About half of young adults who defined themselves as “high functioning” have employment experience. For about 40% of them, this experience can hardly be called positive, job placements weren’t sustainable, didn’t match educational level, and income didn’t meet expectations. More than half of all respondents with work experience did not receive any support and didn’t know where to apply for it.

Conclusions: Study results confirmed that for people with ASD and/or ID in Russia employment opportunities are extremely limited and SE projects at open market are extremely rare. Jobseekers, family members and employers have very limited information about SE good practices examples, possible adaptations, legal aspects, etc.

**425.084 (Poster)** Examining the Psychometric Properties of an Implicit Association Test Used to Identify Potential Implicit Biases in Autism Identification

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Background: Despite evidence to suggest the prevalence of ASD does not differ as a function of race-ethnicity (Fombonne, 2003), misdiagnoses and delays in diagnoses are most commonly documented among minoritized racial-ethnic groups (Begeer et al., 2013). One hypothesis for these racial disparities is clinician bias (Begeer et al., 2009). To investigate this, Obeid & colleagues (2020) developed a “Disability Valence” Implicit Association Test (IAT) to assess implicit stigma and racial bias related to ASD. Guided by evidence that ASD elicits less stigma than more “disruptive” disorders (Feldman & Crandall, 2007), participants were asked to sort phrases associated with ASD and Conduct Disorder (CD) with positive and/or negative attributes. Using the IAT, this study confirmed that participants demonstrated a heightened stigma for CD as compared to ASD. In this study, an additional IAT evaluating racial association of ASD and CD revealed participants who identified as White implicitly associated images of White children with ASD and the Black children with CD. However, a limitation of this study was that given CD is partially defined by aggression and deviations from the law (American Psychiatric Association, 2013), the characteristics included in the original valence IAT are likely more overtly stigmatizing than ASD and thus, may not be an ideal comparison. A validated IAT that utilizes a less stigmatizing externalizing disorder, such as Oppositional Defiant Disorder (ODD), will allow for more nuanced examination of these racial biases.

Objectives: The purpose of the current study was to develop and validate a different disability valence IAT to examine participants’ implicit stigma toward ASD as compared to ODD, an externalizing disorder that has less overtly stigmatizing diagnostic criteria than CD.

Methods: To identify targets for the ODD category, we created 32 three-word phrases representing symptoms of ODD using diagnostic criteria. Phrases for the ASD category were derived from the original study (Obeid et al., 2020). To ensure construct validity of the phrases, fifty participants rated each phrase on “readability” and the degree to which each statement characterized ODD. To examine the resulting ODD Disability Valence IAT (Figure 1),  $n = 156$  participants were tasked with sorting phrases associated with ASD and ODD with positive and/or negative attributes.

Results: Using the validation data collected, we identified five phrases that had high mean ratings on Likert scales assessing i) readability, ii) representation of ODD and iii) low means for characterizing ASD. We used these phrases as the target items for the ODD category. As hypothesized and in support of the task validity, on the Disability Valence IAT, participants were more likely to implicitly associate good words with ASD and bad words with ODD;  $t(156)=13.96, p<.001$ .

Conclusions: The observed heightened negative associations toward ODD contributes to the existing evidence that externalizing disorders are more stigmatizing than ASD. Future research should use this new disability valence IAT and replicate the racial IAT to quantify if a racial association exists for ASD and ODD. Similar findings may suggest that the implicit biases which contribute to diagnostic disparities are even more subtle.

**425.085 (Poster)** Extension for Community Healthcare Outcomes (ECHO) Autism: Protectea, Argentina: Promoting Best Practices in Detecting and Managing Autism Spectrum Disorders

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Background: It is estimated that approximately 6 million individuals with autism spectrum disorder (ASD) live in Latin America. Researchers identified issues faced by families affected by ASD throughout Latin American countries, including Argentina, where long wait lists were identified as one of the most prevalent concerns (Paula et.al, 2020). The current pilot project was developed to test a new model for training primary care clinicians in best-practice care for ASD using the Extension for Community Healthcare Outcomes (ECHO) Autism framework. The ECHO Autism PROTECTEA (Program for Early Detection and Conscientization on Development and Autism Spectrum Disorders) project consisted of clinics focused on screening and identification of ASD and developmental differences and management of co-occurring conditions.

Objectives: To share the experience of the ECHO Autism PROTECTEA program in the first 8-month cycle of implementation and determine the feasibility of a telementoring program to reduce barriers for diagnosis and follow-up of individuals with ASD.

Methods: ECHO Autism is an innovative approach that leverages videoconferencing technology to amplify scarce specialist knowledge to mentor generalist clinicians to deliver best-practice care. ECHO Autism PROTECTEA sessions occurred once per month for 90 minutes, where community clinicians presented de-identified cases to the ECHO Autism expert hub team for feedback and guidance. A brief didactic presentation was also provided to address specific knowledge gaps. All participating clinicians completed pre- and post-teleECHO surveys regarding knowledge of ASD,

knowledge of best-practice guidelines in screening and assessment, satisfaction with content provided, and overall information regarding practice patterns. The current project contains analysis of ECHO Autism PROTECTEA clinic data from March 2020 through October 2020.

Results: 8 cases were presented; median age of 7 years (ranging from 2-12) and 1 adult; 5 were male, 3 were female. An average of 115 clinicians attended each ECHO Autism session from centers across the country. Using SPSS, data were analyzed to investigate if there was a change from pre-intervention, when participants reported using non-standardized clinical observation, to post-intervention, with a goal of increasing either standardized screening or formal testing after participation in ECHO Autism PROTECTEA. Across all domains measured, including assessment for overall development and autism, there was a significant change from pre- to post-intervention. Clinicians rated different measures on a Likert scale from 1-4, 4 being very good. 92% of participants found the content, 87% the expertise, and 83% the timing of the ECHO Autism program to be very good, with high applicability to their work (with 69% in the very good range and 27% in the average range). This was also reflected in the consistent attendance and engagement of clinicians. In addition, participants emphasized the opportunity to be able to develop strong multidisciplinary networks and collaborative partnerships across sites.

Conclusions: ECHO Autism PROTECTEA in Argentina demonstrated it is an effective model to deliver prompt access to assessment and best practice care. This model shows great promise as a means to reduce diagnostic waitlists in specialty centers and expand access for families in remote or underserved areas.

#### **425.086 (Poster) Journey Towards a Diagnosis: Studying the Experiences of Latinx Parents of Children with ASD**

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#### **Background:**

Early identification is a necessary precursor for optimal outcomes for children with autism spectrum disorder (ASD). However, even though gold-standard diagnostic assessments can reliably diagnose ASD as early as 18 months, the median age of diagnosis remains at 4-5 years and lags another 1.5 years for lower-income, minority families. This delay has measureable adverse outcomes: Spanish-speaking Latinx children display an elevated burden of ID and are ascertained at lower rates than their English-speaking, non-Latinx counterparts. Reliably documenting the process by which families obtain an ASD diagnosis will help to clarify the reason for delays in early identification, thus, allowing for more targeted and equitable efforts to lower the age of diagnosis in these populations. Although the qualitative experiences of families from underserved Latinx communities has been documented before, their experiences have not yet been studied systematically. The Diagnostic Odyssey Interview was developed to address this gap. This semi-structured interview was first used on a sample of African American families of toddlers with ASD to document the added barriers and difficulties they face (Constantino et al., 2020). Here, we deploy this interview for the first time in a sample of Spanish-speaking Latinx families of children with ASD and investigate these families' journey towards an ASD diagnosis. In doing so, we will elucidate how this underserved community in research and clinic experienced this process and aim to identify areas of improvement.

#### **Objectives:**

- (1) To evaluate the feasibility of using the Diagnostic Odyssey to document Spanish-speaking Latinx families' journey towards an ASD diagnosis.
- (2) To document barriers to accessing diagnostic services and identify characteristics that may predict more delays to diagnosis.

#### **Methods:**

The recruitment sample was gathered through a retrospective chart review of children evaluated at an ASD-specific clinic. All families had received a diagnosis of ASD for their child and had used a Spanish-language interpreter during their evaluation. Families were contacted via phone to enroll in the study and participate in the phone interview.

Feasibility outcomes were measured as recruitment success and parents' perceptions of participating in the Diagnostic Odyssey interview. Caregivers' experience obtaining a diagnosis will be measured through the interview itself. Data regarding the child's evaluation will be used for exploratory analyses.

#### **Results:**

Data collection is ongoing and is scheduled to be completed by December 2021. The current recruitment sample is composed of 96 families. All families received a diagnosis of ASD for their child and made use of a Spanish-language interpreter during their evaluation.

So far, 82% of parents that have been contacted have expressed willingness to participate in the study.

#### **Conclusions:**

Spanish-speaking, Latinx families comprise a community that has been historically underrepresented in research. Similar to limited prior research, we've begun to show that Spanish-speaking, Latinx families are willing to participate in research when they are approached with the opportunity. More specifically, these results begin to show that the Diagnostic Odyssey Interview is acceptable to families. The complete results of this study will further demonstrate feasibility and elucidate barriers to accessing services.

**425.087 (Poster)** Pilot Study of Citas: Communication Interaction Training on Autism for Spanish-Speaking Caregivers

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**Background:**

Children with ASD from Latinx families experience significant delays in accessing intervention and, when they do, access a lower dosage and lower-quality intervention compared to non-Latinx, White families (Angell & Soloman, 2017; Bishop-Fitzpatrick & Kind, 2017; Zuckerman et al., 2017). Magaña, Lopez, & Machalicek, (2017) identified a lack of information in the community as one factor that contributes to lower treatment access for Latinx families of children with ASD. Increasing ASD-related knowledge and provider trust are two strategies for decreasing disparities in the diagnosis and treatment of ASD among Latinxs families in the US (Zuckerman et al., 2017).

**Objectives:** The purpose of this study was to test the feasibility and acceptability of Communication Interaction Training on Autism for Spanish-Speaking Caregivers (CITAS), a 6-month intervention designed for Latinx families delivered within the context of a parent education support group

**Methods:**

Thirteen Latinx mothers of children diagnosed with ASD consented to participate and eleven completed the intervention (two participants dropped out due to transportation and childcare challenges). Participating mothers ranged in age from 30 to 52 years ( $M = 29.1$ ,  $SD = 1.2$ ), and their children were a median age of 54.5 months ( $IQR = 43-74$ ). Participants received CITAS, a manualized group intervention delivered once per month over 6 months aimed at increasing caregiver social support, empowerment, and ASD knowledge in a manner that considers the caregiving experience of Latinx families. Two waves of data collection (pre and post) included caregiver report measures available in Spanish that focused on caregiver empowerment, stress, and well-being. Measures included the Parents' Sense of Competence Scale (PSOC; Johnson & Mash, 1989), the Parenting Stress Index (PSI; Solis & Abidin, 1991), and the World Health Organization Quality of Life Questionnaire (WHOQOL-BREF; Lucas-Carrasco, 2012).

**Results:**

A mixed models analysis revealed no significant treatment effects ( $p$ -values ranging from .32 - .91), however medium effect sizes were detected for the Difficult Child subscale of the PSI ( $d=.37$ ; Solis & Abidin, 1991) and total scores on the PSOC ( $d=.49$ ; Johnson & Mash, 1989). A large effect size was detected for the Social Relationships subscale of the WHOQOL-BREF ( $d=.74$ ). Of the participants who completed the study, eight participated in greater than 80% of sessions. Three participants attended 33-67% of sessions. All participants completed 100% of survey measures. Survey results indicated high levels of satisfaction with CITAS, with 90% of responses indicating 'agree' or 'strongly agree' across ten items. Informal interviews with three participants indicated that caregivers valued learning CITAS content and this knowledge contributed to more positive parent-child interactions. Caregivers emphasized that their overall needs were met by connecting with other caregivers who shared common challenges.

**Conclusions:**

The results of this data provided preliminary evidence regarding the feasibility, acceptability, and potential impact of CITAS, low-intensity group treatment. Specifically, the study demonstrated the potential to significantly improve caregivers' knowledge of child development, sense of parenting competence, and social support for Latinx caregivers of children with ASD. These findings will be presented in terms of clinical implications and future research directions.

**425.088 (Poster)** Validation of the M-CHAT-R/F Illustrated, in Spanish: Preliminary Results

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**Background:** Although screening for ASD is recommended at 18 and 24 months in the primary pediatric setting, implementation of this public health measure is far from optimal, especially in low- and middle-income countries, where capacity might not be at par with the population's needs. The Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F) is a validated, widely studied screening tool that has been translated to over 50 languages, including Spanish, and has shown good psychometric properties in studies worldwide. A previous version, the M-CHAT, was validated in a case-control Mexican cohort. With cultural adequacy and relevance as the main interest, it focused on item-level analysis rather than the performance of the total screener scores. Additionally, there is preliminary evidence from a Mexican sample showing that the M-CHAT illustrated, in Spanish, can achieve better psychometric properties than the version without pictograms. There is still great need to validate screening and diagnostic tools to detect autism in different languages and populations.

**Objectives:** To validate the M-CHAT-R/F, illustrated, Spanish version, in a sample of toddlers in Nuevo Leon, Mexico.

**Methods:** The sample included 896 toddlers ( $N_{male}=548$ , 61.1%) ages 16-36 months ( $M_{age}=24.23$ ,  $SD=5.71$ ), recruited at primary care centers where parents/caregivers completed the screener online. Screener results were categorized based on initial scores as High Risk (HR;  $>7$  points), Moderate Risk (MR; 3-7 points), or Low Risk (LR;  $<3$  points). Follow-Up items were administered by telephone to the MR participants as needed to re-categorize them into HR (final score of  $\geq 2$ ) or LR (final score 0-1). Families with a HR score were invited to attend a no-cost evaluation that included cognitive and adaptive skills testing (Merrill Palmer-3) and autism diagnostic measures (ADOS-2, Toddler Autism Symptom Interview - TASI).

**Results:** From the 896 screeners collected through the initial 20-item questionnaire, 535 (59.7%) were LR, 177 were MR (19.8%) and 184 scored within HR (20.5%). From the MR group, 37 participants were re-categorized as LR. A total of 260 participants from the HR and MR groups were lost to follow up or declined the evaluation. Diagnostic outcomes of the 64 evaluations conducted to date include 79% ASD, 4.6% GDD, 4.6% Language Disorder, 1.5% hearing impairment, and 9.3% typical development/no diagnosis.

**Conclusions:** Our preliminary results show a higher proportion of positive screens as compared to other reported validation studies. This phenomenon, along with the high percentage of cases lost to follow up, could be related to the atypical circumstances that primary care has experienced during the COVID pandemic. It is encouraging that over 90% of the children who screened at risk with the M-CHAT-R/F and attended the evaluation were identified with a condition that warrants early intervention. However, preliminary results should be interpreted with caution, since the level of parent concern and the pandemic restrictions may have biased attendance that otherwise would have occurred based on screening results. Ongoing data collection, especially including evaluation of systematically randomized negative screen cases will contribute to the current knowledge about M-CHAT-R/F's performance in a Spanish-speaking, Mexican population.

**425.089 (Poster)** ASD Screening in Persian: "What Does 'Bright Lights' Mean? a Lamp, Sunlight, or Light-up Toys?"

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## **Background:**

Community-based and epidemiological data on developmental disability status in low- and middle-income countries is limited. Given the concerns in these countries, developmental monitoring and screening are considered essential for early identification. While significant advances have been made in the creation, validation, and implementation of screening tools for use in low-income countries, most tools have been developed in North America or Europe, and tools used in low-income countries often originate from existing tools. Having a culturally appropriate tool with good psychometric properties is a challenge. A review of translation and adaptation studies suggested that more rigorous approaches using multi-step methods lead to higher quality translations (Acquadro, et al. 2008). Numerous studies have documented differences in psychometric properties between different language versions of the same tool, both in the traditional and rigorous translation approaches (Fourie and Feinauer 2005; Granas, et al. 2014).

## **Objectives:**

The purpose of this study is to translate, culturally adapt and examine the face and content validity of the Persian version of the "First Year Inventory 2.0," a parent-report screening tool for autism spectrum disorders (ASD).

## **Methods:**

During a pre-planning phase, the research team examined the full intent of each questionnaire item, documenting words or terminology that would need to be replaced, culturally adapted, or further clarified. After completing linguistic, construct, and technical equivalence training, two native Persian translators (a parent of a child with ASD and an occupational therapist) who were highly proficient in English, independently translated the instructions, items, and response options of the "First Year Inventory" questionnaire (Baranek, et al. 2003).

In the next step, two experts with experience in the field of ASD analyzed the quality of the translations, and finally, the research team members and a coordinator, the two versions of the translation were merged into a single version. The integrated version of the questionnaire will be evaluated by 10 parents through qualitative cognitive interviews to determine face validity. To determine the content validity, at least 10 Iranian experts in the field of ASD will be asked to rate the items of the questionnaire in terms of conceptual relevance through a Likert scale. Finally, the questionnaire will be revised based on the data collected and sent to developers for approval.

## **Results:**

Our preliminary expert quality review and an integrated version of the two forward translations have been completed. The instrument has required replacement, addition, or removal of words in order to maintain linguistic equivalence and to adapt the instrument culturally. For instance, the games, such as patty-cake, are not known in Iran and require adaptation. Other illustrative examples along with qualitative and quantitative data will be presented.

## **Conclusions:**

Using a more rigorous translation and adaptation approach compared to the traditional approach, allows us to review each questionnaire item several times, document expert opinions, and ensure the quality of translations. The information that we will obtain will help to develop other screening and assessment tools across cultures.

**525 - International and Cross-Cultural Perspectives --- (V)**

**525.055** (*Virtual Poster*) Comparison of the Effects of Center-Based Vs. Virtual Training and Supervision of a Parent-Mediated Program Based in Applied Behavior Analysis in Children with Autism Spectrum Disorder in Lima, Peru

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**Background:**

Early intervention based on the principles of applied behavior analysis (ABA) has shown to be effective in improving communication, social, and daily living skills of children with autism spectrum disorders (ASD). Despite the research supporting ABA-based early intervention for children with ASD, many have limited or no access to services due to geographic location, economic reasons, and lack of available trained professionals (Antezana, et al., 2017). In Latin America, results of a recent study indicated that services for individuals with ASD were significantly lacking within educational and health systems (Montiel-Nava et al. 2020).

**Objectives:**

Currently, in Latin America there are 73 professionals certified to practice in the behavior analysis field across 20 countries, compared to over 44,000 in the United States alone. In March 2020, due to COVID-19, a country-wide mandatory quarantine was declared in Peru. All early intervention center-based services were required to stop, making it critical to integrate the use of virtually delivered ABA training to parents/caretakers on the implementation of a parent-mediated program with their young children with ASD. The current study assessed the progress of 5 children diagnosed with ASD, who were participating in a center-based early intervention program based on the principles of ABA in Lima, Peru. It compares their progress during center-based sessions versus during a parent-mediated model.

**Methods:**

Participants (n=5, Mean age 51.6 months  $\pm$  8.5 months) were evaluated at the beginning of center-based services and at the end of parent-mediated sessions using the Assessment of Basic Language and Learning Skills - Revised (ABLLS-R; Partington & Partington Behavior, 2010). During the center-based condition, the instructors delivering intervention were trained psychologists. During the parent-mediated condition, parents/caretakers virtually completed a 5-module training on the principles of ABA, and implemented the intervention under the supervision of qualified clinicians.

**Results:**

Data from this small sample indicated that most (n=3) participants met a larger number of objectives under the parent-mediated program; however some participants (n=2) met fewer goals. For all participants during the center-based condition, the average number of monthly objectives gained ranged between 30 and 37 (M= 33  $\pm$  2.5 objectives). Similarly, during the parent-mediated condition, the average number of objectives gained ranged between 26 and 66 (M= 46  $\pm$  15.9 objectives).

**Conclusions:**

Based on this small sample, our results suggest that gains obtained in a center-based model could be replicated and in some cases be improved in a parent-mediated model in which parents are virtually trained and closely monitored by qualified professionals. Results support that best practices can be established and implemented in Latin America and provide a foundation to improve service delivery and access to effective services to individuals with ASD in this region. Further studies with a larger population and for a longer period of time is highly recommended. Future studies should focus on further analyzing the variables that might make this model more effective for some families over others

**525.056** (*Virtual Poster*) Diet Quality and Dietary Pattern of Children with Autism Spectrum Disorder in China

**L. Cai, S. Pan, X. Wang and J. Jing,** Sun Yat-sen University, Guangzhou, China

**Background:** Food selectivity and the consequent inadequate dietary intake is common in children with autism spectrum disorder (ASD). However, there were limited studies regarding diet quality and dietary patterns among school-aged children with ASD, especially in Asian area.

**Objectives:** To investigate the diet quality and dietary patterns in children with ASD in China.

**Methods:** A total of 107 children with ASD and 209 typically developing (TD) children aged 6-10 years were recruited from an ongoing longitudinal study in Guangzhou, China. The information of food consumption was assessed by a validated parent-reported Food Frequency Questionnaire (FFQ), which contains 20 kinds of food such as cereal, vegetables, fruit, animal food, condiments and so on. Diet quality was evaluated by the Chinese Dietary Balance Index (DBI\_16, including three composite indices: High Bound Score [HBS]; Low Bound Score [LBS]; and Diet Quality Distance [DQD]). Dietary patterns were determined by cluster analysis using the k-means algorithm. Chi-square test and multivariate logistic regression analysis were used to compare the difference in diet quality and dietary patterns between children with ASD and TD children.

**Results:** The average DQD of autistic children was higher, which means the dietary intakes of children with ASD were more unbalanced (ASD, 32.4 vs. TD, 28.9,  $P=0.013$ ). By using the cluster analysis, three dietary patterns were identified: the healthy pattern which was in line with recommendations, the cereal/dairy/soybean pattern, and the salt/oil/sugar pattern. The proportion of three patterns in children with ASD and TD children was 20.6% vs. 22.5%, 44.9% vs. 51.2%, and 34.6% vs. 26.3%, respectively. Children with ASD had a significantly higher proportion of the salt/oil/sugar pattern compared with TD children ( $\chi^2=101.85$ ,  $P<0.001$ ).

**Conclusions:** School-aged children with ASD had lower diet quality and a higher proportion of unhealthy dietary pattern than their typically developing counterparts. Our findings highlight the need for regular monitoring nutrition problems and improvement of eating habits among children with ASD.

**525.057 (Virtual Poster)** Disclosing the Child's Autism Spectrum Disorder: Perspectives of First-Generation Immigrant Korean Mothers  
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**Background:** While immigrant families face common challenges such as culture clashes and language barriers, caring for children with autism spectrum disorder(ASD) leads to many issues that can complicate their adjustment to the host culture. Concerning disability culture within the Korean immigrant community, discomfort, stigma, and discrimination are the prevailing emotions, especially for people with disabilities (Kang-Yi et al., 2018), resulting in Korean immigrant mothers feeling hesitant to disclose their children's disabilities. However, very little is known about the influence of the home culture of the Korean-American community on parents' decision-making related to revealing a child's disability.

**Objectives:** This study aims to examine first-generation immigrant Korean mothers' perceptions and experiences of disclosing their children's ASD diagnoses. Specifically, the study examines: 1) first-generation immigrant Korean mothers' perceptions of an ASD diagnosis, 2) their experiences of disclosing their children's disability to others (i.e., to the community, their family members), and 3) difficulties in disclosing an ASD diagnosis to the public school system.

**Methods:** Eleven first-generation immigrant Korean mothers of children diagnosed with ASD were included in the study. Using snowball sampling, the participants were mainly recruited from a support group for Korean-American mothers who have children with ASD. The qualitative case study method, using semi-structured interviews conducted via Zoom, was employed to explore how their cultural backgrounds influence the disclosure of their children's diagnoses and how the participants reached their conclusions. Thematic analysis was used to identify patterns or themes in the dataset.

**Results:** First, participants' interviews showed that traditional Korean values, such as homogeneity, Confucianism, and collectivism, play a critical role in forming perceptions of and revealing disabilities. Second, the fear of stigma (i.e., the labeling effect, negative stereotypes, and wrong conceptualizations) makes mothers of children with ASD reluctant to disclose their children's diagnoses. Lastly, although all mothers showed a positive attitude toward disclosing their child's disability to public institutions, such as schools and other services providers, the expected stigma and benefits from services largely contributed to the parents' decision-making about disclosing a child's disability to the child's school.

**Conclusions:** Although cultural sensitivity has been emphasized, cultural factors that can create cultural clashes in the field of special education require further explanation. This study examined how native cultural conceptions of disability held by Korean immigrant mothers continue to be an obstacle to disclosing their children's disabilities. In addition, the lack of resources and limited access to services prevent mothers from disclosing their children's disabilities. Considering the paucity of empirical studies on this topic, further research should be carried out in the future.

**525.058 (Virtual Poster)** Diversity Representation in Evidence-Based Practices for Social Communication  
**M. Y. S. Bak<sup>1</sup>**, **A. D. Duenas<sup>2</sup>**, **A. M. Reilly<sup>1</sup>**, **H. Abas<sup>3</sup>** and **Q. Pan<sup>1</sup>**, (1)Educational Psychology, University of Minnesota, Minneapolis, MN, (2)College of Education and Human Services, Lehigh University, Bethlehem, PA, (3)College of Liberal Arts, University of Minnesota, Minneapolis, MN

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## **Background:**

Although the phenotype of autism spectrum disorder (ASD) is highly heterogeneous, a common difficulty among individuals with ASD is in the area of social communication. For individuals with ASD, social communication impairments can result in limited engagement with peers and development of social relationships, thus many of the evidence-based practices (EBP) identified in the 2021 report from the National Clearinghouse on Autism and Evidence Practice (NCAEP) target social communication skills. In 2016, West and colleagues conducted a review of evidence-based practices identified in the previous EBP report and found that most studies reported participants from White and English-speaking populations with ASD. This is particularly concerning when we consider social communication skills, as social communicative behaviors are constructed by cultural communities. Therefore, it is important to examine the current evidence-base for improving social communication to determine the extent to which it includes individuals with ASD from culturally and linguistically diverse backgrounds.

## **Objectives:**

The current systematic literature review investigated the extent to which social communication intervention studies that were included in the 2021 NCAEP report to support EBPs include diverse participants, settings, and culturally responsive learning objectives.

## **Methods:**

The current systematic literature review investigated studies in the 2021 NCAEP report specifically targeting social communication skills in individuals with ASD. Social communication was defined as the use of social behavior and language in various modalities (e.g., verbal, gestural, physical, textual) that facilitate inter-human interaction and communication (APA, 2013; ASHA.org; Prizant & Wetherby, 2005). We analyzed participant and researcher demographics such as race, ethnicity, nationality, socioeconomic status; setting characteristics such as country, school or clinic; dependent variable characteristics such as verbal language, social interaction outcomes; and intervention effect size.

**Results:** Of 1215 studies in the 2021 NCAEP report, 801 studies were included in the current systematic literature review per inclusion criteria for studies regarding social communication objectives. 24.47% (n = 196) of the studies included reported the race and/or ethnicity of their participants. Only 2.62% (n = 21) of the studies reported the nationality of the participants or the country in which the study was conducted. However, 5.11% (n = 41) of the studies included indicators of participant nationality or the country in which the study was conducted such as the language used (e.g., Korean) or the measurement (e.g., Turkish scales). Results also include researcher demographics and other participant characteristics such as cognitive measures.

## **Conclusions:**

The EBP reports from organizations such as NCAEP are often used to train pre-service practitioners and assist in-service practitioners in selecting and implementing effective, scientific interventions for individuals with ASD. Practitioners are increasingly trying to seek culturally responsive interventions especially in the area of social communication for individuals with ASD (Freeth et al., 2014). Although there have been calls for representation of diversity in participants (West et al., 2016), studies that investigated social communication interventions included in 2021 NCAEP may represent a heterogeneous population. We need increased research in social communication interventions to identify and promote effective and sustainable interventions for diverse individuals with ASD in diverse communities.

### **525.059 (Virtual Poster) How Do Japanese People Perceive the Concept of "Developmental Disorders"?**

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**Background:** In Japan, the term "developmental disorders" is widely used and has become an umbrella concept that includes several individual diagnoses, such as autism. The high level of recognition of developmental disorders has meant the concept is actively used in Japanese legislation and public awareness campaigns. However, it is conceivable that Japanese people do not place enough importance on the individual diagnostic labels of the various disorders classified under developmental disorders, and they may be applying a broad framework to their perceptions of the various developmental disorders that individuals experience. Although there have been studies examining images and stereotypes of mental illness (e.g., Angermeyer, & Dietrich, 2006), no study has examined Japan's unique cultural perception of the concept of developmental disorders. It is therefore necessary to examine perceptions of developmental disorders because it is generally recognized that perceptions of disorders lead to attitudes toward people with disorders (e.g., Corrigan et al, 2000).

**Objectives:** This paper conducted an exploratory study to clarify the general perception of developmental disorders in Japan.

**Methods:** Semi-structured interviews were conducted with 22 participants (9 males and 14 females; mean age 34.65 years,  $SD=14$ ) ranging from high school students to those in their 60s. The study participants had no diagnosis among themselves or their families and had no professional experience in learning about disorders. For the analysis, we used M-GTA, which is a method of generating concepts from verbatim interview data, interpreting the relationships among multiple concepts, aggregating them, and then presenting the results as a model. The theme of analysis was set as "What is the perception of developmental disorders at the Japanese". The analysis was conducted in five steps according to age, from which a final conceptual model was generated.

**Results:** As a result of the analysis, 27 concepts were extracted from the narrative content. From these, 10 subcategories were generated, which were finally organized into the three major categories of "Symptoms," "Evaluation," and "Causes". First, "Symptom" was categorized as narratives about specific characteristics and symptoms of developmental disorders. Some of these were thought to be related to the diagnosis of developmental disorders, while others were difficult to determine. Next, for "Evaluation", subcategories related to abilities (e.g. talent) and personality (e.g. kindness) were classified. It was suggested that people with developmental disorders, unlike those with mental illness, may be perceived as possessing special abilities and talents. Additionally, it was inferred that the subcategory [talent] classified in "Evaluation" has a compensatory role in the "state image". Lastly, "Causes" was related to the causes and reasons for developmental disorders, which were broadly classified as congenital and acquired. This suggests that there may be a combination of both accurate and inaccurate/false perceptions regarding causation.

**Conclusions:** The results of this study suggest that although people form their perceptions of developmental disabilities based on some medical knowledge, false perceptions may also contribute, therefore it is necessary to distinguish these from accurate knowledge. In the future, we plan to examine the relationship between perceptions toward developmental disabilities and stigma.

### **525.060 (Virtual Poster) Mapping Socio Economic Factors and Their Relation to Strengths, Difficulties and Autistic Traits in a Large Multinational European Autism Cohort**

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**Background:** There has been increased recognition that people from low socio-economic backgrounds do not benefit from equitable inclusion in autism research studies, whose conclusions may not be applicable to autistic people from a broad range of socioeconomic and ethnic backgrounds. The first step to addressing this is understanding the socio-economic backgrounds of participants in existing studies, and developing socio-economic scores (SES) that are reliable and whose profiles across domains are specific to autism, reflecting differences in needs and challenges.

**Objectives:** We aim to examine the structure of SES including both demographic and clinical variables in a large cohort of autistic and non-autistic people from the large dataset of the multisite Longitudinal European Autism Study (LEAP), and to investigate the relation between SES and everyday Strengths and Difficulties.

**Methods:** 453 Autistic - mean age = 16.71(5.83), mean FSIQ = 96.82(19.98), females = 123 -, 311 non Autistic - mean age = 17.17(5.94), mean FSIQ = 103.79(18.86), females = 107 - people participated in LEAP. For generating data-driven SES, socio-economic and clinical variables related to child, parental and family resources were selected (Figure 1B). As the outcome variable, we selected the Strengths and Difficulties Questionnaire (SDQ) total, internalising and externalising sub-scores. We performed parallel analysis and Minimal Residual Factor Analysis and labelled the factors based on variable loadings. To assess differential effects of SES in autistic participants, we used these data-driven SES in interaction with a dimensional measure of autistic traits, the Autistic Quotient (AQ) as predictors of SDQ.

**Results:**

The parallel analysis detected 5 factors (RMSE=0.03, TLI=0.8). Based on loads, we assigned the labels: 1) Child's Characteristics: participants' adaptive and cognitive profile 2) Life Changes: life cycle changes related to growth and living arrangements 3) Family System: size of family 4) Parental Resources: parents' education, occupation and income 5) Material Resources: living environment.

The SDQ total increased with Life Changes (Coef. = 2.72, p-value = 0.04) and AQ (Coef. = 0.14, p-value < 0.01); Life Changes and AQ significantly interacted (Coef. = -0.05, p-value < 0.01). The SDQ Internalising Score was higher with higher child adaptive functions (Coef. = 1.27, p-value = 0.03) and Life Changes (Coef. = 2.73, p-value < 0.01), but less so in people with higher AQ (Child's Characteristics : Coef. = -0.02; Life Changed: -0.03, p-values < 0.01). The SDQ Externalising Score decreased with Material Resources (Coef. = -1.52, p-value = 0.04) and increased with AQ (Coef. = 0.05, p-value < 0.01).

**Conclusions:** The 5 factors jointly covered and untangled cognitive and adaptive functions from environmental variables pertaining to SES. Life Changes and Material Resources related to SDQ, and Life Changes interacted with AQ. Formally diagnosed autistic people may experience less difficulties because of existing links to health services, less shift towards living independently, or less recognition from parent reports. Future research should aim for more diversified sampling, and data collection in domains that influence the strengths and difficulties of autistic people, such as Life Changes and Material Resources.

#### **525.061** (Virtual Poster) Medical Encounters for Individuals with Autism Spectrum Disorder (ASD): Perceptions and Practices of Filipino Physicians

**M. K. P. Alonzo**, Division of Developmental and Behavioral Pediatrics, Philippine General Hospital, Manila, Philippines

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**Background:** Given the increasing prevalence of Autism Spectrum Disorder (ASD) with the presence of co-morbidities, more patients with ASD will be encountered by different physicians in the clinical setting.

**Objectives:** This research aimed to assess the knowledge, perceptions and attitudes of Filipino physicians and describe their medical encounters with patients with ASD.

**Methods:** It is a mixed-methods cross-sectional study which employed online surveys and interviews.

**Results:** Among 315 physicians, 87% described an ASD encounter. Most of patients encountered were <18 years of age with only 14% having an encounter with an adult with ASD. The top reasons for consult were for general and unspecified, psychological, neurological and respiratory concerns. Although Filipino physicians have adequate knowledge on autism, they gave themselves low self-ratings for confidence and efficacy in their medical encounters. Pediatric providers were significantly more confident and employed more strategies in their encounters. Personal experience was not correlated to increased knowledge, confidence and self-efficacy. Majority believed that there are barriers to the care of patients with ASD citing the need for 1) training 2) preparation 3) resources 4) hospital and clinic accommodations and 5) establishing a referral system.

**Conclusions:**

Training with regards to care for patients with ASD must be skills-based and should take into consideration the specific clinical setting. The development of clinical practice guidelines with regards to best care of patients with ASD is recommended.



**525.062** (Virtual Poster) Social-Demographic Factors and Clinical Diagnoses of Autism Spectrum Disorder Among 16-30 Months Children: A National Cross-Sectional Study

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**Background:** For early diagnosis and management of autism spectrum disorders (ASD), high-quality services are essential but socio-economic dependent.

**Objectives:** This study aimed to determine potential inequalities in the early diagnose of children with autism in China, examine the association of socioeconomic status with ASD diagnosis during 16-30 months of age.

**Methods:** A national, cross-sectional, populational-based study was conducted between August 1<sup>st</sup> 2016 to March 30<sup>th</sup> 2017, and a national sample was derived by convenience sampling, including North region (Beijing), West region (Chongqing and Guizhou), South region (Guangdong), Central region (Hubei) and East Region (Zhejiang). Clinical diagnosis of ASD were made by child psychologists, followed the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). We collected information including maternal/paternal education, maternal/ paternal occupation, household income, rural residence and minority of ethnic background. The final sample included 6049 children (mean age 22.68 months with standard deviation 4.11 months, 55.6% male), among which 71 of them were diagnosed with ASD.

**Results:** According to maternal education level, the ASD prevalence was 0.9%, 1.6% and 2.4% among children whose mother had educational level 'college or above', 'high school' and 'junior middle school or below' respectively. After adjusting for demographic factors and prenatal/perinatal indicators, the aOR for having the diagnosis ASD (2.46, 95% CI: 1.32-4.59) among children whose mother's level is 'junior middle school or below' was significantly higher than children whose mother's level is 'college or above'.

**Conclusions:** Among children of lower educated mothers there is a higher risk for being diagnosed with ASD at a young age. This may guide ASD early screening, diagnosis and management. We recommend more support for families with a low socio-economic status to early detect, diagnose and manage ASD.

**525.063** (Virtual Poster) Psychometric Properties of the Chinese Version of the Children's Empathy Quotient and Systemizing Quotient

**X. Wang<sup>1</sup>, L. Lin<sup>1</sup>, J. Jing<sup>1</sup> and B. Auyeung<sup>2</sup>, (1)Sun Yat-sen University, Guangzhou, China, (2)University of Edinburgh, Edinburgh, United Kingdom**

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**Background:** The profiles of empathizing and systemizing can be used to reflect specific characteristics of ASD and describe gender-typical behaviors in general population but no validated Chinese version of the Children's Empathy Quotient (EQ-C) and Systemizing Quotient (SQ-C) are available in Mainland China yet.

**Objectives:** We aimed to validate the Chinese version of the EQ/SQ-C in children aged 4-12 years from both clinical and general population.

**Methods:** A total of 782 typically developing (TD) children, aged 4-12 years was recruited with whose parents completed the Chinese version of EQ/SQ-C. A 23-item three-factor EQ-C and a 22- item four-factor SQ-C was developed which showed good internal consistency and test-retest reliability.

**Results:** Girls scored significantly higher on EQ-C ( $31.4 \pm 7.8$  vs.  $28.2 \pm 7.7$ ) but there were no gender differences in SQ-C scores. When categorizing cognitive styles by considering EQ/SQ-C, TD children showed different cognitive styles (empathizing-dominant for girls with 42.3% identified as Type E; systemizing-dominant for boys with 40.7% identified as Type S). A further sample of 222 children with autism spectrum disorder (ASD) additionally assessed for intelligence and socio-economic status (SES) was recruited. They scored lower on EQ/SQ-C compared to TD children ( $13.2 \pm 5.1$  vs.  $29.7 \pm 7.9$ ;  $12.4 \pm 5.8$  vs.  $23.5 \pm 8.3$ ) and were generally systemizing-dominant (Type S: 46.7% for boys and 44.0% for girls). Autistic children scored higher on the SQ-C in those without intellectual disability and with higher paternal education level and family income ( $14.2 \pm 6.1$  vs.  $10.9 \pm 5.0$ ,  $13.3 \pm 6.2$  vs.  $11.5 \pm 5.1$ ,  $13.7 \pm 5.6$  vs.  $11.9 \pm 5.8$ ), while there were no differences in the EQ-C.

**Conclusions:** This study indicated good reliability and validity of the Chinese 23-item EQ-C and 22-item SQ-C, which can be used in Chinese children with and without ASD.

**525.064** (Virtual Poster) The Validity and Reliability of the Chinese Version of the Social Communication Questionnaire

**L. Lin, S. Liu, X. Wang and J. Jing, Sun Yat-sen University, Guangzhou, China**

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**Background:** The Social Communication Questionnaire (SCQ) has been used to assess the symptoms of autism spectrum disorder (ASD) worldwide except in Mainland China.

**Objectives:** This study aims to validate the Chinese version of the SCQ in children aged 2~12 years from both general and clinical population.

**Methods:** We recruited 819 Chinese children in this study, including 505 typically developing (TD) children, 202 children with ASD and 112 children with non-ASD neurodevelopmental disorders. All the children's parents completed the Chinese version of the SCQ and all children with ASD were additionally assessed for intelligence and the Childhood Autism Rating Scale (CARS) to confirm their diagnosis.

Results: We have developed a 40-item, 4-factor structure of SCQ with two domains (social communication and social interaction; and restricted, repetitive, and stereotyped patterns of behavior), which showed adequate goodness of fit (comparative fit index [CFI] = 0.981, Tucker Lewis index [TLI] = 0.980, standardized root mean squared residual [SRMR] = 0.116, root mean square error of approximation [RMSEA] = 0.061), with good internal consistency (Cronbach's alpha = 0.923). We have provided different cut-offs to distinguish ASD cases from TD children (10.5 for children under 4 years [sensitivity: 0.963, specificity: 0.952], 11.5 for children 4 years and above [sensitivity: 0.926, specificity: 0.975]) or children with other neurodevelopmental disorders (13.5 [sensitivity: 0.851, specificity: 0.875]).

Conclusions: Through this large sample validation, we confirmed that the Chinese version of the SCQ could be used for children aged 2~12 years with relatively good psychometric properties.

**525.065** (Virtual Poster) Understanding Cultural Sensitivity in Autism Education: A Semi-Structured Interview with Chinese American Parents of Children with Autism

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Background: The acculturation process has increased the diversity of the autistic population seeking professional services and education in the U.S. As the diagnosis of autism increases within Chinese American immigrant population, there is an increasing need to understand this population and provide appropriate intervention and education for this group. Among all the factors influencing the intervention process, culture remains an essential one that needs extra attention. To our knowledge, no previous studies have evaluated the cultural appropriateness of the education Chinese American autistic children received. The current study explored the cultural sensitivity of the education and intervention autistic students received from the perspectives of their Chinese American parents.

**Objectives:**

The study intended to understand the perception and expectation of Chinese American parents over the cultural sensitivity of intervention strategies and educational materials their autistic children receive in the U.S.

**Methods:**

An online screening questionnaire and a semi-structured interview were conducted with eight Chinese American parents (7 mothers; 1 father; average time in the U.S. 7.5 years ( $SD = 2.71$ ) with children between 4 to 11 years old ( $M = 7.88$ ,  $SD = 2.64$ ; 4 born in China, 4 in U.S.) were recruited. Participants completed the screening questionnaire with basic demographic information of their family and autistic children online first. Eligible participants were interviewed via online meeting in Mandarin (native language). Interview questions were developed to explore participants' perception of cultural sensitivity in educational materials/strategies, their expectation and recommendations of cultural education, and experiences after diagnosis. Thematic analysis approach was used to analyze interviews (Braun and Clarke, 2006).

**Results:**

Analysis of the transcripts focused on four themes: immigration context and family environment, cultural sensitivity perception and expectation, attitudes and experiences with ASD diagnosis and stigma, as well as expectations and suggestions. Chinese American parents' experiences and attitudes towards the cultural-related stigma influenced how they perceived children's autism diagnosis and symptoms as well as their expectations of children's culturally-sensitive education. The education materials and intervention strategies provided to their children with autism were not considered culturally-sensitive. Parents expected more systematic guidance and support from the education institutions and provided suggestions to lower the pressure of the special education system.

**Conclusions:**

Interviews supported the idea that cultural sensitivity is a critical missing piece of education for autistic children with Chinese American parents. Based on Mistry et al.'s integrated conceptual framework (2016), a theoretical model was created to provide culture-centered interpretation of the interconnected relationship between the specific context Chinese American parents' lived in and their parenting domains (Figure 1). It analyzed parents' attitudes towards autistic diagnosis and symptoms, expectations of children's culturally-sensitive education through their understanding of cultural-related stigma. The model highlighted the necessity and importance to construct and reform the distribution of special education resources that are culturally sensitive to Chinese American parents and autistic children. Follow-up research with larger sample size and diverse family type are emphasized to improve and refine the model. Broadening the study sample to include perspectives from individuals outside Chinese American families is also recommended for future work.

**525.066** (Virtual Poster) Brief Report: Parental Stress in Parents of Autistic Children in China and the Netherlands

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Background: Parents of autistic children experience higher stress levels than parents of non-autistic children. Asian parents with autistic children may experience more stress compared to Western parents (Chung et al., 2012; Nomaguchi & House, 2013), though findings are mixed (Smith et al.,

2021). In addition to culture, fewer autism symptoms, female gender of the autistic child, and high Social Economic Status (SES) have been linked to lower parenting stress. It is unknown whether these factors have a different impact on parenting stress in Asian (China) and Western (The Netherlands) countries.

**Objectives:** In this pre-registered study, we (a) compared parenting stress levels between parents of autistic children from China and the Netherlands, using the abbreviated Parenting Stress Index (PSI), and (b) examined the impact of caregiver factors (age, income, educational level) and child factors (gender) on parenting stress in both countries, and exploring the association with parents' worries about COVID-19.

**Methods:** 95 Chinese parents (76 boys; 19 girls) and 118 Dutch parents of autistic children (93 boys; 25 girls) aged 2 to 16 years ( $M = 9.64$  years,  $SD = 4.24$ ) participated. Most parents (92%) were well educated and had middle to higher-level family income (83%) (see Table 1). A hierarchical multiple regression analysis was used to examine if parenting stress differed between countries, with caregiver factors (age, income, educational level) and child factors (gender) and COVID-19 worries as the predictors (step 1), followed by country (step 2) and the interaction terms between caregiver/child factors and country (step 3).

**Results:** Caregiver factors, child factors and COVID-19 worries explained 15% of the variance in parenting stress. Younger parents and parents with more COVID-19 worries reported more parenting stress. Country explained 15.9% additional variance in parenting stress, indicating that Chinese parents ( $M = 43.36$ ,  $SD = 8.45$ ) reported higher parenting stress than Dutch parents ( $M = 32.92$ ,  $SD = 11.69$ ) (see Table 2).

**Conclusions:** Chinese parents of autistic children reported higher parenting stress levels than Dutch parents, despite fewer COVID-19 worries. Culture could play a role: Chinese culture emphasizes interdependence and parents' responsibility for training a child to behave properly in society. Chinese parents of autistic children may place less value on their own needs and may fear non-conformity of their child, promoting self-sacrificing behaviour and social isolation, which may negatively impact parental mental health and well-being. Moreover, having an autistic child in China may be perceived relatively more as a social devaluation. It may invoke different stressors (e.g., cultural concerns of losing face) that are particularly salient in Chinese parents. Factors influencing parenting stress in different socio-cultural settings is an important issue that requires further study.

**525.067 (Virtual Poster)** Working Towards Inclusive Education for Autistic Children in Algeria: An Analysis of the English As a Foreign Language (EFL) Teacher Preparation Programme

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**Background:**

Since signing the Convention on the Rights of Persons with Disabilities (CRPD) in 2007, Algeria has been striving to improve rights in all domains including education. However, it has been suggested that these laws are merely "words on paper" (Kaci, 2019). One potential example case is inclusive education. To what extent have inclusive education practices been followed in Algeria? We have investigated teachers' knowledge and attitudes with the hope of identifying training needs and barriers to implementation with respect to the educational inclusion of autistic children.

**Objectives:**

The focus of this study was on Ecole Normale Supérieure (ENS) and University students/graduates (prospective teachers) of English as a Foreign Language (EFL). We investigated their knowledge of autism and their attitudes towards inclusive education for autistic children. We also explored the connections between prospective teachers' knowledge/understanding of autism and the EFL teacher training programme.

**Methods:**

These research objectives were addressed qualitatively, using a combination of semi-structured individual interviews and focus group discussions. 13 Individual interviews involved introducing scenarios about autistic children in a general classroom and direct questions about participants' knowledge of autism and attitudes towards inclusive education for autistic children. In each of the two focus groups ( $n=3$  per group) we discussed how participants' teacher training experiences contributed to their knowledge. Critical thematic analysis was used to analyse the data generated.

**Results:**

We identified the following themes: (1) knowledge of the characteristics of autism, (2) personally/socially driven sources of information, (3) fluctuating attitudes and (4) educability of autistic children. Participants' knowledge of autism was highly variable (Theme 1). Whilst some had accurate information, the responses of other participants exhibited stereotypical views about autistic children all being (e.g.) "highly intelligent". The chief characteristics of autism reported were communication difficulties, repetitive behaviours and sensory issues. Regarding their sources of information (Theme 2), some participants mentioned the role of the internet and social media in developing their current understanding of autism. Personal experiences and previous contact with autistic people also influenced a number of participants. It is noteworthy that 3 participants mentioned 'The Good Doctor' TV series and how it contributed to their knowledge and understanding of autism. Participants' attitudes towards teaching autistic children fluctuated between positive, negative and mixed (Theme 3). A number of participants saw autistic children as 'unintended students' (Titchkosky, 2002) who should receive education in special schools or classes (Theme 4). The main argument among those who were hesitant towards including/teaching autistic children was related to lack of knowledge and effective training.

## Conclusions:

Our participants' knowledge of autism was highly variable and mostly obtained from individual experiences and personal efforts rather than any sort of institutional training programme or material. Nonetheless, this situation is unlikely to be unique to Algeria or even developing countries like Algeria.

### **525.068 (Virtual Poster)** Examination of the Impact of the Get SET Early Program on Racial and Ethnic Disparities on the Screen-Evaluation-Treatment Chain in Toddlers with ASD

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**Background:** Although trends are improving, children from underrepresented minority (URM) backgrounds are often identified with autism spectrum disorder (ASD) less frequently, at older ages, and with reduced access to services than their Caucasian counterparts, which could negatively influence developmental outcomes for these groups. It is not clear if disparities exist at all levels along the screen-evaluation-treatment chain, or if early detection programs such as *Get SET Early* that standardize steps for screening, evaluation, and treatment referral are effective at reducing disparities.

**Objectives:** The aim of the present study was to determine if engagement in the *Get SET Early* program (Pierce et al., 2011; 2021), a universal early screening and detection program, results in equal levels of ethnic and racial participation and performance from the screening level to the treatment level, thus reducing any existing disparities along the screen-evaluate-treat chain. To do so, uptake rates within key metrics of the model were examined stratified by ethnicity and race, including average screen age, screen failure rates, parent concern rates, pediatrician referral rates, average evaluation age, average treatment start age, and average hours of treatment received over the most recent six months of treatment.

**Methods:** Following the *Get SET Early* program training, 97 pediatricians digitally administered 30,554 CSBS-DP-IT Checklist screens at 12, 18, and 24-month well-baby exams, and parents designated presence or absence of concern. Toddlers who failed the screen, or whose pediatrician had an ASD concern, were referred to a clinic that specializes in the infant-toddler period and evaluated by licensed clinical psychologists and referred for treatment the same day as appropriate. Treatment engagement data was retrieved directly from the San Diego Regional Center that administers Part C funding for ASD treatment and was also supplemented by parent report.

**Results:** Children from URM backgrounds were screened at expected rates for San Diego County; however, they were more likely to fail the screener than their Caucasian/Not Hispanic counterparts. Parents of children from URM backgrounds also expressed more concern than Caucasian/Not Hispanic parents. Pediatrician referrals were most influenced by screen failure and parent concern, over ethnic/racial group membership. Overall, there were no group differences between the mean age at first screen (range 16.98 to 17.32 months), evaluation and treatment referral (range 20.50 to 22.93 months), first treatment engagement (range 21 to 27 months) or level of treatment engagement between groups (4.50 hours per week to 9.55 hours per week).

**Conclusions:** Leveraging standardized early detection programs such as *Get SET Early* may help reduce disparities traditionally found along the screen-evaluation-treatment chain. Though there remain gaps within the pipeline that need to be addressed, e.g., applicability of specific screen items to some groups or how to further ensure that families will follow-through with treatment referrals, implementation of systemized programs that are easily accessible among all demographic groups may be key in ameliorating disparities in access to care across communities.

### **525.069 (Virtual Poster)** Examining Cultural Differences in Face Processing: Implications for Assessment and Intervention in Autism Spectrum Disorder (ASD)

**Y. Bean<sup>1</sup> and A. J. Harrison<sup>2</sup>, (1)School Psychology, University of Georgia, Athens, GA, (2)Educational Psychology, University of Georgia, Athens, GA**

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**Background:** Most autism spectrum disorder (ASD) assessments and treatments evaluate or target “typical” social conventions such as eye contact, joint attention, and social referencing (Lord et al., 2012; Volkmar et al., 2014). Research documenting cultural differences in overt or observable social behaviors, such as eye contact and body language (e.g., Fugita et al., 1974; Archer, 2007), highlights the need to adapt assessment and intervention to align with distinct cultural norms. Recommendations for how to adapt best practices to take into account cultural variability should be informed by research documenting cultural differences in both overt and more covert social behaviors (e.g., face processing and emotion recognition). Preliminary research shows cultural differences in face processing when comparing across countries (e.g., Matsumoto, 1989; Ekman & Friesen et al., 1987); however, a more nuanced examination of sociocultural differences within individuals from different racial-ethnic groups living in the same country can result in more culturally sensitive ASD diagnostic procedures and interventions.

**Objectives:** We examined cultural differences in face processing, due to the role this may play in ASD assessment and treatment planning. Theory suggests that groups of racial-ethnic minoritized individuals, as compared to White participants, may prioritize different facial features. This study examined differences in total dwell (viewing) time to key facial features (eyes, mouth, and nose) across racial-ethnic groups.

**Methods:** Data from 88 participants was analyzed across distinct racial/ethnic groups (Asian, Black, and White). Each participant completed questionnaires to obtain demographic information (race, ethnicity, etc.), individualism versus collectivism identification, and acculturation level. Participants then completed a 20-minute face processing task in which they viewed a series of racially-ethnically diverse facial stimuli depicting a range of emotions for 5 seconds each. Amount of participant eye gaze to facial features was quantified using an eye tracker.

**Results:** Results from a 3 (Racial Group: White, Black, Asian) x 3 (Facial Feature: Eyes, Mouth, Nose) repeated measures ANOVA revealed a significant emotion by group interaction  $F(2, 154) = 2.61, p = .01$ . A post-hoc examination showed that White participants demonstrated significantly different patterns than both Black ( $p = .05$ ) and Asian ( $p = .014$ ) participants. The difference between Asian and Black participants was not significant ( $p = .48$ ). To further examine the nature of the interaction, post hoc tests examined the duration of time spent looking at each facial feature within each racial group. Results revealed that White individuals viewed the mouth more than Asian individuals ( $p = .040$ ) and viewed the eyes more than Black participants ( $p = .002$ ).

**Conclusions:** In alignment with our hypothesis that participants from collectivistic countries may avoid overly expressive features like mouths (Yuki et al., 2007), we found that White participants prioritized mouths more than Asian participants. We also found a novel, meaningful difference in how White and Black participants prioritized facial features. This indicates culture affects more subtle social functioning within racial-ethnic groups and could inform the development of culturally sensitive assessments and treatments for individuals with ASD. Follow-up analyses will also examine the effect of acculturation and worldview on facial viewing times.

**525.070 (Virtual Poster)** Identifying the Best Discriminating Signs of Autism Spectrum Disorder (ASD) in High-Risk Siblings in Singapore  
**C. M. Wong, N. Mohd Zambri, H. H. Fan, L. H. S. Lau, L. M. Daniel and H. C. Koh, Department of Child Development, KK Women's and Children's Hospital, Singapore, Singapore**

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**Background:** Singapore's population comprises a multiracial demographic of 76% Chinese, 15% Malay, 7.5% Indian, and 1.5% other races. The estimated prevalence of ASD in Singapore is 1%, and although nationwide developmental surveillance is conducted for young children, there is no standardised ASD-specific screening. The Modified Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F) is the most commonly used. Koh (2014) previously found that the M-CHAT Critical 6 and Best 7 scoring methods were accurate (sensitivity >0.75) in detecting ASD in 18-30-month-old Singaporean children referred with developmental concerns. However, studies from other Asian countries have reported lower M-CHAT sensitivity (Toh 2018), and that the critical/discriminating items may vary by race/culture (Wong 2018, Kamio 2015, Seung 2015, Wong 2004).

**Objectives:** To determine the accuracy of the M-CHAT-R/F as a Level Two screener in a population of siblings at high risk for ASD in Singapore, and to identify the best discriminating signs of ASD.

**Methods:** Siblings aged 12-30 months of children with confirmed ASD were invited to undergo a structured screening programme which involved parents completing the M-CHAT-R/F at 12, 18 and 30 months old. Only the English version was used as Singaporeans are predominantly English-speaking. Although the M-CHAT-R/F is only validated for children 16 months and older, the 12-month screening was conducted to explore its utility compared to other 12-month screeners. The siblings then underwent an Autism Diagnostic Observation Schedule – Second Edition (ADOS-2) assessment at 36-48 months old to determine if they met the autism spectrum diagnostic algorithm. Sensitivity, specificity, positive predictive and negative predictive values for the M-CHAT-R/F were computed, and Fisher's exact test was used to determine higher-discriminating items. Discriminant Function Analysis will be conducted on more complete data.

**Results:** 185 siblings underwent screening (54.5% male; 64% Chinese, 26% Malay, 5.7% Indian). 18 withdrew and 88 have completed the ADOS-2 to date. 32 met criteria for ASD. 23 of the 88 were screened at 12 months, 49 at 18 months, and 70 at 30 months, with some being screened at more than one time point. Results on the 88 indicated overall low sensitivity but high specificity of the M-CHAT-R/F at all age groups, even with using Critical 6 scoring. Further analyses of the 30-month data indicated that the most discriminatory items were protodeclarative pointing, spontaneous showing, response to name, gaze following, and gaining attention. ADOS-2 assessments are ongoing hence detailed results will be presented at INSAR 2022.

**Conclusions:** The performance of tools developed for low-risk ASD screening should also be examined in higher-risk populations. In a population of Singaporean siblings at high risk of ASD, the M-CHAT-R/F did not perform as well as previously found. This may be due to high-risk siblings having more subtle features of ASD which are missed by screening but picked up on ADOS, or biased parental reporting if their older child had more obvious signs of ASD. Higher-discriminating items appear to be different from those defined in the US population.

**525.071 (Virtual Poster)** South Korea's Perception of Autism and Play, and the Effects on Parents and Educators of Children with ASD  
**S. Kim<sup>1</sup> and A. K. Marcelo<sup>2</sup>, (1)Kindle Behavior Consultants, Burlington, MA, (2)Psychology, Clark University, Worcester, MA**

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**Background:**

Play has been used as an intervention for children diagnosed with Autism Spectrum Disorder (ASD). Although the relations of play and ASD have been widely studied, there is a dearth in studies in this area of research in more diverse samples, especially in Asian samples. For example, there are a small handful of studies on ASD and effectiveness of play intervention on children with ASD in South Korea. Understanding how specific ethnic-racial groups perceive these constructs, in terms of their form and function, is important in developing more effective and accessible interventions to support families with children diagnosed with ASD across different cultures.

**Objectives:**

This exploratory study aims to examine if and how the effects South Korean cultural attitudes have on Korean children with ASD, their parents, and their educators. Additionally, cultural attitudes towards play, and if Koreans view play as something that could be beneficial for children with autism's development, will be collected.

## Methods:

South Koreans (N=???; data collection ongoing) in Korea completed questionnaires with open ended questions via Qualtrics on their knowledge of ASD, perceptions of children with ASD, and perceptions of play/play intervention. Participants chose if they identified as a parent or an educator of a child with ASD, or part of the public with no personal connection to ASD.

## Results:

Preliminary findings illustrate that common belief from the public is that people with ASD feel isolated, trapped, and have severe developmental and physical disabilities. Much of the public perceived play intervention/education as a positive strategy because play was seen as something easy that would garner interest from children and could teach social/communication skills. Most of the general public's responses reflected a stereotypical view of autism. Many of the written responses stated that play is something children with ASD would benefit from, because play is considered easy, play can teach communication skills, and improve social interaction skills which many noted children with ASD may struggle with.

## Conclusions:

Most of the general population group carried a stereotypical belief of ASD, such as an inability to socialize at all, and that ASD is a severe disability which requires life-long parental care. This belief neglects that autism is on a spectrum, and there is no one diagnosis that fits everybody. If the majority of a population believes that ASD has a certain look, then parents may forgo taking their child to the doctor for a diagnosis if their child does not completely fit the stereotype. Furthermore, this could harm children who do not fully fit into the stereotype as they may be denied intervention services and other forms of care. These misconceptions could contribute to a deeper separation of people with developmental disabilities from neurotypicals in society. Data collection is ongoing, and focusing on recruiting more caregivers and teachers of children with ASD. Gaining an understanding on how South Koreans perceive ASD, people diagnosed with ASD, and play as a potential intervention, will allow us to develop better intervention programs to help children with ASD across different cultures.

## **525.072 (Virtual Poster) The Relationship between Social Camouflage and Mental Health in Japanese Autistic Adults.**

**F. Oshima<sup>1</sup>, T. Takahashi<sup>2</sup>, M. Hongo<sup>3</sup>, L. Hull<sup>4</sup>, W. Mandy<sup>4</sup> and E. Shimizu<sup>1</sup>,** (1)Research Center for Child Mental Development Chiba University, Chiba, Japan, (2)Waseda University, Saitama, Japan, (3)Chiba University, Chiba, Japan, (4)Department of Clinical, Educational and Health Psychology, University College London, London, United Kingdom

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## Background:

An autism spectrum disorder (ASD) diagnosis is intended to signal the need to support, to improve functioning and quality of life. However, many autistic people are not diagnosed adulthood and therefore miss out on the support and understanding they need. One of these reasons for autistic people being undiagnosed or diagnosed late is potentially related to camouflaging of autistic characteristics (Hull et al., 2017). Social Camouflaging (SC) refers to strategies that mask social difficulties and enable "passing" as though non-autistic in social situations (Hull et al., 2017; Livingston et al., 2020). While appearing to improve external adaptation in social situations, SC has been shown to increase fatigue and anxiety in people with ASD and is associated with worse mental health outcomes (Lai et al., 2017). As cultural differences, including gender, highly influence SC, there is a need to clarify the characteristics of SC in a range of cultural contexts. But most SC research to date has been done in Western countries, especially the UK, and the relationship between mental health and SC in autistic adults in Japan is not clear.

## Objectives:

This study aims to clarify the relationship between SC and mental health in Japanese autistic adults.

## Methods:

A total of 192 men and women aged between 20 and 65 years with a diagnosis of ASD and an IQ in the normal range participated in the study. All gave informed consent to participate in the study, and completed the following self-reported, Japanese-version questionnaires: the Camouflaging Autistic Traits-Questionnaire (CAT-Q), the Broad Autism Phenotype Questionnaire (BAPQ), the Warwick-Edinburgh Mental Well-being Scale, the Patient Health Questionnaire-9 (PHQ-9), the Liebowitz Social Anxiety Scale, and the Generalized Anxiety Disorder-7 (GAD-7).

## Results:

Figure 1 & 2 show the results of the hierarchical multiple regression analysis. In the present study, SC did not predict worse mental health in Japanese autistic adults. Furthermore, non-linear effects of SC were found on the GAD-7 and PHQ-9. Again, there were no gender differences in the relationship between SC and mental health deterioration. Hull et al. (2021) found that the higher the camouflage score, the greater the generalized anxiety, depression, and social anxiety. In our data, on the other hand, depression and generalized anxiety were nonlinearly related to higher camouflage scores. While there were no significant differences between men and women, but non-binary subjects were not studied.

## Conclusions:

In Japan, SC for people with ASD was not simply associated with poorer mental health. It is suggested that the relationship between this outcome and the socio-cultural background needs to be clarified.

## Interventions - Non-pharmacologic - Preschool & Infant

### PANEL — INTERVENTIONS - NON-PHARMACOLOGIC - PRESCHOOL & INFANT

#### 229 - Leveraging Diverse Digital Technologies to Disseminate Evidence-Based Autism Interventions

**Panel Chair:** Ty Vernon, *University of California, Santa Barbara, Santa Barbara, CA*

**Discussant:** Karen Bearss, *Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA*

##### **229.001 (Panel)** Pivotal for Early Autism Intervention: Preliminary Outcomes of a Smartphone App-Based Parent Education Program

**E. F. Ferguson, A. Arias, M. Jimenez Munoz, S. Licon, K. M. Russell, P. Adams, A. Nees and T. W. Vernon, University of California, Santa Barbara, Santa Barbara, CA**

**Background:** Many families experience challenges accessing appropriate interventions to promote language and social development in young children on the autism spectrum (Bishop-Fitzpatrick & Kind, 2017). Online training for caregivers of autistic children may increase access to high-quality treatment methods and jumpstart child development through daily parent-child interactions (Ingersoll et al., 2016). While self-directed parent education programs have generally resulted in inferior outcomes when compared to in-person professional training, video self-monitoring and self-management of one's performance, paired with adaptive app-based feedback based on self-scoring, have the potential to facilitate training outcomes that approximate those obtained by in-person clinical services. Pivotal Response Treatment (PRT) may be an ideal autism intervention to explore in an app-based training program. PRT is a parent-friendly naturalistic developmental behavioral intervention (NDBI, Schreibman et al., 2015) that combines motivational and behavioral principles to develop communication skills in naturalistic settings. Given the substantial evidence supporting the efficacy of PRT (Verschuur et al., 2014), increased access to these treatment techniques has the potential to benefit families nationwide.

**Objectives:** To examine the increase in parent PRT fidelity scores associated with participation in a Department of Defense-funded RCT to evaluate the efficacy, feasibility, and acceptability of using *Pivotal*, a self-directed mobile training app developed by the research team.

**Methods:** Participants include 48 parent-child dyads across the U.S. (24 randomized to a video self-scoring PRT app version and 24 to a standard PRT app without self-scoring functionality). Child participants (1 - 4.5 years) have an existing diagnosis of ASD and parent endorsements of significant language delay. Parents complete intake and follow-up assessments, eight PRT lessons, and record and review parent-child videos in-app after each lesson, which are automatically uploaded to the research team for analysis. In the adaptive condition, parents review and self-score PRT videos with their child and then receive in-app feedback to improve their PRT performance. Researchers masked to treatment condition score all videos for PRT fidelity of implementation (Primary Outcome). Refer to Table 1 for a list of all fidelity components coded as part of PRT fidelity of implementation.

**Results:** Analysis of baseline to initial intervention videos from participating families indicate a significant increase in the use of PRT fidelity components. The widely used passing percentage of 80% was used as the benchmark for meeting PRT fidelity standards. Overall PRT fidelity increased from a mean of 45.13% (SD = 14.34) at baseline to 67.90% (SD = 16.68) after a single week of app-based PRT training (Cohen's  $d = 1.47$ ). The critical PRT fidelity component of contingency increased from a mean of 15.53% (SD = 18.57) at baseline to a mean of 92.60% (SD = 12.82) across families (Cohen's  $d = 4.91$ ).

**Conclusions:** Initial parent training through the Pivotal app was associated with significant improvements in the demonstrated use of PRT intervention strategies captured through analysis of parent-uploaded video recordings. These data provide exciting evidence that this app-based approach may serve as an effective parent training tool to facilitate dissemination of high-impact early intervention techniques.

##### **229.002 (Panel)** Making an Impact: Relative Efficacy of Self-Directed and Therapist-Assisted Telehealth Parent-Mediated Intervention on Parent Learning and Well-Being

**B. R. Ingersoll, Psychology, Michigan State University, East Lansing, MI**

**Background:** Parent-mediated intervention is a cost-effective and ecologically valid approach to increasing access to intervention that leads to increases in parenting self-efficacy and decreases in parenting stress. Although there has been growing interest in extending telehealth interventions to parent-mediated intervention for children with ASD, empirical evaluations of such programs are limited, and little is known regarding the relative benefits of self-directed and therapist-assisted telehealth interventions. A pilot study of ImPACT Online, a telehealth adaptation of a parent-mediated intervention targeting social communication suggested that both self-directed and therapist-assisted intervention led to improvements in parent learning and well-being, although parents in the therapist-assisted group made greater gains in intervention fidelity and positive view of the child (Ingersoll et al., 2016). However, the lack of a control condition and follow-up period limited the conclusions that can be drawn regarding the impact of the intervention on parenting outcomes.

**Objectives:** The objective of this study was to replicate our pilot results on the impact of self- and therapist-assisted ImPACT Online on parenting learning and well-being, using a larger sample, the inclusion of a web-based informational support control condition, and a follow-up period.

**Methods:** Sixty-five families of young children with ASD were age and IQ matched and then randomized to self-directed ImPACT Online (n=24), therapist-assisted ImPACT Online (n=22), or an informational support condition (n=19), and received intervention for 5 months. Outcome assessments occurred at post-intervention and a 3-month follow-up. Preliminary analyses of group differences in parent intervention knowledge, intervention fidelity, positive view of the child, parent self-efficacy, and parenting stress were examined at post-treatment and follow-up using ANCOVA.

**Results:** Consistent with our pilot findings, we observed significant group differences for parent intervention knowledge at post-intervention ( $F(2,45)=3.66, p<.05$ ), parent fidelity at post-intervention ( $F(2,30)=3.88, p<.05$ ) and follow-up ( $F(2,28)=3.83, p<.05$ ), and parent positive perception of child at post-intervention ( $F(2,45)=4.17, p<.05$ ) and follow-up ( $F(2,48)=4.23, p<.05$ ). Post-hoc analyses found a significantly higher scores for the therapist-assisted group than the informational support group on all measures, with the self-directed group falling in between. We did not observe significant group differences in parent self-efficacy or parenting stress and post-intervention or follow-up, suggesting that improvements in parent self-efficacy and parenting stress in our pilot findings may not have been directly attributable to exposure to the intervention.

**Conclusions:** This study provides additional support for the efficacy of therapist-assisted telehealth parent-mediated intervention for teaching parents intervention strategies to support their child's social communication skills and improving their positive perceptions of their child. Additional research on the potential benefit of self-directed telehealth programs as well as the impact of telehealth-based parent-mediated intervention on child outcomes is needed.

**229.003 (Panel) START Connections Online: Outcomes of an Online Social Interaction Skill Group for Adolescents with Autism**

**K. M. Russell<sup>1</sup>, K. Rackham<sup>2</sup>, A. Bhatt<sup>2</sup> and T. W. Vernon<sup>1</sup>, (1)University of California, Santa Barbara, Santa Barbara, CA, (2)University of California Santa Barbara, Santa Barbara, CA**

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**Background:** The social challenges associated with autism can have life-long impacts on the ability to establish meaningful relationships. Social skill interventions have emerged to target socialization vulnerabilities of autistic adolescents, but there is a critical need for effective dissemination of these programs to overcome barriers to service access. Digital communication platforms offer a promising method for facilitating these trainings, but it is unknown if virtual sessions can yield similar outcomes to in-person. The Social Tools And Rules for Teens (START; Vernon et al. 2016; Vernon et al, 2018; Ko et al, 2018) Program is an intervention for increasing social competencies and motivation while reducing autism-related social communication challenges. This program for adolescents with autism combines a 20-topic social curriculum with immersive experiential learning with peers during unstructured socialization periods to provide a supportive, natural context for social experimentation and skill building.

**Objectives:** The aim of this study was to develop and evaluate START Connections, an online adaptation of the original START model. Specifically, we aimed to assess the preliminary efficacy, feasibility, and acceptability of START Connections when compared to the outcomes of the original START RCT participants. It was hypothesized that teen and parent participants would perceive the START Connections program as acceptable and efficacious. Additionally, we hypothesized that participant's social competence and motivation would increase and be comparable to in-person START outcomes, as measured by parent and teen surveys, real-world social data, coded conversation samples, and social impression ratings.

**Methods:** Participants were 42 adolescents with autism (START Connections: 13, in-person START: 14, waitlist control: 15) aged 12-16 (Mean age=13.67) and their parents. Inclusion criteria included the use of full sentence phrases to communicate, the ability to respond to and ask questions, a verbal IQ  $\geq 70$ , and verification of their autism diagnosis. Participants were diverse across genders (31% female) and racial and ethnic identities (26% Latinx, 57% white, 14% Asian, 3% Other). The bi-weekly START Connections program consisted of an individual therapeutic check-in, group socialization time, group discussion and practice of 20 social skill topics, group activity, and individual checkout via Basecamp and Zoom software programs.

**Results:** Results indicate that socialization measures significantly improved following implementation of START Connections. Analysis of treatment gains in the START Connections participants yielded evidence of medium to large effects on several parent-report and adolescent self-report measures of emotion regulation (EDI;  $d=0.72$ ), autism symptom severity (SRS-2;  $d=0.75$ ), and social motivation and competency (SMCS;  $d=0.36$ ). Additionally, significant improvements in individual target skills (questions asked and comments made) were observed for 75% of participants through observations of naturalistic conversations with unfamiliar peers. Both parents and teens endorsed high levels of program enjoyment (Mean=8.5/10) and improvement of skills (Mean= 6.8/10). Mixed ANOVAs revealed comparable outcomes between START Connections and in-person START groups, with both groups superior to waitlist control outcomes.

**Conclusions:** Results show promise for the online START Connections model in improving social communication in autistic teens. These results warrant a prospective investigation comparing in-person to digital implementations of social skill programming.

**229.004 (Panel) Implementation of Telehealth Services to Deliver Applied Behavior Analysis**

**A. Pomales-Ramos<sup>1</sup> and B. R. Ingersoll<sup>2</sup>, (1)Michigan State University, East Lansing, MI, (2)Psychology, Michigan State University, East Lansing, MI**

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**Background:** Telehealth implementation of applied behavior analysis (ABA) has resulted in positive outcomes for autistic children and caregivers and reduced service disparities (Ferguson, 2019), but has not been widely adopted until recently. During the COVID-19 pandemic, agencies turned to telehealth to deliver ABA services and prevent service disruption. Understanding providers' experiences and perspectives on telehealth adoption can inform practice considerations that support successful telehealth implementation.



**Objectives:** The current study examines ABA providers' adoption of telehealth services and factors that influence acceptability and intentions for continued use.

**Methods:** We surveyed 479 providers delivering ABA services to autistic children recruited through the Behavior Analyst Certification Board email list. Clinicians reported on telehealth adoption and barriers using a 5-point Likert-scale. Clinicians also completed the Telehealth Usability Questionnaire (TUQ), Implementation Climate Scale (ICS), the Acceptability of Intervention Measure (AIM), and rated their intention to use telehealth in the future on a 5-point scale. Telehealth adoption and barrier items were analyzed using descriptive statistics. A hierarchical regression was conducted to examine predictors of telehealth acceptability (AIM). Provider demographics associated with acceptability were entered in the first step, TUQ subscales were entered in the second step, and ICS subscales were entered in the third step. A correlation was used to examine acceptability as a predictor for intentions for continued telehealth use.

**Results:** Of the sample, 18.9% had provided telehealth services before stay-at-home orders, 58.6% transitioned to providing telehealth services during COVID-19, and 22.5% had never used telehealth. Clinicians who currently or previously provided telehealth services reported using telehealth to deliver direct intervention (84.63%), parent coaching (56.87%), assessment (37.46%). In terms of modality, 86.83% used videoconferencing, 47.73% used a hybrid model, 8.23% asked clients to send video recording. Clinicians more frequently reported difficulty addressing client-level barriers than technological or administrative barriers, with addressing eloping or maladaptive behaviors over telehealth being the most difficult barrier (Table 1).

Telehealth acceptability was significantly predicted by BCBA certification, telehealth perceived usefulness, ease-of-use, and effectiveness, and agencies' openness and selection for telehealth service provision (Table 2). Providers' ratings of telehealth acceptability was significantly correlated with their intention to continue using telehealth in the future [ $r(310) = .618, p < .001$ ].

**Conclusions:** We explored providers' adoption of telehealth services. Direct services and parent coaching were frequently delivered via videoconferencing and hybrid modalities. These modalities facilitate service provision in different settings which may support generalization of new skills across contexts. Providing telehealth services to autistic children who elope or demonstrate maladaptive behaviors presented additional barriers, thus indicating a need for targeted strategies that facilitate telehealth use with these clients.

The study also highlighted factors that influence providers' telehealth acceptability, which significantly predicted intentions for continued use. Agencies that stated importance or prioritized telehealth use fostered acceptability. Strategies that facilitate or simplify telehealth use and enhance interaction quality between client and clinician influence acceptability. These considerations can support telehealth service implementation and continued use, which is a helpful tool to increase access to evidence-based services and reduce service disparities.

## ORAL SESSION - 1A — INTERVENTIONS - NON-PHARMACOLOGIC - PRESCHOOL & INFANT

### 301 - Community Caregiver-mediated Early Intervention

**301.001** (Oral) Feasibility and Acceptability of Parenting Interventions Delivered in Spanish to Caregivers of Children with Autism and Other Developmental Delays: A Mixed-Methods Design

**J. Safer-Lichtenstein<sup>1</sup>, L. L. McIntyre<sup>2</sup>, G. Rodriguez<sup>3</sup>, D. Gomez<sup>4</sup>, S. Puerta<sup>1</sup> and C. L. Neece<sup>4</sup>, (1)University of Oregon, Eugene, OR, (2)Special Education and Clinical Sciences, University of Oregon, Eugene, OR, (3)Loma Linda University, Loma Linda, CA, (4)Psychology, Loma Linda University, Loma Linda, CA**

**Background:** Parents of children with autism spectrum disorder (ASD) or developmental delay (DD) experience increased stress due to raising a child with a disability, particularly if the child has challenging behaviors (Baker et al., 2003). Thus, there is benefit to interventions that: 1) help parents cope with stress, and 2) manage challenging behaviors. This is particularly true for Spanish-speaking Latinx populations, who are often underrepresented in ASD services and research (Zuckerman et al., 2017). Two interventions that have shown promise in reducing caregiver stress are providing psychoeducation (Bitsika & Sharpley, 2000), and teaching Mindfulness-Based Stress Reduction (MBSR) through meditation (Neece et al., 2014). Furthermore, Behavioral Parent Training (BPT) has proven to produce positive outcomes around child challenging behavior (McIntyre, 2013).

**Objectives:** This presentation will discuss pilot testing of these three interventions for Spanish-speaking Latinx caregivers of young children with ASD/DD as part of a larger, randomized-control trial. The primary objective is to investigate the feasibility and acceptability of these interventions for this population.

**Methods:** Sixty Spanish-speaking caregivers of 3-5-year-old children with ASD/DD were enrolled in this cohort. Two cohorts of English-speaking caregivers ( $n = 80$ ) were previously run, resulting in a total sample of 140 caregivers. Participants were randomly assigned to either MBSR plus BPT (BPT-M) or psychoeducation plus BPT (BPT-E). In BPT-M, participants received six weeks of group-based MBSR intervention, followed by 10 weeks of BPT. In BPT-E, participants received six weeks of group-based psychoeducation, then 10 weeks of the same BPT intervention. Of note, BPT for both groups was delivered virtually due to the onset of COVID-19 following the six-week stress reduction component. Attendance was recorded at each session. Participants also completed a Parent Satisfaction Questionnaire. Qualitative data on parent satisfaction was gathered through focus groups and analyzed using Thematic Analysis.

**Results:** Attendance and satisfaction data were analyzed as two separate two-way, between-subjects analyses of covariance, with independent variables of “group” (BPT-E versus BPT-M) and “language” (Spanish versus English). Demographic variables of caregiver ethnicity, income/education, acculturation, stress, and child problem behaviors were controlled. The dependent variable was run first as satisfaction and second as attendance. For satisfaction, neither intervention type nor language was significant on its own after controlling for the covariates. However, the interaction effect of intervention type by language was significant  $F(1, 56) = 7.16, p = .010$ . Participants in Spanish BPT-E reported significantly greater average satisfaction than those in English BPT-E, while the reverse was true for BPT-M. There were no significant differences between groups or languages in attendance. Focus group data revealed seven main themes that further elucidated the crossover effect in satisfaction.

**Conclusions:** This study adds data on the extent to which child behavioral and caregiver mental health services are feasible and acceptable to an often underserved population. Findings suggest that Spanish-speaking caregivers preferred psychoeducation supports over MBSR, in contrast to the preferences of English-speaking caregivers. These data inform how to best adapt these types of interventions to support these families, recognizing that there may be differing needs within this community.

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**301.002 (Oral)** Stakeholder Perspectives on Family ‘Fit’ for a Parent-Implemented Naturalistic Developmental Behavioral Intervention

**K. M. Frost<sup>1</sup>, D. Duggan<sup>2</sup>, D. Weedmark<sup>2</sup> and B. R. Ingersoll<sup>1</sup>,** (1)*Psychology, Michigan State University, East Lansing, MI, (2)Michigan State University, East Lansing, MI*

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**Background:** Parent-implemented naturalistic developmental behavioral interventions (NDBIs) are evidence-based practices for supporting social communication development for young children on the autism spectrum. These interventions are increasingly being researched and deployed in community settings. Many factors may influence an intervention’s “fit” (i.e. appropriateness, feasibility) for different families, which in turn may affect client outcomes (e.g. retention; Swift & Callahan, 2009), providers’ decision to offer a treatment (Rye, Friborg & Skre, 2019), and providers’ decision to flexibly adapt treatments to address poor fit (Georgiadis, Peris & Comer, 2020).

**Objectives:** The goal of this study was to examine stakeholder beliefs about family “fit” for a parent-implemented naturalistic developmental behavioral intervention.

**Methods:** Semi-structured interviews were conducted with stakeholders (10 expert trainers, 21 certified providers, and 11 caregivers) about their experiences with Project ImPACT. As part of a longer interview, participants responded to questions about how ImPACT fits for families, based on parenting style, values, cultural background, or other facets of individual difference. We used a codebook-based thematic analysis to identify key themes. Recruitment of additional caregivers is underway and analyses will be updated accordingly.

**Results:** Themes, subthemes, and illustrative quotations can be found in Table 1. Many caregivers spoke about how the intervention felt like a natural extension of their parenting style, while others identified specific aspects they found more challenging based on their personality or usual style of parenting. Providers and experts discussed specific cultural and linguistic factors that decrease fit, including cultural attitudes about play and the challenge of in-vivo coaching when the coach and family do not share a common language. Another prevalent theme pertained to decreased fit for families with little time to devote to practicing the intervention, due to work schedules, multiple children in the home, or other stressors (e.g. parent wellness, financial distress). Providers and experts also discussed the role of motivation or commitment as an essential but malleable contributor to good fit, while acknowledging that not all families want to engage in parent-mediated interventions.

**Conclusions:** Project ImPACT is increasingly being implemented in community settings. In order to successfully implement a high-quality service for diverse families, it is important to identify and remedy potential sources of poor fit. A combination of client-level adaptations (e.g. coaching in daily routines, flexible scheduling, providing case support to connect families with other services), program modifications (e.g. augmenting the manual’s coverage of using the techniques in the presence of several children), organizational (e.g. agency scheduling practices), and systems level factors (e.g. linguistic diversity among practitioners, availability of respite services) may support increased appropriateness and feasibility of parent-mediated NDBIs for diverse families.

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**301.003 (Oral)** Exploring Coaching and Follow-up Supports in Community Implemented Caregiver-Mediated Jasper Intervention

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**Background:** Although a growing number of caregiver-mediated interventions models for families with children with autism are being examined in efficacy trials, few have been transferred to community implementation. Preliminary data suggest that caregivers make some gains through observation (Shire et al., 2015). However, the role of observation prior to coaching has yet to be explored. Further, little is understood about how to support caregivers following coaching intervention when gains can stagnate. In partnership with a publicly funded intervention agency in Canada this pilot project explored intervention implementation strategies and follow-up supports.

**Objectives:** This study engaged a partnership with a publicly funded intervention agency operating two sites in Northern Ontario, Canada serving small urban centers, large rural areas, and First Nations communities. Applying a Community Based Participatory Research approach (Minkler & Wallerstein, 2003), the project aims were co-constructed with agency leadership: (a) explore fidelity of both clinician-child implementation and caregiver coaching; (b) examine the influence of starting caregiver coaching immediately (Coach) versus four-weeks of observation of the practitioner supporting their child followed by coaching (Observation+Coach) on caregivers’ strategy use and children’s play and social communication skills, and (c) explore families’ adherence to individual versus group follow-up visits.

**Methods:** In this Hybrid Type-I Effectiveness-Implementation (Curran et al., 2012) pilot randomized trial, caregiver-child dyads were randomized at (a) entry to Coach or Observation+Coach and (b) intervention exit to individual or group follow-up. The 12-week caregiver-mediated Joint Attention, Symbolic Play, Engagement and Regulation (JASPER: Kasari et al., 2010) intervention was provided agency staff (three supervisors and nine practitioners) to a diverse community sample of families with young children awaiting or diagnosed with ASD. They served 56 children ( $n=26$  Observation+Coach,  $n=30$  Coach). Children ( $M=2.75$  years) were White (60.7%), Indigenous Canadians (10.7%), Asian (5.6%), and Hispanic (1.8%). Mullen age-equivalent mental age scores were significantly different at entry ( $p=0.024$ ) between Site 1 ( $M=16.93$ ,  $SD=7.66$ ) and Site 2 ( $M=19.78$ ,  $SD=7.89$ ).

Three video recorded measures were delivered by independent staff assessors at entry, exit, and follow-up: (a) Early Social Communication Scales (ESCS: Mundy et al., 2003), (b) Structured Play Assessment (SPA: adapted Ungerer & Sigman, 1981), and (c) Caregiver-Child Interaction (CCX: Kasari et al., 2010). Blinded raters scored children's initiations of joint attention, play actions, joint engagement, and caregivers' strategy implementation.

**Results:** Practitioners implemented the intervention and coaching strategies well ( $M=83\%$ ). Overall, caregivers made significant gains in strategy use ( $F(1,74)=78.33$ ,  $p<0.001$ ) with no significant differences between conditions ( $p=0.797$ ). Children demonstrated overall improvement in child-initiated JE ( $F(1,73)=51.42$ ,  $p<0.001$ ), IJA ( $F(1,55)=27.26$ ,  $p<0.001$ ) and total play diversity ( $F(1,63)=21.88$ ,  $p<0.001$ ) by intervention exit with no significant differences between conditions. Caregivers' strategy use was associated with children's joint engagement ( $F(1,71)=18.14$ ,  $p<0.001$ ) but not IJA or play assessment outcomes. Adherence to follow-up was limited but greater for individual ( $n=12$  completed all sessions) over group ( $n=1$ ).

**Conclusions:** Overall, children and caregivers made gains through public community implemented caregiver-mediated intervention. Similar outcomes across conditions suggest that the agency may offer families different caregiver-mediated intervention approaches. Adherence indicates a preference for individual over group follow-up.

#### **301.004 (Oral) Comparison of Who Caregiver Skills Training Delivered Remotely and in Person**

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**Background:** During the pandemic telehealth often represents the only viable option to guarantee continuity of care. However, while remotely-delivered caregiver-mediated interventions show promising acceptability, feasibility and effectiveness, there is scant evidence of their equivalence to in-person delivery.

**Objectives:** We compared feasibility, acceptability and effectiveness data of an adaptation of the WHO Caregiver Skills Training (CST) delivered remotely during lockdown with those of a pilot RCT of CST delivered in person against treatment as usual (TAU), which had shown excellent feasibility, acceptability and favourable treatment effects in public health settings.

**Methods:** In-person-CST was delivered per manual. Online-CST was delivered via adapted activities in virtual Group Sessions and Home Visits via video-conferencing. Participants were caregivers of children with ASD (Table 1). Caregivers and program interventionists completed feasibility and acceptability measures (5-point scales; 'satisfactory'=3, 'good'=4) and took part in focus groups. Observers completed integrity ratings. Pre-post clinical outcomes were measured with the Caregiver Knowledge and Skills Test (including CSQ, self-efficacy, and KSQ, knowledge and skills) and the Autism Parental Stress Index.

**Results:** Online and in-person-CST were delivered with high and similar levels of integrity, attendance and therapeutic alliance, and minimal drop-out rates. Feasibility ratings of standard components were high and similar, but the intervention contents were rated as significantly more complex to deliver in online-CST ( $p=.048$ ). Intensity of caregiver adherence to home practice was not different in the two delivery methods, and caregivers in online-CST reported fewer contextual barriers ('unexpected circumstances'  $p=.007$ ; 'lack of time'  $p=.021$ ). In online-CST, overall facilitator and caregiver acceptability ratings were in the 'good' range, however caregiver-rated comprehensibility, applicability, alignment with values and facilitator-rated caregiver participation were lower than in in-person-CST ( $ps <.001$  to  $.012$ ). For the adapted components (Table 2) facilitator-rated feasibility and acceptability were above satisfactory levels, although issues with technology were reported and feasibility ratings of home visits were in the 'satisfactory' range. Most caregiver ratings were in the 'good' range, however 'unsatisfactory' for perceived realism of the videorecorded modelling of strategies, presence of distractions and representativeness of child behaviour during the home visits. ANCOVAs of change scores controlling for baseline levels showed that in-person- and online-CST improved significantly more than TAU on caregiver knowledge and skills ( $\eta^2=.131$ ) and were not different from each other. There were no statistically significant effects for parental stress or self-efficacy. The thematic analysis of focus groups indicated that online-CST reduced the barriers to participation and delivery, partly at the expense of perceived quality of interpersonal relationships.

**Conclusions:** Online-CST was highly feasible and acceptable to caregivers and facilitators although lower in some dimensions of acceptability and participation than in-person-CST. Despite these barriers, online-CST improved caregiver knowledge and skills as in-person-CST. Due to design features, including lack of a control group during lockdown, deemed unethical, and the reduced sample size, the findings should be interpreted with caution. Despite these limitations, the study shows that online-CST could represent a feasible, albeit partial, clinical response in contexts where in-person delivery is not possible, due to geographical distance, restrictions to travel or personal circumstances.

## 402 - Interventions - Non-pharmacologic - Preschool & Infant

### 402.013 (Poster) Fidelity in Caregiver and Educator-Mediated Intervention Research: A Systematic Review

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**Background:** Implementation fidelity is defined as, the degree to which a treatment is carried out as intended by program developers and may also encompass components such as adherence, completeness and dosage, quality of delivery, participant engagement and program differentiation (Dusenbury, Brannigan, Falco, & Hansen, 2003). Accurate assessment of fidelity is critical to the reliability, validity, replicability and scale-up of any intervention research study (Feely, Day, Lanier, Auslander, & Kohl, 2019). Measurement and assessment of fidelity within indirect service delivery models commonly used in early intervention and early childhood special education must be monitored at multiple levels (e.g., coach/trainer, implementer), presenting unique challenges for researchers and practitioners.

**Objectives:** Through a systematic review of the literature, we aimed to (a) identify the degree to which fidelity is monitored and reported across caregiver and educator mediated interventions and (b) explore the frequency with which researchers are examining the relationship between fidelity and child outcomes as well as the results.

**Methods:** Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, we conducted a systematic search and review of the literature on caregiver and educator mediated social communication interventions published between 1994 and 2020.

**Measures:** Data extraction was completed by the first and third authors (SA & WB). A variety of variables including child and adult demographics, intervention components, fidelity measurement and reporting practices, and child and adult outcomes were extracted. To examine fidelity reporting, studies were examined individually and then grouped by intervention and scored using a 6-item scale adapted from Schoenwald et al. (2011) designed to categorize the rigor with which studies assess and report on fidelity. Risk of bias (methodological quality) was assessed for all studies (Gersten et al. 2005; Reichow, 2011).

**Results:** The 82 included studies represented 30 different manualized interventions and 11 non-manualized interventions. Most studies used a group design including randomized controlled trials, quasi-experimental designs and sequential multiple assignment randomized trials (SMART). The remaining studies used single case experimental designs.

**Fidelity:** When assessed using the Schoenwald et al. (2011) scale, no interventions received the highest score which required established measures of fidelity complete with reported psychometrics. The most common scores for caregiver and educator fidelity reporting were 2's (report of quality control methods such as therapist training or specific manual) and 5's (fidelity measure and data reported comprehensively with data on reliability or validity), while fidelity reporting for trainers most commonly scored a 3. It was uncommon that interventions included statistical examination of the relationship between fidelity and outcomes for any participant.

**Conclusions:** Currently, fidelity monitoring and reporting in caregiver and educator mediated intervention research is a developing practice. A lack of rigorous and comprehensive reporting of fidelity in this review limits the field's understanding of how interventions are being delivered and what mechanisms are responsible for changes in outcomes. Moving forward, more attention must be paid to how fidelity is being monitored and reported (at both the trainer and caregiver/educator levels) in research.

### 402.014 (Poster) CST: Caregiver Skills Training, Virtual Modality and COVID-19

D. Suaya Demaria<sup>1</sup>, N. E. Granana<sup>2</sup>, P. C. Consortium<sup>3</sup>, V. Nanclares-Nogues<sup>4</sup> and P. Dixon<sup>5</sup>, (1)Pediatrics, Health Center 11, Buenos Aires, Argentina, (2)Servicio de Neurología Infantil, Hospital Durand, CABA, Argentina, (3)Primary Care Department, Ministry of Health City of Buenos Aires, Buenos Aires, Argentina, (4)Pediatric Developmental Center, Advocate Children's Hospital, Chicago, IL, (5)Wayne State University, Ann Arbor, MI

**Background:**

CST is an intervention program mediated by Caregivers of children developmental delays or disorders, including *autism*, developed by the WHO and Autism Speaks. The program has proven efficacy and has been found to be beneficial in underserved populations, given the difficulties in access to support, lack or modest economic resources, or due to distance. Families with children between 2-7 years of age are included, and no specific diagnosis of autism was required.

**Objectives:**

The intervention aimed at supporting parent-child interactions. It also contributed to the formation of networks and better integration of families into their communities. Our main objectives were to explore the program's feasibility to increase communication, management of disruptive behavior, promoting autonomy, and heighten coping skills from parents.

**Methods:**

24 families of children who attended early childhood daycare centers in vulnerable areas were recruited. Inclusion criteria were deficits in communication and socioindividual areas detected by screening with the Ages and Stages Questionnaire 3rd Version (ASQ-3). We delivered 8 weekly group meetings and 3 individual sessions in a virtual format. In addition, the caregivers received booklets with the essential contents covered and illustrated stories that served as an identification models. The topics were presented and explained during training sessions. Reflective discussions were generated. Videos with role-plays helped to practice new skills.

#### Results:

Ninety percent of families completed the intervention. All these families were currently without any treatment due to the COVID-19 pandemic. The program was adapted to be performed virtually. An evaluation was carried out before and 12 weeks after completing the workshop sessions. Parents reported an increase in their ability to reduce tantrums from 37% in the pretest to 56% in the posttest and to participate in a back and forth games with the child from 8% to 31%. Their children increased autonomy from 20% to 50%. They experienced an improvement in communication to request and to share, and an empowerment in the caregiver's selfcare skills. Caregivers could seek recreational moments at least once a week from 29% to 62.5%. Families reported that training fulfilled their expectations at 87%. They observed that 9 of 10 children improved their behavior. We found out that 94% of parents reported that they could enhance their abilities as caregivers and 87% achieved favorable changes in their everyday life.

#### Conclusions:

CST intervention demonstrated very positive results in overall parent self-efficacy and family functioning. Parents felt empowered and knowledgeable on how to stimulate the development of their children and reported great improvements in their child's communication, interaction and behavior. The virtual modality actually increased adherence to treatment. CST showed continued success as a tool to enhance parent skills. As a team, it was gratifying to observe families move through the process and provide tools to improve their quality of life.

#### **402.015** (Poster) Changes in Maternal Language during a Parent-Mediated Intervention

**A. Bentenuto, G. Bertamini, S. Perzoli, S. De Falco and P. Venuti, Department of Psychology and Cognitive Science, University of Trento, Rovereto, Italy**

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**Background:** In recent decades, a growing literature has highlighted the fundamental role of parents in therapy (Althoff, 2019;). Starting from the child's own interests the therapist and/or parents try to slowly raise engagement, interaction, communication, affection, and then specific cognitive skills. Parental speech directed to young children is important for many developmental purposes (Herrera et al., 2004). In fact, through language parents can convey both affect and information to children.

**Objectives:** The main purpose of this study was to explore how the maternal speech directed to children with ASD change after a period of 14 months of parent-mediated intervention. Moreover, we aimed to analyse how mothers' language was associated with symptoms severity and cognitive profiles of children.

**Methods:** Participants were 22 mothers in interaction with their children with ASD (Chronological age:  $M = 43.77$  months;  $SD = 13.60$ ; Mental age:  $31.99$  months;  $SD = 12.07$ ). Functional aspects of speech produced by mothers during 10-min of free play interactions have been analyzed pre and post intervention. Mother' speech was verbatim transcribed with ELAN (Version 6.2, 2021, The Language Archive) an annotation tool for audio and video recordings. Maternal speech was then categorized in terms of the primary function of each speech unit, using a coding scheme validated in previous studies (Bornstein et al., 1992; de Falco et al., 2011). These classes are mutually exclusive and exhaustive. The functional analysis was applied by two independent coders.

**Results:** Data analyses showed a significant increase in affective function of maternal speech after the intervention (mean  $T0 = 23.95$ ,  $SD = 12.96$ ; mean  $T1 = 29.55$ ,  $SD = 14.08$ ;  $t(21) = -2.05$ ;  $p = 0.05$ ). After the intervention (mean  $T0 = 5.73$ ,  $SD = 3.64$ ) mothers used significantly more "action descriptions" than at the beginning (mean  $T1 = 9.82$ ,  $SD = 8.81$ ;  $t(21) = -2.35$ ;  $p = 0.03$ ). Correlation analyses show a significant negative association between affective maternal speech and the cognitive functioning of the children ( $r = -0.35$ ;  $p = 0.023$ ), and a positive correlation between the use of question about the child internal states and the social-affective area of the children ( $r = 0.46$ ;  $p = 0.002$ ). Considering linguistic predictors of change, preliminary results showed that the general cognitive functioning of the child is associated with the amount of referents that the caregiver uses referring to the child's internal state ( $\beta = 0.70$ ;  $t(20.04) = 2.32$ ;  $p = 0.03$ ).

**Conclusions:** The direct involvement of mothers during intervention seems to support some specific adjustment regarding the quality of the exchange between mother and child. In particular, these results highlighted that a specific parent-mediated intervention focused on the promotion of the social reciprocity, helped mothers to use more affective language, a crucial element for the quality of the dyadic exchange.

#### **402.016** (Poster) Comparison Groups in Early Childhood Autism Research: A Meta-Analytic Review

**S. Albarran, J. E. Crank, M. Sandbank and M. Canihuate, The University of Texas at Austin, Austin, TX**

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**Background:** Comparison group characteristics are important to consider when interpreting the results of intervention studies. Comparison conditions may influence the magnitude or direction of intervention effects. Misinterpretations of intervention effects could lead to underutilization of effective strategies to support children on the autism spectrum, or lead to ineffective allocations of available resources that support the learner. Although recent reviews and meta-analyses have summarized the effects of various intervention approaches on various outcomes, none of these reviews systematically described comparison conditions, nor did they examine whether comparison group moderated intervention effects.

**Objectives:** This project will describe the types of comparison conditions tested in studies of autism-focused early childhood interventions, and investigate whether comparison condition type moderates intervention effects.

**Methods:** The data for this project were collected as part of the larger Project AIM meta-analysis. Comparison group categories were coded as either: Business as Usual (BAU), separate intervention, or a modified version of the same intervention being tested. Only comparison conditions that included intervention methods that were different from those used in the intervention condition were coded as 'separate.' Comparison conditions were coded as modified versions of the intervention being tested when they employed similar methods with different parameters (e.g., different implementer, dose frequency). Using robust variance estimation to account for correlated effects, we will test whether intervention effects are significantly moderated by comparison group category. Subgroup summary effects will be calculated for each comparison group category and plotted for comparison. We anticipate that summary effects for interventions tested against BAU conditions will be significantly larger than summary effects for interventions tested against separate or modified interventions.

**Results:** The original investigation summarized treatment effects by intervention approach and outcome domain across 1,615 effect sizes extracted from 150 reports. All original effect sizes will be included in the current investigation. Coding and analyses are in progress and will be completed prior to the presentation to provide a visual representation of findings for discussion.

**Conclusions:** Evidence-based practice guides have largely overlooked a research design characteristic that may significantly influence researcher perception of intervention effectiveness. If comparison conditions significantly influence estimates of intervention effects, such guides must take comparison groups into account in evidence summaries.

**402.017 (Poster) Early Intensive Behavioral Intervention (EIBI): Predicting Outcome and Examining Relations between Treatment Intensity, Treatment Quality and Treatment Acceptability**

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**Background:**

Early intensive behavioral intervention (EIBI) is an empirical based intervention which may improve cognitive and adaptive functioning for preschool children with autism spectrum disorders (ASD). However, there is a need to identify characteristics that interact with outcome. Previous research identified age at intake, level of intake adaptive and intellectual functioning, as well as treatment intensity as possible key factors.

**Objectives:**

This study is a prospective study designed to examine different predictors of outcome after 12 months of community-based EIBI in 171 children (142 males; mean age of 49.74 months) with ASD. Predictors included are Age at Intake, Intake Adaptive Behavior (Vineland-II), Treatment Intensity, Treatment Quality and Treatment Acceptability.

**Methods:**

All procedures were in accordance with the ethical standards of the institutional and national research committee. Correlational analysis was used to test the hypothesis. In order to evaluate predictors of outcome, hierarchical multiple regressions (MR) was conducted for each outcome measure. Non-parametric tests ( $\chi^2$ ) were used for variables that did not meet normal distribution.

**Results:**

Higher intake Vineland Adaptive Behavior Composite (ABC) score and higher intake scores of all Vineland Subscales predicted significantly higher outcome scores. Age at Intake predicted Communication at follow-up ( $R^2=.451$ ,  $F=34.16$ ,  $p<.001$ ,  $\beta=-.248$ ,  $t=7.40$ ), indicating that younger age is associated with greater improvements in Communication. Furthermore, Social Skills at intake ( $R^2=.039$ ,  $F=6.02$ ,  $p=.016$ ,  $\beta=-.197$ ,  $t=-2.45$ ) and higher Treatment Quality predicted lower Maladaptive Behaviors ( $\Delta R^2=.019$ ,  $F=50.75$ ,  $p=.074$ ,  $\beta=-.137$ ,  $t=-1.81$ , 1-tailed finding) at follow-up. Treatment Quality assessed 12 months into treatment was significantly higher than Treatment Quality assessed after 6 months of treatment ( $\chi^2=48.05$ ,  $df=2$ ,  $p<.001$ ), and thus Treatment Quality improved over time, although lower Treatment Quality was associated with lower Treatment Quality at follow-up ( $\chi^2=21.78$ ,  $df=4$ ,  $p<.001$ ,  $V=.305$ ). Children receiving higher Treatment Intensity also received better Treatment Quality ( $R^2=.061$ ,  $F=9.07$ ,  $\beta=.247$ ,  $p=.003$ ). Treatment Acceptability was high for both parents and therapists ( $M=5.6$  ( $SD=5.07$ ) and  $M=5.5$  ( $SD=4.30$ ), respectively on a 6-point Likert scale). Treatment Acceptability was not associated with outcome.

**Conclusions:**

For Vineland ABC and all Vineland subscales (Communication, Social Skills, Daily Living Skills, Motor Skills and Maladaptive Behavior), higher intake scores predicted significantly higher outcome scores. Furthermore, younger Intake Age and Higher Treatment Quality was associated with improved outcome. Treatment quality improved over time, but children who received lower treatment quality initially tended to receive overall lower treatment quality. Children who received higher number of treatment hours also tended to receive better treatment quality. Parents and therapists scored Treatment Acceptability as very high, and high Treatment Acceptability score was independent of the children's outcome. Although this study

does not include a control group, findings add to our knowledge of potential predictors of outcome for children receiving EIBI.

**402.018** (Poster) Effects of Therapist Dosage on Child-Therapist Rapport in Toddlers with Autism Spectrum Disorder  
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Background:

Children with Autism Spectrum Disorder (ASD) often receive early intervention from teams involving multiple therapists, including therapists whose involvement is of limited duration (e.g., staff covering in case of sickness of the primary therapist). A plausible yet untested scenario is that the quality of child-therapist rapport might be affected by the number of therapists in the intervention team and the consistency of their involvement in the intervention program.

Objectives:

We examined whether the number of therapists in the treatment team of young children with ASD receiving early intervention, and the consistency of their involvement in intervention delivery contribute to the quality of child-therapist rapport. We hypothesized that child-therapist rapport would be of higher quality in teams with a smaller number of therapists and in response to therapists who are more consistently involved in the intervention program.

Methods:

We examined child-therapist rapport in 22- to 33-month-old children with ASD who received the Early Start Denver Model for 6-months, 6-10 hours per week, with intervention delivered either by a team of 1-2 therapists (Low Therapist Dosage group) or a team of 3+ therapists (High Therapist Dosage group). Preliminary data involving 11 children are presented, with effect sizes examined as a preliminary indication of support to the study predictions, to be substantiated via ongoing analyses involving a larger sample (anticipated  $n=40$ ). For each participant we examined two 10-minute videorecorded intervention sessions within their six months of intervention: one with their primary therapist (i.e., the therapist who administered the majority of sessions during the 6-month intervention period) and one with their secondary therapist (a therapist involved for less than one month in the intervention program). Child-therapist rapport was coded using a novel behavioral coding scheme that included frequency of challenging behavior, compliance, child initiations, and shared affect initiated by the child towards their therapist. Inter-rater reliability for the child-therapist rapport coding scheme was conducted on 20% of the videos using intraclass correlation coefficient.

Results:

Intraclass correlation coefficient for the behavioral coding scheme indicated excellent agreement ( $ICC=88\%$ ). Preliminary findings involving 11 participants, five in the Low Therapist Dosage and six in High Therapist Dosage showed that compared to children in the High Dosage Therapist group, children in the Low Dosage Therapist group had fewer challenging behaviors in response to their primary therapist ( $d=.65$ ) as well as more initiations ( $d=.74$ ) and more compliance ( $d=1.1$ ) in response to their secondary therapists. Additionally, children appeared to show more initiations ( $d=1.0$ ) and more compliance ( $d=.44$ ) in response to their primary therapist compared to their secondary therapist, although this was the case only for the children in the high therapist dosage group.

Conclusions: Our preliminary results, if substantiated by our ongoing analyses with the larger sample, suggest that children receiving intervention from teams composed by a smaller number of therapists might experience better rapport with their therapists, particularly in response to therapists who are more consistently involved in the intervention program.

**402.019** (Poster) Efficacy of the Early Achievements Intervention in Preschools: A Teacher-Implemented Interpersonal Synchrony Curriculum Supplement Increases Motor Imitation, Joint Attention, and Initiations of Peer Engagement in Preschoolers with ASD  
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Background: Few evidence-based early interventions for children with autism spectrum disorders (ASD) have demonstrated efficacy in public school settings. Through former research, an interpersonal synchrony intervention designed for toddlers (see Landa et al., 2011) was adapted with input from school professionals into a preschool curriculum supplement (Wilson & Landa, 2019). In a pilot trial, teachers randomized to training in Early Achievements (EA-ASD) learned to implement EA-ASD with high fidelity, and children receiving EA-ASD made greater gains in initiation of joint attention and nonverbal cognition than children receiving Business-As-Usual (BAU) instruction (Engelstad et al., 2020). This randomized controlled trial evaluates the efficacy of EA-ASD in 23 schools spanning 4 states across the US including a racially, geographically, and socioeconomically diverse sample of preschoolers with ASD.

Objectives: The goal of this study was to evaluate the efficacy of the EA-ASD intervention in public preschool classrooms. Objectives were 1) to determine whether teachers receiving EA-ASD professional development attain high levels of fidelity, 2) to examine child growth on proximal social communication measures, and 3) to examine child growth on distal measures of nonverbal cognition, language, and social communication.

**Methods:** 70 classroom teachers and 159 preschoolers with ASD were randomized to EA-ASD or BAU instruction. Teachers in both conditions received five day-long professional development workshops, with content for BAU group not related to EA-ASD. In addition to EA-ASD workshops, teachers randomized to EA-ASD also received 20 job-embedded coaching sessions. Teacher fidelity and child social communication data were blindly coded from monthly videotapes. Pre- and post-intervention assessments measured child growth on distal measures. 3-level hierarchical linear models accounting for clustering at the individual, classroom, and school levels were used to assess growth patterns.

**Results:** Teacher fidelity levels at baseline were not different between groups (mean fidelity for BAU = 32.8%, EA-ASD = 29.6%). EA-ASD teachers demonstrated significantly greater gains in fidelity of implementation than BAU teachers ( $\beta=0.12$ ,  $p<.001$ ). On average, EA-ASD teachers achieved 87.9% fidelity at post-intervention (BAU = 32.2%). Children receiving the EA-ASD intervention showed significantly greater improvements in motor imitation from pre- to post-intervention than children receiving BAU ( $\beta=1.48$ ,  $p<.05$ ). Children's gains in imitation generalized across contexts and communication partners, as demonstrated by growth on the *Motor Imitation Scale* (Stone, 1999), on which children in EA-ASD made significantly greater gains than children in BAU ( $\beta=3.55$ ,  $p<.05$ ). Children in EA-ASD made significantly greater gains on the proximal measures of initiation of and response to joint attention than children in BAU ( $\beta$ 's=1.13 and 3.68, respectively,  $p$ 's<.05). Children in EA-ASD made significantly greater gains in initiation of peer engagement than children in BAU ( $\beta=0.64$ ,  $p<.05$ ). The following school year, six months post intervention, EA-ASD teachers sustained fidelity levels (mean

**Conclusions:** With professional development workshops and coaching, public preschool teachers can learn to implement EA-ASD with high levels of fidelity. EA-ASD instruction is associated with child gains in motor imitation, initiation of and response to joint attention, and peer engagement, with gains in motor imitation generalizing to unfamiliar contexts.

**402.020 (Poster)** Imitation in Autism within Early Intervention: Examining the Roles of Motor Skills and Social Engagement  
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**Background:** Imitation difficulties are commonly reported in young children with autism spectrum disorder (ASD), but there is limited understanding on what drives or mediates them. Motor difficulties are also reported frequently in young children with ASD, yet findings have been inconclusive as to whether such difficulties are related to imitation. Additionally, though challenges in social engagement are a core feature of ASD, their role in imitation is unclear. Within the context of early intervention, increases in social engagement behaviors have been related to therapist strategies such as utilizing child interests and following the child's lead. Therefore, a plausible yet untested scenario is that autistic children may imitate more frequently while participating in highly engaging activities with their therapist compared to in activities that are not. Additionally, atypical motor skill development might further contribute to the variability of imitation performance observed in this population in early intervention.

**Objectives:** This study aimed to evaluate whether motor imitation of actions without objects in children with ASD is modulated by child motor skills and social engagement within the activity.

**Methods:** We examined clips of video-recorded intervention sessions as part of a previous study involving trained therapists delivering a play-based, naturalistic intervention, the Early Start Denver Model (ESDM), to 10 young children (aged 20-41 months) with ASD. One "early in treatment" and one "late in treatment" video clip was chosen for each participant. We created a novel coding scheme to analyze (1) how frequently the child was imitating, and (2) the degree of social engagement with the therapist throughout the activity. A blind coder was trained on the coding scheme and coded all videos, and intraclass correlation analyses were conducted on 35% of randomly selected videos. Motor skills were measured through the motor subscales of the Vineland Adaptive Behavior Scales and the Mullen Scales of Early Learning.

**Results:** Initial results based on 20 videos from 10 participants showed an intraclass correlation for the coding scheme of  $>.7$  across variables. There was not a significant association between imitation and baseline motor skills or child age. Conversely, social engagement and imitation frequency were significantly correlated ( $r=.65$ ,  $p=.002$ ). Social engagement continued to be a significant predictor of imitation in a regression analysis that included "child" as a factor as each child was featured in two videos [ $F(2, 17) = 6.595$ ,  $p=.008$ ,  $R^2=.37$ ]. Analyses designed to test the study predictions on a larger sample ( $n=50$ ) are under way.

**Conclusions:** Initial results suggest that children who are more socially engaged with their therapist during a play activity are more likely to imitate the therapist's actions. Motor skills did not appear to be significantly related to imitation in this preliminary analysis, yet this will be further explored in a larger sample. Imitation in young children with ASD might be enhanced in response to socially engaging activities compared to activities or partners that are less engaging, supporting that social engagement likely has an important role for promoting imitation during naturalistic play routines.

**402.021 (Poster)** Implementing a Community-Based Caregiver Intervention in Low-Resource Contexts: A Focus on Implementation Strategies during the Planning and Preparation Phase

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**Background:** There are more than 50 million young children with autism and other developmental disabilities (DD) in the world, most of whom live in low- and middle-income countries (LMICs). However, there is a substantial treatment gap in these parts of the world. The World Health Organization (WHO) developed a Caregiver Skills Training Programme (WHO-CST) for families of children with DD, to help address the treatment gap. The WHO-CST includes a range of evidence-informed strategies aimed at empowering caregivers to support their children's communication



and learning, and is designed to be adaptable, appropriate, feasible, and scalable in resource-limited contexts. The Diamond Families Project is a multi-partner project that aimed to implement and evaluate the WHO-CST programme, specifically in South Africa. To promote successful and sustainable implementation, the project included a range of activities in the planning and preparation phases guided by the principles and strategies of Implementation Science.

**Objectives:** The objective of this study was to identify and describe the specific implementation strategies used across all the activities that occurred during the planning and preparation phases of the Diamond Families Project prior to running the 12-session WHO-CST programme in South Africa.

**Methods:** We used three steps to achieve our objective: (1) Data extraction: We analysed the project archives to identify all activities that took place and captured the data in an activity log. (2) Identify: Each activity was then coded into implementation strategies, using a coding manual compiled from three existing implementation strategy coding schemes. A consensus coding approach was used on all data. (3) Describe: Descriptive statistics were used to describe the frequency, duration, actors, and costs of each implementation strategy.

**Results:** One hundred and fifty activities were identified, which represented 34 unique implementation strategies. The most frequently used strategy was “Developing an implementation blueprint” (28%), which focused on how to implement the intervention in low resource communities. The strategy that required the most person-hours was “Promoting adaptability” (627 hours). This included activities such as Setswana translations of the facilitator booklets with help from a community champion and community visits to gain insight into the rural context. The most expensive strategy was “Developing academic partnerships”, which included planning meetings with Africa Autism Treatment Network and discussions with the Service Systems Stakeholder group, to find effective answers to address our local needs and to establish a community-academic partnership.

**Conclusions:**

The results suggest that the successful implementation of this new intervention in South Africa included time devoted to developing the implementation plan, adapting materials to suit the local context, and building partnerships with academic and community stakeholders. Furthermore, the most frequently used strategy was found not to be the most expensive. These findings contribute to an evidence-base of implementation-focused research in South Africa, which can guide the successful implementation of other interventions in similar low resource settings.

#### **402.022 (Poster)** Implementing the Who Caregivers Skills Training Program Via Telehealth in Rural Missouri

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**Background:** Caregivers of autistic children who reside in low-resource areas- including rural settings- often do not have access to quality parent skills training programs that may improve child outcomes and lead to decreased parent stress and increased parent competency and efficacy. Telehealth strategies that incorporate technology to provide health care services have been explored as a potential solution to the challenges of reaching families in rural settings, resulting in positive caregiver outcomes and satisfaction with services.

**Objectives:**

This is a mixed-methods study with a phenomenological framework to evaluate the feasibility and acceptability of the WHO- Caregivers Skills Training Program. It also used a pretest-posttest design to explore the preliminary efficacy of the program's implementation via telehealth in a rural setting.

**Methods:**

Caregivers of 15 autistic children (3-7 years), residents of rural Missouri, completed the nine group sessions in an online format (conducted through Zoom) and three virtual home visits. This pilot study measured feasibility outcomes using parental attendance to CST sessions, attrition, parental and master trainers' post-session feedback forms, caregiver's knowledge and confidence in skills, and parental and master trainers post-program focus groups. Indicators of preliminary efficacy outcomes were the rate of score reduction in parent-reported ratings of autism-related behaviors, parental stress, family distress, and parental sense of competence.

**Results:**

The attendance rate for the group sessions was 96.8% and 100% for the three home visits, and none of the caregivers dropped out, attaining a 0-attrition rate. Four main themes emerged from the focus groups related to participants' experiences with the program and suggestions for its implementation. For most caregivers' ratings of content's complexity (73%), relevance (66%), and usefulness (60%) were greater than or equal to 4 (somewhat easy) for all nine sessions. Throughout the program, the most liked activity was the demonstration (36%), and the least liked was the practice with other caregivers. From baseline to week 12, there was a statistically significant improvement on the communication subscales of the ATEC ( $d=.78$ ,  $p<0.01$ ) and the AIM, in both frequency ( $d=.68$ ,  $p<0.05$ ) and impact ( $d=1.55$ ,  $p<0.01$ ). AIM impact scores also showed a reduction for atypical behaviors ( $d=.95$ ,  $p<0.01$ ) and the total impact score ( $d=.63$ ,  $p<0.05$ ). For caregivers' outcomes, only confidence in skills ( $d=-.57$ ,  $p<0.05$ ) and the parental sense of confidence ( $d=.62$ ,  $p<0.05$ ) showed a positive change.

## Conclusions:

This adaptation study supports the feasibility of implementing the WHO CST program via telehealth in a US rural setting. In general, participants thought the online format was convenient, with benefits outweighing the disadvantages. The preliminary efficacy of the CST program delivered via telehealth is promising. The significant results aligned with the primary outcomes of the program (increase joint engagement and communication and reduce challenging behaviors). This is the first implementation of a telehealth PMI conducted with non-specialists in a rural US setting; and could be generalizable to similar rural, mainly white settings. Results from this study can impact public policy by offering a scalable and sustainable program to bridge the gap between research and community implementation.

### **402.023** (Poster) Investigating the Extent to Which Consultation Improves Community Providers' Adherence to a Manualized Social Communication Intervention

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**Background:** Project ImPACT is a manualized Naturalistic Developmental Behavioral Intervention (NDBI) that increases social communication skills in autistic children. Providers using an evidence-based practice (EBP) such as Project ImPACT for the first time often do not deliver the intervention to fidelity. Consultation is an implementation strategy that is considered a core component of successful implementation programs. This study investigates the extent to which consultation improves adherence to the Project ImPACT manual.

**Objectives:** This preliminary analysis investigates the extent to which consultation improves providers' adherence to the Project ImPACT manual during telehealth intervention sessions with caregivers of Medicaid-enrolled autistic clients. We outline methods for using multilevel modeling within a single-case experimental design (SCED), which extends the typical SCED analysis method of visual analysis (i.e., inspecting graphs of data) by introducing advanced statistical modeling with effect estimates within cases (i.e., effects for individual providers) and across cases (i.e., average effect across providers).

**Methods:** We fit a two-level multilevel model to analyze data from an ongoing trial which had an ABCD single-case experimental design with multiple baselines. Our sample includes 16 behavior analysts from 5 agencies. Agencies were randomized to the baseline period (3-6 weeks) in which providers delivered Project ImPACT without consultation. After the baseline period, providers received 12 weeks of group consultation. Thirty-eight intervention sessions were behaviorally coded by 4 blind undergraduate research assistants. Adherence to the manual was measured using the Project ImPACT Fidelity Coaching Checklist, yielding a percentage for the adherence score. We ran a two-level multilevel model examining the change in average adherence score from the baseline period to the consultation period.

**Results:** Sufficient data was currently available for 4 of the 16 providers.

At the single-case level, there are no statistically significant changes in level of adherence within the 4 cases (i.e., individual providers); however, the trend for one provider is approaching statistical significance ( $p = 0.09$ ), such that the provider's average fidelity score for sessions in the consultation phase were approximately 15% higher than scores in the baseline phase.

The two-level model analyzed the change in adherence scores averaged across the 4 providers. Consultation did not statistically improve adherence scores, though it is changing scores in the expected direction (i.e., improving scores),  $b = 0.97$ ,  $t = 0.12$ ,  $p = 0.91$ . See Table 1 and Figure 1 for effect estimates and regression plots.

**Conclusions:** This preliminary analysis does not show a statistically significant improvement in adherence from baseline to the consultation period. This analysis is likely underpowered to find an effect of consultation, with only 4 providers in the current analysis (the trial is ongoing and not all sessions are coded yet). We expect to have appropriate power to determine an effect when we have additional adherence data from the current providers and from additional providers, with a planned sample of ~25 providers across 6 agencies to be completed by January 2022. Additionally, future analyses will include providers with longer baseline periods that can provide a more stable estimate of adherence during the baseline period.

### **402.024** (Poster) Music-Enhanced Reciprocal Imitation Training in ASD: A Single-Subject Study of a Telehealth Parent Coaching Intervention

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**Background:** Parent-mediated interventions support the social communication and play skills of young children with ASD, but there remains a need for interventions that are accessible for parents and can be delivered via remote, telehealth modalities. Reciprocal Imitation Training (RIT) is one such intervention that has shown promise for both parent-mediated and telehealth formats. As a Naturalistic Developmental Behavioral Intervention (NDBI), RIT coaches parents in using contingent imitation, linguistic mapping, modeling, prompting, and reinforcement to teach object and gesture imitation in a play-based setting. Imitation is a common deficit in children with ASD, and imitation training has corollary effects on joint attention, play skills, and language (Ingersoll & Schreibman, 2006; Ingersoll & Lalonde, 2010). Like other NDBIs, RIT relies on predictability and structure to support children's skill development through routines and repetition. Imitation is also a core component of musical play during early childhood, and the affordances of musical play naturally shape parents' interaction with their children (Lense & Camarata, 2020). Many children with ASD are motivated by music, and music-based interventions may support social communication development. As a natural, reinforcing, and predictable activity, musical interactions may align well with RIT principles to support parents' learning of RIT principles and child imitation behavior.

**Objectives:** Evaluate the feasibility of a music-based, telehealth adaptation of RIT — music-enhanced RIT (tele-meRIT) — as a novel format for coaching parents in NDBI strategies for increasing their child's imitation skills.

**Methods:** This single-subject, multiple baseline design study included 4 male children with ASD (32-53 months old) and their parents. Following baseline parent-child play sessions, parent-child dyads participated in weekly individual tele-meRIT sessions and small group music class sessions for 10-weeks over Zoom. During meRIT sessions, parents learn to incorporate rhythm and song into the RIT strategies through psychoeducation, direct coaching, and weekly homework goals. At each weekly session, and at a one-week and one-month follow-up, parent-child dyads were recorded during a 10-minute free play probe. Probes were coded for parent fidelity of RIT implementation (using a standardized scoring rubric), parent musicality, and frequency of child spontaneous imitation.

**Results:** No parent met fidelity of implementation during the baseline. All parents increased their use of RIT strategies and met fidelity ( $\geq 80\%$ ) by the end of the 10-week treatment period. Parent fidelity was maintained at the follow-up probes. Children exhibited no to minimal spontaneous imitation during baseline sessions, which did not increase during the treatment session probes. Nevertheless, a post-intervention evaluation survey indicated high parent satisfaction with the tele-meRIT program, including perceived benefits to their children's imitation and play skills more broadly.

**Conclusions:** Implementation of a telehealth, parent-mediated version of meRIT is feasible. Results demonstrate that even though meRIT additionally involved instruction and coaching in incorporating rhythmicity and song into their play interactions, parents were able to achieve fidelity in the RIT principles, suggesting one avenue by which music can be integrated within evidence-based parent-mediated NDBIs. Further qualitative and quantitative analyses will demonstrate how parents incorporated music into the RIT strategies such as via sung speech and prosodic changes.

**402.025 (Poster)** Pandemic-Related Interruptions to Early Intervention Services: Impacts on Students Academic and Behavioral Outcomes  
*S. Hurwitz and T. O'Neal, Special Education, Indiana University, Bloomington, IN*

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## **Pandemic-Related Interruptions to Early Intervention Services: Impacts on Students Academic and Behavioral Outcomes**

### **Abstract**

**Background:** The COVID-19 pandemic disrupted educational systems for young students with disabilities, especially for students with autism. Delayed enrollment into special education, dropped early intervention services, and postponed Kindergarten entry due to COVID closures and precautions caused many students to miss out on the early intervention and early school-aged services to which they were entitled. Additionally, the pandemic did not equitably impact all students. Some families were able to afford private therapies, learning pods, and special teachers while others were unable to access programs and services due to financial constraints, transportation, work conflicts, and connectivity issues. Thus, post-pandemic recovery efforts will be especially relevant for students from minoritized and poor backgrounds that are more likely to have been underserved during the 2020-2021 school year.

**Objectives:** The purpose of this study is to evaluate the academic and behavioral impacts of delays in assessment and interruption of early intervention services on young students with autism.

### **Research Questions:**

- 1) How did the pandemic impact the identification of students with autism and their consequent enrollment into special education?
- 2) Were specific subgroups (e.g., students from minority backgrounds, ELL, financially struggling) disproportionately affected by pandemic-related disruptions to educational services?
- 3) Is there an increase in disruptive behavior (or disciplinary outcomes) as students (re)enter school?

**Methods:** Three years of student-level SIS data from three school corporations in the state of Indiana are being analyzed. This data is collected and de-identified by INsite (Indiana Student Information to Empower), which is a partnership between a University's School of Education and K-12 school districts. INsite uses the Ed-Fi data standard to allow multiple data systems to be inter-operable. Student-level data includes demographic information, race, ethnicity, grade level, disability type, disciplinary data, and NWEA math and reading scores (when applicable). Students are being followed longitudinally.

**Results:** Analyses show that preschool enrollment of students with disabilities dropped by more than 10% between April 2020 and April 2022 and dropped by 12% for students with autism. Additionally, as students returned to school in fall 2021, behavior problems like eloping, physical aggression, and adamant refusal, are being reported at high levels among K-2<sup>nd</sup> graders, and referrals for special education evaluation have spiked. Academic (NWEA) outcomes are being examined.

**Conclusions:** Post-pandemic, students with autism will require substantial support to rebound academically and behaviorally as they (re)enter school. The results of this study focus on issues of equity, suggesting that minoritized and poor children who were underserved during the pandemic will require intensive intervention. Unfortunately, the special education teacher shortage is growing. This widespread dearth of qualified and well-trained specialists jeopardizes recovery.

**402.026 (Poster)** Piloting an Evidence-Based, Parent Mediated Intervention for Spanish Speaking Latinx Families

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**Background:** Parent-mediated intervention (PMIs) are an evidence-based intervention approach for young children with ASD (Nevill et al., 2018). However, treatment disparities limit access to PMIs for children with ASD from Spanish-speaking, Latinx families (Mangaña et al., 2013; Zuckerman et al., 2017). Addressing issues of equity requires proactively supporting access to PMIs and ensuring that their delivery is guided by frameworks designed for the development and adaptation of psychosocial interventions for Latinx families (i.e., Ecological Validity Model; Bernal & Bodilla, 1995). In the absence of using these frameworks, there is significant risk that PMIs do not reflect the needs, values, and systemic barriers experienced by Spanish-speaking Latinx families. Within the ASD field, interventions developed for Spanish-speaking Latinx families to date have had promising results but utilize a parent education model (Lopez et al., 2019). Although important, there remain gaps in understanding the extent to which existing PMIs can be proactively delivered and tailored.

**Objectives:** (1) Pilot an evidence-based PMI, Project ImPACT (Ingersoll & Dvortcsak, 2019), for Spanish-speaking Latinx families of a young child with ASD; (2) Examine caregiver and child outcomes associated with participation; (3) Assess caregiver perceptions of Project ImPACT and provider adaptations using the Ecological Validity Model.

**Methods:** Caregivers of a child with ASD (12-40 months) were referred to Project ImPACT by their primary care physician or following the receipt of an ASD diagnosis. All caregivers indicated Spanish as their preferred language. After consent and enrollment, participating caregivers received Project ImPACT from a bilingual provider in either an individual or group model. In both formats, Project ImPACT was delivered once each week for one hour over 12 weeks. Prior to and following participation, caregivers completed the following measures validated in Spanish: 1) child social communication skills; 2) parent social support; 3) parenting sense of competence; and 4) parent empowerment. Data were also collected on caregiver attendance, fidelity, overall satisfaction, and perceived acceptability (i.e., exit interview). All adaptations to Project ImPACT were tracked after each session using probes specific to the Ecological Validity Model.

**Results:** Data collection is ongoing. To date, 8 caregivers have enrolled and are between sessions 1 and 10 in the individual model. Caregivers are predominantly mothers and participating children are 80% Male and ranging 23 to 38 months of age. Data collection is anticipated to be complete and include a total of 20 families by May 2022. One-way analysis of variance (ANOVA) will be used to examine changes in caregivers' social support, perceived parenting competence, empowerment, and Project ImPACT fidelity. Thematic analysis will be used to code adaptations and caregiver exit interviews.

**Conclusions:** Results from this study will demonstrate the preliminary child and caregiver outcomes associated with participation in Project ImPACT. Importantly, findings from this study will directly highlight the acceptability of Project ImPACT for Spanish-speaking, Latinx families historically not included within PMI research, and the extent to which Project ImPACT may benefit from cultural adaptations as guided by the Ecological Validity Model.

**402.027 (Poster)** Positive Reinforcement during Naturalistic Developmental Behavioral Interventions: Application of the New Coding Scheme Opris

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**Background:** Supporting learning of new skills through positive reinforcement (PR) is one of the basic methods of behavioral therapy and a central component of the natural developmental *Frankfurt Early Intervention Program for Preschool Children with ASD (A-FFIP)*. Although this mechanism of learning has been well established in ASD, PR has not yet been directly investigated in the therapeutic context.

**Objectives:** We describe *OPRIS (Observation of Positive Reinforcement in Intervention Settings)*, a new scheme for coding PR based on video recordings of intervention sessions. In addition, we explore the correlation of child characteristics, such as core ASD symptoms and cognitive abilities, with the type of PR (TPR) observed during the acquaintance phase of A-FFIP.

**Methods:** Cross-sectional data of  $N = 17$  children with ASD, aged  $M = 49.94$  ( $SD = 10.54$ ) months are presented. For each child, one session of the A-FFIP acquaintance phase was coded from video. Two raters logged PR situations throughout the sessions with OPRIS (inter-rater agreement on single item level  $.701 < ICC < .979$ ). Different aspects of each PR situation were specifically classified: I) contextual factors in the form of child intention and target behavior, II) type of reinforcers, and III) child response. Here, the number of reinforcement situations and frequency of TPRs observed with OPRIS are reported. The correlation between different TPRs and the child's cognitive ability (Bayley-III and WPPSI-III), social communication and repetitive behavior symptoms (BOSCC total score, RBS-R) was explored with Spearman's correlation.

**Results:** Therapists provided a reinforcer around 48 times ( $M = 47.7$ ,  $SD = 10.70$ ) per session. On average, the children accepted 56% of these. In 11% of the cases the child's response was unclear, due to ambiguous behavior or insufficient visibility. Natural non-social PR ( $M = 8.47$ ,  $SD = 8.04$ ), natural social PR ( $M = 8.35$ ,  $SD = 6.33$ ), and the combination of both ( $M = 7.12$ ,  $SD = 5.09$ ) occurred most frequently. No single arbitrary non-social

PR was observed. Medium to large correlations were found for the BOSCC total score with social PR ( $r = -.65$ , 95% CI  $[-.88, -.25]$ ) and combined PR ( $r = .53$ , 95% CI  $[.03, .82]$ ). Cognitive abilities correlated positively with social PR ( $r = 0.49$ , 95% CI  $[-.03, .80]$ ).

Conclusions: OPRIS was able to capture different forms of PR. Therapists employed natural non-social and social PR, but no arbitrary non-social stimuli, which reflects the nature of A-FFIP as naturalistic developmental behavioral intervention (NDBI). High interindividual variability regarding the TPR was observed. Correlation analysis with child characteristics indicate that therapist are able to use different TPRs based on the child's core ASD symptoms and cognitive abilities. Since many of these child characteristics have been reported as predictors of intervention outcome in other studies, our findings emphasize the importance to differentiate child characteristics and the mediating effects of diverse TPR in the future.

#### **402.028 (Poster)** Pre-Treatment Developmental Quotient, Age at Treatment Start, and Early Intervention Type Predict Differential Developmental Trajectories in Autism

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#### Background:

Early detection and intervention are theorized to facilitate better outcomes in autistic children. However, response to early intervention varies considerably between individuals. A number of pre-treatment individualized characteristics as well as intervention-specific factors (e.g., type, intensity) also are theorized to moderate outcomes. These factors are hard to definitively untangle within smaller individual studies but could be examined in larger mega-analyses that pool together datasets and control for differences between datasets.

#### Objectives:

Examine the moderating influence of a variety of treatment-specific as well as individualized pre-treatment factors for predicting early intervention developmental trajectories.

#### Methods:

We pool data from 10 studies on early intervention in autistic toddlers, collected over 9 sites internationally (USA, Switzerland, Israel, Italy, Australia) and comprising  $n=567$  children with autism ( $n=450$  males,  $n=117$  females) ages 12-60 months. Participants received from 6 to 27 months of intervention, with variable levels of intensity, and were enrolled in either Early Start Denver Model (ESDM;  $n=315$ ) or other treatment as usual/community (TAU/COM;  $n=252$ ) interventions. Longitudinal data common to most datasets included Mullen Early Scales of Learning (MSEL), Vineland Adaptive Behavior Scales (VABS), ADOS, and Griffith Mental Development Scales (GMDS). Linear mixed effect models were used to predict MSEL age-equivalent scores or VABS domain standardized scores trajectories from random effects of dataset (random intercepts) and age grouped by subject (random slopes and intercepts) and fixed effects of age, treatment type, intensity, sex, age at treatment start, and pre-treatment developmental quotient. Control for multiple comparisons was achieved using FDR  $q<0.05$ .

#### Results:

For all MSEL subscales, the interaction effect between age and pre-treatment developmental quotient was highly significant ( $p<3.41e-10$ ). Decile splits indicate that this effect is driven by progressively steeper slopes with higher pre-treatment developmental quotient. Age at treatment start was also highly significant for all MSEL subscales, with early starts having better outcomes. MSEL Visual Reception (VR) and Receptive Language (RL) showed a significant treatment type by age interaction, with ESDM having steeper slopes than TAU/COM. All VABS subscales except motor showed a significant main effect of pre-treatment developmental quotient.

#### Conclusions:

This work provides definitive evidence that pre-treatment developmental level and starting intervention early are the most important predictors of verbal, non-verbal cognitive ability, and fine motor skills as measured by MSEL. ESDM also facilitates better outcomes particularly for non-verbal cognitive ability and receptive language. Unlike MSEL, predicting VABS outcomes was more challenging. This work provides an overview for understanding the main ingredients that facilitate positive outcomes in early intervention.

#### **402.029 (Poster)** Prediction and Monitoring of Treatment Response in Early Intervention: Measuring Social Visual Engagement during a Randomized Clinical Trial of the Early Social Interaction Project

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#### Background:

In order to improve the efficacy of interventions for young children with ASD, we must understand the mechanisms of change by which interventions work, as well as accurately measure change during and due to intervention. Eye-tracking is a promising objective and automated method for tracking progress in interventions. It may be a particularly useful measure of progress and/or outcome in naturalistic developmental behavioral intervention (NDBIs), as these interventions emphasize building engagement and social communication skills (Schreibman et al., 2015), constructs already shown to relate to measures of social visual engagement (SVE) in young children with ASD (Jones & Klin, 2013).

#### Objectives:

This project sought to determine 1.) whether eye tracking measures of social visual engagement (SVE) predict response to Early Social Interaction (ESI), a parent-mediated NDBI, and 2.) the extent to which patterns of SVE change in response to participation in ESI.

#### Methods:

Children participating in a longitudinal study from birth to 24 months were screened at 12 months for early signs of ASD. The present study includes all children who screened positive at 12 months and later received diagnoses of ASD ( $n=27$ ). All were invited to participate in ESI from 12-24 months. Seventeen families participated and 10 declined. All parents completed the Communication and Symbolic Behavior Scales (CSBS) and Vineland Adaptive Behavior scale (VABS-II) at 12 and 24 months. Eye-tracking measures of SVE (quantified as percentage of time spent fixated on different facial regions of interest (ROIs)) were collected at 11 timepoints over the course of the study. Linear regressions were used to determine the relationship between SVE to eye regions at 6 months and treatment response, measured by change scores on the CSBS and VABS-II from 12 to 24 months. Functional data analysis was utilized to model longitudinal trajectories of SVE to eye regions for intervention and non-intervention groups.

#### Results:

SVE to eye regions at 6 months significantly positively predicted change scores in the Speech domain of the CSBS and the Communication domain of the VABS-II ( $F(1,15)=5.48, p=0.03$ ;  $F(1,8), p=0.01$ ) for children who participated in ESI. Trajectories of SVE to eye regions for children in the intervention and non-intervention groups are displayed in Figure 1. SVE to eye regions did not differ between intervention and non-intervention groups at 12 months. Between 12 and 24 months, eye-fixation in the ESI group remained relatively stable whereas eye-fixation steadily declined in the non-intervention group. By 24 months the non-intervention group fixated significantly less on eye regions ( $t(23.05)=2.14, p=0.04$ ).

#### Conclusions:

Measures of SVE in infancy predict improvement in communication abilities over the course of ESI intervention; specifically, infants who look more at others' eyes showed greater gains in communication abilities while participating in ESI. Additionally, longitudinal trajectories of SVE to eye regions suggest that these trajectories may differ between infants who participated in ESI intervention and those who did not. These findings provide preliminary evidence that measures of SVE are predictive of and responsive to NDBI effects.

#### **402.030 (Poster)** Predictors of Active Engagement in Inclusive Preschool Classrooms for Children with and without ASD: Teachers' Classroom Supports and Children's Social Visual Attention

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**Background:** Learning occurs when children are actively engaged during planned teaching opportunities (NRC, 2001). In classroom-based interventions, where teachers implement intervention strategies or embed learning supports within/across daily routines/activities, measures of active engagement (AE) provide a meaningful metric for quantifying the intensity of children's intervention receipt. By its very nature, AE is a transactional construct, and moments of AE may emerge because of classroom interventions/supports implemented by the teacher, because of generalized behavioral tendencies of the child (e.g., social attention), or both.

**Objectives:** This research uses observations collected across three classrooms of an inclusive laboratory preschool for children with/without ASD to investigate whether observational classroom measures of AE (frequency of children's directed communication) are predicted by (1) observational measures of classroom interventions/supports (teachers' active facilitation and supportive language use), and/or (2) objective generalized measures of children's social visual engagement (eye tracking).

**Methods:** The research sample includes 42 children between 24 and 62 months ( $M = 46.7$ ,  $SD = 11.1$ ; 71% male), including 20 children with a diagnosis of ASD. Day-long classroom videos were recorded once per week, for five weeks. For each child and day-long recording, a 5-minute segment of center time (i.e., indoor free-play) was selected randomly for subsequent coding (i.e., up to five repeated observations per child). Video segments were coded for (1) the frequency of children's directed communication (Classroom Measure of Active Engagement; Morgan et al., 2018),

and (2) qualitative ratings of teachers' active facilitation and supportive language use (Classroom Assessment Scoring System; Pianta et al., 2008). Further, 32 of the 42 children participated in a single eye-tracking session during which participants viewed videos of naturalistic social situations (e.g., children engaged in play). Children's eye movements were recorded and used to quantify children's generalized visual social engagement (% gaze allocation to the faces of the protagonists shown in the videos). Finally, children's parents completed the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) to provide a continuous, quantitative measure of autistic traits. To accommodate the nested data structure (five repeated classroom observations nested within children), data were analyzed by specifying mixed models for longitudinal data using SAS Proc Mixed.

**Results:** Preliminary results showed that observed frequencies of children's directed communication were not predicted by children's age, diagnostic group (ASD vs. TD), or continuous, quantitative measures of autistic traits ( $p > .40$ ). In contrast, observed frequencies of children's directed communication were significantly predicted by (1) observational measures of classroom interventions/supports (average ratings of teachers' active facilitation and supportive language use scores),  $F(1,65) = 4.3, p < .05$ , and eye-tracking measures of children's generalized social visual engagement (gaze allocation to faces while viewing naturalistic social interactions on video),  $F(1, 54) = 4.9, p < .05$ . Importantly, measures of social visual engagement and classroom interventions/supports were not associated, suggesting that both variables contribute unique information in predicting AE.

**Conclusions:** Results from this research illustrate the transactional nature by which children and teachers collaborate to create moments of AE in inclusive preschool classrooms for children with and without ASD.

**402.031 (Poster)** Preparation for Adaptation of Intensive Early Intervention for Toddlers with ASD: Childcare Providers' Perspectives on Training Approach

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**Background:** Naturalistic developmental behavioral interventions (NDBI) are effective interventions for toddlers with autism spectrum disorder (ASD) that occur in a natural environment, during daily activities and tasks, and at a developmentally appropriate level. An NDBI adaptation for community childcare settings specifically developed to be contextually sustainable and to promote community spread would: 1) increase access to ASD-specific early intervention; 2) support working parents or parents in need of respite care; and 3) possibly reduce parent stress, anxiety, and depression via increased support.

**Objectives:** To explore childcare providers' (providers) knowledge of ASD, confidence and experiences caring for toddlers with ASD and their openness to, and preferred format of, additional training.

**Methods:** Providers completed an online or paper survey regarding their interest in training and experiences with ASD. All providers had provided childcare to a toddler with known or suspected ASD within the last 12 months. Providers were predominantly female (78.9%), lead teachers in their classrooms (49.1%) and ranged widely in their age (20-65 years,  $M = 35.38$  years,  $SD = 12.21$  years) and educational experiences (43.7% BA+). Providers reported working close to full time ( $M = 34.9$  hours/week,  $SD = 9.44$  hours/week), but there was still a wide range in reported classroom hours (Range: 5 to 50 hours/week). Most providers were reporting on professional experiences gained in toddler-specific (76%) or preschool-specific classrooms (18.5%).

**Results:** Most providers were willing to attend/receive at least 1 hour of any type of training format: in-person didactics (98%), online didactics (98%) or in-person coaching (93%). Providers indicated a preference to complete more hours of in-person didactics than any other type of training format (in-person 33%; online 23.7%, live coaching 12.7%). Provider knowledge of ASD did not predict interest in ASD training,  $OR = 1.16, B = 0.15, p = .06$ , nor did provider confidence in working with children with ASD,  $OR = 0.95, B = -0.05, p = .64$ . However, the greater the extent to which a provider perceived ASD symptoms to interfere with children's learning, the more likely providers were to indicate interest in training,  $OR = 2.57, B = 1.27, p = .01$ . Providers who reported working with a toddler with other types of challenging behaviors were also more likely to be interested in training,  $OR = 0.11, B = -2.17, p = .01$ . However, provider perception of interfering child behaviors did not predict quantity of training sessions willing to complete.

**Conclusions:** Providers have clear interest in receiving additional ASD-specialized trainings to support toddlers with ASD in their classrooms – especially when they perceive child behaviors to interfere with learning. Generally, providers interest in type/length of training mirrored current professional development practices but did not align with effective adult learning strategies. These insights demonstrate that an intensive training program, like most NDBI interventions require, may be an unattainable goal for community childcare providers. Childcare adaptations of NDBIs should likely focus on incorporating intervention strategies that are common between NDBIs and existing national early education and care accreditation practices to promote provider engagement and sustainability.

**402.032 (Poster)** Proof-of-Concept Study of a Novel Parent-Mediated Intervention for Infants at Elevated Likelihood of Autism

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## Background:

Associations between parent responsiveness and social-communication outcomes in children with autism provide conceptual support for interventions promoting parent responsiveness. Hypothetically, parent responsiveness fosters parent-child dyadic engagement, which mediates children's social-communication outcomes. However, interventions targeting *infants at elevated likelihood for autism* (EL-AU), have generally yielded modest or null effects on infant outcomes. We developed a new intervention, Parents and Infants Engaged (PIE), coaching parents to recognize and respond to infant variables that likely play transactional roles in social-communication development: prelinguistic communication (PC) and sensory reactivity (SR).

## Objectives:

Estimate PIE's effects on: (a) dyadic engagement (primary outcome); (b) parent responsiveness to infant SR and PC cues; and (c) infant intentional communication and broader social-communication.

## Methods:

We enrolled 36 parent-infant dyads. Infants were 14.1 ( $SD=1.7$ ) months; 27/36 male; 25/36 White; 7/36 Latino. Eligibility required First Years Inventory v.3b-Lite screening scores  $\geq$  cutpoint for EL-AU, and observed language delays and extreme patterns of sensory hypo-/hyper-reactivity at Baseline. Participants were randomized to one of two arms differing in PIE domain coaching order – PC Arm was first coached on responding to infants' PC cues and SR Arm on responding to infants' SR cues. Across domains, coaches engaged parents in reflecting on the effectiveness of their responses to infant cues in establishing or maintaining engagement. After 6 weekly coaching sessions in their initial PIE domain, families returned for Posttest1. They then participated in 6 coaching sessions in the 2<sup>nd</sup> PIE domain, followed by Posttest2. Coders blind to Arm and Timepoint coded 20-minute parent-child interaction videos at Baseline, Posttest1 and Posttest2 for dyadic engagement, parent responsiveness, and infant intentional communication. The Brief Observation of Social-Communication Change (BOSCC) was administered at Baseline and Posttest2 by an assessor blind to Arm and scored by coders blind to Arm and Timepoint.

## Results:

Dyadic engagement improved significantly over time,  $F(2, 58) = 7.8, p = .001$ . Parent responsiveness improved from Baseline to Posttest1, to both infant SR,  $t(63) = 2.79, p = .008$ , and PC,  $t(60.7) = 2.28, p = .026$ , with no Arm x Time effects. Infant intentional communication increased significantly over time,  $F(2, 61) = 9.66, p < .001$ ; BOSCC Social Communication domain scores decreased (improved) significantly,  $F(1, 27.5) = 4.9, p = .04$ . All Arm and Arm x Time effects were nonsignificant.

## Conclusions:

In this proof-of-concept study, participants were randomized to coaching domain order, with all receiving the full PIE intervention by Posttest2. Time effects on targeted parent, infant, and dyadic outcomes aligned with our hypotheses. Coaching in *either* PIE domain was associated with increases in parent responsiveness to *both* infant PC and SR cues at Posttest1, failing to support our hypothesis that responsiveness would improve specific to coaching domain. Moderate to strong time effects on targeted dyadic and infant outcomes by Posttest2 support PIE's potential efficacy. Despite nonsignificant Arm x Time effects, relative patterns of change for the two Arms, especially in dyadic engagement, suggest possible benefits of first coaching parents in the SR domain. Further evaluation of PIE in a well-powered randomized controlled trial is planned.

**402.033 (Poster)** Systematic Review of Very Early Life Interventions for Infants at-Risk or Diagnosed with Neuro-Developmental Disorders  
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**Background:** Neuro-developmental disorders (NDDs) involve atypical brain development early in life. Risk factors for developing a NDD often interact overtime with an individual's characteristics resulting in a wide range of heterogeneous outcomes between individuals. Previous reviews targeting Early Intervention (EI) include a broad range of interventions designed to improve different aspects of child development, however, our selected population has yet to have been examined.

**Objectives:** We conducted a systematic review evaluating existing EI literature across individuals who are at-risk or diagnosed with NDD.

**Methods:** We used the PRISMA guidelines for systematic reviews. Literature search was done using e-databases: PsycINFO, Embase, and Medline, from January 2000 until May 2021. The search strategy focused on Population, Intervention, Comparison, and Outcomes (PICO). We included articles if they were (1) a randomized clinical trial; (2) on infants pre-birth and up to 3 years of age diagnosed or at-risk for NDD; (3) and included outcomes relating to infant risk signs and symptoms or developmental outcomes, caregiver well-being, infant-caregiver interaction, and family functioning. We used the Cochrane Tool for Assessing Risk of Bias.



**Results:** We screened 1,417 results for eligibility of which 97 studies met our criteria. 17 studies met the criteria for low risk of bias across all domains, excluding performance bias. Of the 17 studies, most interventions targeted populations at risk of developing a NDD and/or their families (n=12). In the remaining studies, interventions focused on either autism or Down syndrome (n=5). Only three studies involved group level delivery either partly (n=2) or entirely (n=1), however there were four parent-mediated interventions studied. The dosing frequency varied from 4 biweekly sessions to weekly sessions over 36 months. The length of each session varied from 30 minutes to 2-hour session blocks. The delivery of the interventions was mainly conducted by specialized, trained professionals who used manuals (n=13). In nine studies interventionists continued to receive supervision. Although outcome measures varied substantially across studies, improvements were reported in many studies. Of the 17 studies, they reported improvements in infant outcomes across infant risk and diagnostic status (n=3), motor functioning (n=2), cognitive development (n=5), behavior and emotional regulation (n=4), adaptive functioning (n=1), attention (n=2), language (n=3), and functional play (n=1). Eleven studies reported caregiver outcome improvements in mental health (n=5), global and social functioning (n=2), distress and perceived support (n=2), non-directiveness (n=1), and smiling (n=1). One study reported dyadic outcomes which reported improvements in parent-child interactions, including child attentiveness, responsiveness, and joint engagement. One study focused on clinical outcomes such as length of hospital stay (n=1). Only one study reported an implementation outcome: teaching assistants' implementation strategy when using a newly acquired intervention model in a preschool setting.

**Conclusions:** Very EI before three years of age yields improvement across a range of caregiver, infant, and dyadic outcomes. Nevertheless, the limited number of studies that met quality standards and the heterogeneity in outcomes impeded a meta-analysis. Future studies using comparable measures across populations can eventually inform the extent to which intervention mechanisms and outcomes differ.

#### **402.034 (Poster) The Current State of Preemptive Interventions: A Systematic Review and Meta-Analysis**

**L. H. Hampton and E. Rodriguez, The University of Texas at Austin, Austin, TX**

**Background:** Understanding the impact of preemptive interventions on developmental outcomes for those with a high likelihood for autism is a critical step in building a transdiagnostic sequential model of optimized care, given the current autism prevalence rates. Interventions designed to address core symptoms of autism have a strong evidence base and many of these interventions have also been adapted for toddlers with a growing evidence base. However, earlier intervention has yet to demonstrate definitive evidence of long-term outcomes, despite the wide acceptance and face validity of this practice. The purpose is to examine the impact of preemptive interventions on parent outcomes and child developmental outcomes.

**Objectives:** Are preemptive interventions for infant/toddlers with a high likelihood for autism associated with (1) improved parent implementation? (2) improved developmental outcomes? (3) reduced autism symptoms? And (4) What study characteristics moderate the outcomes?

**Methods:** A total of 571 articles were assessed for eligibility using the PRISMA framework for abstracting data and assessing study quality, and a total of 16 individual sources were included, representing 13 studies. The primary outcomes included parent responsiveness and parent implementation of intervention strategies, caregiver stress, and child developmental outcomes included language, communication, motor, social, and adaptive skills. A robust-variance meta-analysis was used to estimate effects across 13 studies.

**Results:** The meta-analysis includes 13 unique studies, 11 of which are randomized trials. These studies include a total of 715 infant/toddlers with a high likelihood for autism. All of the included studies used a parent-mediated intervention based in developmental or developmental-behavioral principles. There was a significant association between the intervention on parent implementation of responsiveness strategies immediately following the intervention ( $G=.544$ ,  $SE=.166$ ,  $p=.01$ ). However, there was no significant association between the intervention and child outcomes ( $G=.104$ ,  $SE=.086$ ,  $p=.257$ ). The systematic review includes 5 studies reporting moderator and/or mediator analyses which point towards a significant and meaningful association between parent implementation and long-term child social communication outcomes.

**Conclusions:** Previous reviews have examined interventions for young children autism on individual outcomes and to date, no study has reviewed preemptive interventions across all developmental outcomes. In particular, the findings identified in the current meta-analysis highlight the urgent need to develop a nuanced intervention approach during a time of ever-changing concern about child development. Early interventionists and clinicians who frequently work with parents of children with a high-likelihood for autism may need greater training in how to discuss early autism signs and early preemptive interventions with families. Additionally, it may be important to refer all infant/toddler siblings with a high likelihood for autism to intervention in light of the findings that those with the fewest symptoms benefited most from the parent-mediated intervention (Yoder et al., 2021a).

#### **402.035 (Poster) The Effect of "Resilience Intervention with Parents of Children with ASD" on Parental Resilience and Well-Being and on Children's Behavior and Emotion Regulation**

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**Background:** Parents of children with ASD deal with stressors stemming from their child's course of development and experience increased levels of stress, anxiety and depression compared to parents of children with typical development (Bitsika et al. 2013). These experiences challenge their psychological resilience and well-being. Research on parent-specific interventions aimed at improving psychological resilience and well-being is

scarce (Kuhlthau et al., 2020; Schwartzman et al., 2021). Furthermore, the possible impact of parental improved resilience and well-being on these children's behavior and emotional regulation was rarely studied.

The Resilience Intervention with Parents of Children with ASD (RIPCA) is 17-weeks group-based program, designed to teach parents evidence-based resilience strategies, emotion regulation techniques, and child behavior management strategies. RIPCA was adapted from a parent and teacher-delivered resilience intervention (Wolmer, Hamiel, & Laor, 2011; Wolmer et al., 2011).

Objectives: (1) to examine the effect of RIPCA on parental resilience and well-being; (2) to examine the effect of the RIPCA on child behavior and emotion regulation; (3) to explore parents' perceptions of the program and its impact on them and/or their children.

Methods: A pilot study of mixed methods - quantitative pre-post design and qualitative interviews with parents during and after the program was conducted. Participants included 21 parents of school-age children with ASD (4-8 years old) who completed questionnaires evaluating their resilience and well-being and their child's anxiety, behavior, and emotion regulation pre- and post-intervention. Parents' experiences of the intervention were explored through semi-structured interviews with 17 parents, during and after the intervention. Interviews' analysis employed the Immersion/Crystallization method – reading/re-reading the interviews in an iterative consensus building process.

Results: Following RIPCA, both parental well-being and positive relationships, an indicator of resilience, significantly increased. Parents reported a significant decrease in children's maladaptive behaviors: agitation and crying, social withdrawal and hyperactivity/noncompliance. In addition, improvement in parental resilience and decreased child anxiety, agitation and crying and hyperactive behaviors, exhibited significant positive correlations.

The qualitative interviews identified that parents felt RIPCA enhanced their awareness and understanding of needs and stressors as parents to children with ASD, while balancing their own stress thus improving children's well-being. Sharing experiences among parents decreased feelings of isolation and shame. Their increased awareness of feeling and thinking, allowed them to choose alternative approaches of handling child-related stressful situations, thus decreasing automatic anger reactions toward the child, improving communication of their own and the child's emotions and needs to impart their children some of the acquired strategies.

Conclusions: This pilot study preliminarily supports the effectiveness of RIPCA in (1) improving resilience and well-being among parents of young children with ASD, (2) decreasing children's maladaptive behaviors: agitation and crying, social withdrawal, and hyperactivity/noncompliance. The qualitative findings indicate parents' benefit from both safely sharing their challenges and acquiring strategies to handle challenging day-to-day interactions with their children. Additional research is needed to assess and enhance the impact of resilience interventions both on parents and on their children with ASD.

**402.036 (Poster)** The Impact of Parent Resolution of Diagnosis on Intervention Fidelity in a Parent-Delivered Intervention for Pre-School Children with Autism: A Mixed Methods Study

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Background: Despite growing interest in parent-delivered interventions (PDI) for autistic children, evidence of their efficacy and effectiveness are variable. Parent treatment fidelity has been associated with child outcomes but little is known about what impacts fidelity in a PDI. One factor not previously examined is parents' resolution to the child's diagnosis which involves adjusting their expectations about the child following diagnosis and sensitively responding to their cues, strengths and needs. Resolution is, therefore, relevant to PDI fidelity where parents are rated on how they interpret and respond to their child's cues. Few studies have examined resolution to diagnosis in the context of autism but there is evidence of an association between resolution and parent wellbeing.

Objectives: The study aims were to examine a) whether there is an association between parent resolution of diagnosis and PDI fidelity; b) whether resolution to diagnosis is associated with parent wellbeing; and c) to describe and compare interview responses of parents who were classified as resolved/unresolved to their child's autism diagnosis.

Methods: Parents of 31 children (90% mothers) diagnosed with autism (58% male; 3-6years) attended 10-12 parent-delivered Early Start Denver Model (P-ESDM) coaching sessions. A mixed-methods approach was adopted to address the study aims, with a thematic analysis undertaken of parent Reaction to Diagnosis Interviews (RDI; Pianta & Marvin, 1993) to identify themes raised by resolved and unresolved parents. The P-ESDM fidelity tool was used to measure parents' adherence to the intervention principles, with mean fidelity scores calculated at each session, and change scores calculated to ascertain the mean change between fidelity scores at their first and final sessions. The Depression, Anxiety and Stress Scale and the Parenting Stress Index Short Form were used to ascertain parental wellbeing. Children were assessed with the Mullen Scales of Early Learning and the Autism Diagnostic Observation Schedule at study intake.

Results: Parents demonstrated a significant improvement in fidelity over time ( $d = 1.32$ ). In relation to the RDI, 48% of parents were classified as resolved and 52% as unresolved. Quantitative analysis revealed that while there was no significant difference on mean fidelity scores between resolved and unresolved parents, parents classified as resolved demonstrated significantly higher fidelity change scores over time ( $d = .6$ ), as well as significantly lower scores on depression and parenting stress than parents classified as unresolved ( $d$ 's ranging from  $.6 - .8$ ). Despite child measures not distinguishing the resolved and unresolved groups, qualitative analysis revealed that parents' perceptions of their child's progress and their hopes for the future distinguished resolved from unresolved parents.

Conclusions: Findings suggest that parent resolution to diagnosis is likely to impact change in PDI fidelity and also their wellbeing, although causality cannot be ascertained in this study. Targeted supports may be required for parents who experience psychological distress to ensure they have the internal resources to successfully deliver parent mediated intervention.

**402.037 (Poster)** The Relationship between Child-Initiated and Caregiver-Initiated Joint Engagement and Joint Attention Following Jasper Treatment in Toddlers at-Risk for ASD.

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Background: Early interventions for children with ASD often target social communication abilities, including joint attention and language. Joint engagement between adults and children can facilitate increased gesture and language use, and evidence has supported this in both TD children (Tomasello & Farrar, 1986) and children with ASD (Adamson et al., 2017; Shih et al., 2021). While past studies have examined the mediating effects of overall time spent in joint engagement (JE; Shih et al., 2021), this study examined the relationships between mean length of child-initiated JE (JE-C) and adult-initiated JE (JE-A) and social communication following a treatment intervention.

Objectives: Investigate the relationship between mean length of child- and adult-initiated joint engagement and initiations of joint attention (IJA) in infants/toddlers at risk for ASD.

Methods: This study used data collected for an autism intervention study for infants showing signs of ASD. Participants ( $N=78$ , 21% female, 50% white) between 12-21 months of age and with elevated scores on the ADOS-T (Luyster et al., 2009) were eligible (Table 1). Participants were randomized to a Baby JASPER (Kasari et al., 2021) or Standard Baby Classroom. Both classrooms were structured around the AEPS curriculum (Bricker, 2002). Baby JASPER classroom activities were tailored to target early emerging areas of weakness in ASD (joint attention, play); the Standard Baby Classroom targeted various developmental domains. Caregivers in the Baby JASPER classroom received weekly hands-on training in caregiver-mediated JASPER; caregiver in the Standard Baby classroom received weekly parent education. JE-A and JE-C were coded from caregiver-child free play interactions. IJA was measured via Early Social Communication Scales (Mundy et al., 2003). Four linear regression models were run predicting IJA: Models 1-2 tested whether mean duration of JE-A and JE-C in seconds predicted concurrent IJA at Entry after controlling for Visual Reception (VR; proxy for nonverbal cognitive ability). Models 3-4 tested whether mean duration of JE-C and JE-A at Exit predicted IJA at exit after controlling for VR, treatment, IJA at entry and total length of caregiver-child interaction video in seconds.

Results: The relationship between child-initiated mean length of joint engagement and IJA at exit differed by treatment group and results neared significance ( $p=.065$ ). There was a small positive relationship between JE at exit and IJA at exit in the JASPER condition and a slightly negative relationship between the two in the control group at exit. See Table 2 for descriptive information. There was no interaction between adult-initiated joint engagement and treatment ( $p=.13$ ) on IJA.

Conclusions: Results suggest that JASPER can impact the relationship between JE and IJA even in the short period of eight weeks. Mean length of joint engagement gives us a more detailed information about engagement periods as opposed to the overall time in a state of JE. Given that social communication is a core challenge for young children with ASD, these findings support interventions that may increase JE periods between two play partners, and thus may increase a child's ability to learn and initiate social skills (IJA) within a play interaction.

**402.038 (Poster)** Young Children with Autism Placed in Special and Inclusive Educational Settings Exhibit Similar Improvements in Core ASD Symptoms over Time

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Background: In Israel, children with autism are eligible for placement in either special or inclusive education settings. In special education settings, small groups of up to 8 children with Autism spectrum disorder (ASD) receive treatment from a large professional staff including special education teachers and therapists. In contrast, regular education settings include up to 35 typically developing children and children with ASD are accompanied by a personal assistant with limited professional education. Nevertheless, children placed in inclusive programs have the benefit of exposure to their typically developing peers. Remarkably few studies have compared the developmental outcome of children across the two educational settings.

Objectives: To compare longitudinal changes in autism severity of 2-5-year-old children who were placed in special education versus inclusive education settings.

Methods: We examined longitudinal data from 121 children, who were recruited at the National Autism Research Center of Israel. Children were 11-65 months-old (mean age = 32.6 months) at the time of diagnosis. Autism diagnostic observation schedule 2 (ADOS2) scores were collected during initial diagnosis and again 12-24 months later. T-tests were used to compare longitudinal changes in total ADOS calibrated severity scores (CSS) and separately in the social affect (SA) and restricted and repetitive behaviors (RRB) domains. Chi-Square tests were used to compare the percentage of toddlers who improved in each group. Mann Whitney tests were used to assess differences in longitudinal language production changes, which were estimated using a scale of 0 to 7, (no spontaneous word production to language appropriate for age, respectively) based on item A1 of the ADOS.

Results: Initial characteristics of children placed in special or inclusive education did not differ significantly with respect to age of diagnosis ( $t(119) = 0.95$ ,  $p = 0.34$ ), ADOS CSS ( $t(119) = -1.25$ ,  $p = 0.21$ ), SA CSS ( $t(119) = -1.7$ ,  $p = 0.09$ ), RRB CSS ( $t(119) = -0.11$ ,  $p = 0.9$ ), level of language production ( $U(121) = 1271.5$ ,  $p = 0.105$ ), and parental age (mothers:  $t(115) = 0.53$ ,  $p = 0.59$ ; fathers:  $t(105) = 0.18$ ,  $p = 0.86$ ). However, parental education of children placed in inclusive education was higher (mothers:  $t(103) = 3$ ,  $p = 0.003$ ; fathers:  $t(40.48) = 3$ ,  $p = 0.004$ ).

Similar longitudinal changes were apparent in ADOS CSS in both groups. The percentage of children who improved in ADOS CSS in inclusive education (61%) and special education (52%) settings did not differ significantly ( $\chi^2(121) = 0.68$ ,  $p = 0.41$ ). There was also no significant difference in the magnitude of change in total ADOS CSS across the two groups ( $t(119) = 0.93$ ,  $p = 0.35$ ) nor in SA CSS ( $t(119) = 1.22$ ,  $p = 0.22$ ) or RRB CSS ( $t(119) = 1$ ,  $p = 0.3$ ). Longitudinal changes in spoken language scores also did not differ significantly across children placed in mainstream and special education ( $t(119) = 1.44$ ,  $p = 0.15$ ).

Conclusions: These findings suggest that children placed in either educational setting improve similarly in core ASD symptoms as assessed by the ADOS. This may be surprising given the large difference in structure and cost of the two settings. It is possible that while changes in autism severity are less apparent after short period of intervention, outcomes in cognitive abilities and adaptive behaviors would be different between the two educational settings and should be assessed in future studies.

## VIRTUAL POSTER SESSION — INTERVENTIONS - NON-PHARMACOLOGIC - PRESCHOOL & INFANT

### 502 - Interventions - Non-pharmacologic - Preschool & Infant --- (V)

**502.005** (*Virtual Poster*) Early Intervention Modifications for Autism during Covid19 – an ABAB Design Case Series from a Tertiary Care Center in India

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#### Background:

Early Intervention is critical for children with autism. At CAREADD, we follow the Com DEALL Early Intervention program which is a group-based intervention model that uses an interdisciplinary team approach and runs for a period of ten months (Karanth et al 2010). We started the program in January 2020 with 7 children. In April, the pandemic intervened. Initially, during the lock down, we adapted by providing Home Training Programs with regular follow up calls to help parents manage their children. Eventually we adapted the Com DEALL program into an online mode using small-group interventions conducted via Microsoft Teams. Briefly face to face interventions resumed before reverting to online modes during the second wave.

#### Objectives:

This paper is an observational qualitative case series report which aims to study the difference between online and offline modes of interventions in seven children with ASD enrolled in our early intervention program, and the effects of this modified intervention on parental knowledge and stress.

#### Methods:

The ABAB design saw three children undergo 3 months of face-to-face intervention(A), followed by 8 months of online(B), 2 months of face-to-face interventions again (A) and 1 month of online interventions (B). We extended intervention beyond 10 months to sync with the academic year.

Another series had only an ABA design with 3 children, aged below 5 years, of whom 2 were discharged after this program to an inclusive school. One family opted out due to personal reasons.

#### Results:

While face-to-face intervention provided comfort, familiarity, ease of working with children and reduced parental stress, online intervention relied heavily on the parents and depended on their skills and motivation to implement therapists' suggestions. We found that online intervention compelled some parents to understand and manage their child's issues while increasing their awareness and knowledge of the condition. Severity of Autism also played an important role with increase in behavioural and sensory issues in more severe cases. Online intervention seems to be more effective when families have had some face-to-face interactions and sessions with therapists, understand the process of therapy and are motivated.

#### Conclusions:

We have documented interventions and outcomes using ABAB design in a clinical series. Further investigations evaluating long term outcomes online modes of therapy need exploration as it may benefit families staying in remote parts of the country with no access to specialized therapy services in general.

**502.006 (Virtual Poster)** Evaluating Parent Treatment Fidelity and Child Social Communication Outcomes Following Participation in a Parent-Mediated Intervention for Toddlers with Autism Spectrum Disorder

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**Background:**

Parent-mediated interventions (PMIs) using naturalistic developmental and behavioral intervention strategies capitalize on the role of parents to foster social communication development (Schreibman et al., 2015). These PMIs positively impact parent fidelity (e.g., Stahmer et al., 2020) and child outcomes (e.g., Yoder, 2020). Optimizing methods for monitoring fidelity across treatment is important as parent use of intervention strategies has been shown to mediate improvement in social communication outcomes (Yoder et al., 2021). Yet, trends of biased sampling toward highly educated families poses the question of how socioeconomic status may impact parent strategy use and child outcomes (Hao et al., 2021).

Traditionally, fidelity coding can be a resource-intensive process that may not be feasible for community settings. Briefer measures may serve as an efficient alternative (Suhreheinrich et. al, 2013). The present study examined whether clinician perceptions of parent fidelity using a brief Likert scale (*Fidelity of Intervention Implementation*; Ingersoll & Dvortcsak, 2010) were associated with treatment outcomes for children with ASD participating in an evidence-based PMI (Project ImPACT; Ingersoll & Dvortcsak, 2019). The setting was an outpatient clinic serving primarily Medicaid populations based on family income.

**Objectives:**

This study aimed to investigate the association between clinician ratings of parent fidelity and child social communication outcomes following participation in Project ImPACT.

**Methods:**

Data collection is ongoing. Within the current sample, participants were 36 children and their caregivers at or under the age of 40 months. 69.4% of the families had Medicaid or a Medicaid CMO as their primary insurance. Families participated in 12-14 1-hour treatment sessions in-person (36.1%) or via telehealth (63.9%). Treatment focused on promoting social engagement, communication, imitation, and play skills. Following each session, clinicians rated parent use of strategies on a scale from 1 (i.e., *adult does not implement the strategy*) to 5 (i.e., *adult implements the strategy effectively throughout the session*). Fidelity ratings of 4 or higher were considered the threshold for appropriate delivery. Parents also completed the *Social Communication Checklist (SCC)* pre- and post-treatment. Information was collected regarding progress toward treatment goals collaboratively established with families.

**Results:**

Child participants showed significant improvements in social communication skills from pre-treatment (M=110.76, SD=18.82) to post-treatment (M=134.84, SD= 23.01);  $t(24)=-7.16, p<.001$ . Significant improvements were noted across *Social Engagement* ( $p=.026$ ), *Expressive Language* ( $p<.001$ ), *Receptive Language* ( $p=.001$ ), *Imitation* ( $p<.001$ ), and *Play Skill* domains ( $p=.003$ ). By the end of the program, 66.7% of parents met fidelity of implementation (M= 4.05, SD= 0.58), and 72.2% of participants successfully met all treatment goals. Despite improvements in child social communication skills and parent fidelity, no significant relationship was detected between fidelity and SCC scores.

**Conclusions:**

These results suggest that a brief Likert scale may serve as an efficient method to measure parent treatment fidelity and monitor progress over time. However, additional research is needed to evaluate whether this measure may be associated with improvements in social communication skills and to determine if it will correlate with more traditional, comprehensive measures of treatment fidelity, particularly as rigorous study of PMIs implemented in diverse settings continues.

**502.007 (Virtual Poster)** Feasibility of Early Interventionists Implementing a Parent-Mediated Intervention: A Randomized-Controlled Trial in Autism Treatment

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**Background:** Early identification and treatment of ASD is crucial during the first three years of life to maximize developmental potential when neuroplasticity is optimal. The Early Social Interaction (ESI) Model is a parent-implemented intervention teaching families how to support their child's active engagement in everyday activities. The effectiveness of the ESI model has been documented in a multisite randomized controlled trial (RCT) that resulted in improved child outcomes on standardized measures of social communication, developmental functioning, and adaptive behavior (Wetherby et al, 2014).

**Objectives:** The purpose of this study is to expand the results of the initial RCT by training Part C Early Intervention Providers (EIPs) to coach families of toddlers with early signs of ASD. EIPs will have access to an autism specific screening tool that can identify children at risk for ASD. Our goal is to identify children under the age of 24 months, recruit and retain 18 EIPs, then provide intervention with the ESI Model. Participants received online training and randomized into two study arms: Business-as-Usual (BAU) or Early Social Interaction (ESI). Providers offer study

participation to families with children demonstrating delays in social-communication and/or red flags for autism. We expect EIPs to work with an average of three toddlers totaling 54 families.

**Methods:** The Early Social Interaction (ESI) Study was implemented in 2019 with funding from the Institute of Education Sciences. Due to the onset of the COVID-19 pandemic, EIPs began having sessions with caregivers via WebEx. New EIPs were oriented virtually. Clinician-blinded developmental evaluations of participants resumed in July 2020, with revisions to administration of some measures. Use of video conferencing platforms, electronic surveys, and online resources allowed us to continue this study in the community despite pandemic restrictions to offer support to families of children with early signs of autism.

**Results:** Thirty-two EIPs were recruited to the study since January 2019. To date, 30 were enrolled in the study (i.e., 20 in ESI arm, 10 in BAU arm). Ten EIPs across groups withdrew from the study (33% attrition). Currently, 20 EIPs have recruited 39 families. Forty-seven screening home observations (HOBs) were completed (85% since COVID-19). Of the 47 screens, 39 enrolled in the study (90% since COVID-19). Intervention sessions transitioned to telehealth, totaling 374 sessions across arms (87.5% since COVID-19). EIP fidelity shows group differences of intervention fidelity scores (i.e., averages: BAU - 30%, ESI - 78%; fidelity is met at 80%). Evaluations restarted in July 2020 totaling 58 (93% since COVID-19).

**Conclusions:** The ESI Model was proposed as an in-home intervention, with EIPs coaching the parents to administer the intervention. The grant continues to see study participation grow despite the restructuring of various study processes. The number of EIPs recruited to the project exceeded the number anticipated and family recruitment continues. Fidelity differences across groups may indicate the telehealth platform is beneficial. The results of developmental progress in this population is to be determined due to the pandemic; however, we demonstrated a modified study continues to recruit and provide services in the community.

**502.008 (Virtual Poster)** Adapting PEERS® for Preschoolers for Telehealth: A Novel Remote Caregiver-Mediated Social Skills Intervention for Young Children with Social Challenges

**R. S. Factor, L. Glass, D. Baertschi and E. A. Laugeson, UCLA Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA**

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**Background:** By early childhood, social impairments are evident and associated with significant ramifications for children with autism spectrum disorder (ASD) and other developmental disorders. PEERS® for Preschoolers (P4P) was developed as an extension of the evidence-based social skills PEERS® program for children ages 4-6. P4P has had positive outcomes with large effect sizes. Due to COVID-19, there was reduced access to interventions for young children, when treatments moved to online delivery. The importance of providing this service for families prompted the translation of P4P to a caregiver-focused social skills-telehealth group.

**Objectives:** This study aims to investigate the translation, satisfaction, and initial findings of the novel telehealth caregiver-focused version of P4P, with the intention of improving social skills for young children with difficulty making and keeping friends.

**Methods:** Eleven caregivers of children (9 boys, 63.6% Caucasian; May projected  $n=21$ ) between 4-6 years ( $Mage=5.06$ ;  $SD=.701$ ) with social difficulties (81.8% ASD) participated in P4P telehealth groups (16 1.5 hour sessions once/week). Consistent with in-person P4P groups, children were required to have adequate expressive and receptive language. Caregivers were fluent in English and required to have access to telehealth. Children unable to participate in social coaching or playdates were excluded. Measures included a satisfaction survey (questions on a 5-point scale), the Parenting Stress Index, 4<sup>th</sup> Edition, Short Form (PSI-4-SF), the Social Responsiveness Scale, Second Edition (SRS-2), and the Quality of Play Questionnaire (QPQ). Descriptive analyses and pre/post comparisons were conducted. Data collection is ongoing.

**Results:** Almost all caregivers (90%, 9/10) were quite to somewhat satisfied with the group ( $\geq 20\%$  response options). All 10 caregivers found the distinct components (e.g., homework review, social skills, discussion) of the translated P4P to be somewhat to very helpful (100%,  $\geq 20\%$  response options). Additionally, 100% of caregivers reported improvement in confidence to coach their child in social skills as well as navigate social situations with other parents. Parental stress decreased upon completion of P4P (PSI-4-SF). Though the study was not powered to detect significant pre/post results, there were positive trends across almost all measures. On the QPQ there was a trend toward increase in invited playdates at own house  $t(7) = 1.19, p = .28, d=.29$ . Additionally, there was a correlation between invited playdates and total SRS-2 score post-P4P intervention ( $r = .71, p = .05$ ). There was a decrease in conflict scores during playdates  $t(7) = 1.59, p = .155, d=.56$  and decrease in social difficulties on the SRS-2,  $t(7) = .70, p = .59, d=.25$ . Finally, there was a significant correlation between caregiver confidence in their ability to social coach their child and their child's improvement in social skills ( $r = .73, p = .017$ ). Overall, 90% of caregivers reported a positive change in their child's social skills via survey.

**Conclusions:** We aimed to innovatively create and examine a caregiver-focused telehealth version of P4P. These preliminary results support the telehealth translation, especially regarding improving parental confidence. Future work will enable greater understanding and powered analyses for efficacy of the telehealth version and comparison to in-person P4P implementation.

**502.009 (Virtual Poster)** Examining Variability in Naturalistic Developmental Behavioral Intervention (NDBI) Strategy Use in Caregivers  
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**Background:**

Early NDBIs for ASD are often caregiver-mediated. Although caregivers play a critical role in the intervention process, research focused on caregiver characteristics and response to intervention has been limited. Thus, there is a clear need to examine variability in caregiver skills at intervention entry and the effects of early caregiver-mediated intervention on caregivers.

#### Objectives:

We aim to 1) examine varying profiles of NDBI strategy use in caregivers of young children with ASD at intervention entry based on a clustering analysis; and 2) examine how caregiver NDBI strategy use changes over the course of caregiver-mediated interventions.

#### Methods:

Data were drawn from 191 caregivers ( $M_{\text{age}}=34$  years,  $SD=6.49$ , 89% mothers, 49% with bachelor's degree/above) and their children ( $M_{\text{age}}=29.41$  months,  $SD=12.19$ ,  $n=152$  boys) who participated in randomized controlled trials of three different NDBIs. Caregiver-child play sessions were blindly coded to evaluate changes in child social communication (Brief Observation of Social Communication Change, BOSCC; Grzadzinski et al., 2016) and in caregiver strategy use (Measure of NDBI Strategy Implementation – Caregiver Change; MONSI-CC; Vibert et al., 2019), including subdomains of Environmental Set-up, Child-Guided Interactions, Active Teaching and Learning, Opportunities for Engagement, and Naturally Reinforcing and Scaffolding. Hierarchical clustering analysis with Ward's method was conducted to identify clusters based on z-scores of all MONSI subdomains at intervention entry. Group differences were examined with chi-square tests and ANOVAs, with Tukey HSD post-hoc analyses. Pre-post differences for MONSI-CC total/subdomain scores, and BOSCC Social Communication scores were compared at intervention entry and follow-up time points approximately 3 months after intervention-entry ( $n=155$ ) using paired sample  $t$ -tests. Alpha was set at .01 to account for multiple analyses.

#### Results:

Four caregiver strategy implementation profiles emerged based on scree plot analysis and agglomeration schedule (Fig.1): Limited implementation ( $n=36$ ), Emerging implementation ( $n=91$ ), Inconsistent implementation ( $n=14$ ), Consistent implementation ( $n=50$ ). The clusters did not differ for most caregiver demographics (race, age, education) or child factors (race, IQ, gender); however, there was a trend for caregiver gender with most fathers in the moderate group (80%;  $\chi^2(3) = 9.71$ ,  $p = .021$ ). Children of caregivers in Limited and Emerging implementation groups had less mature language,  $F(3,18)=8.92$ ,  $p<.001$ , social communication skills,  $F(3,187)=16.73$ ,  $p<.001$ , or were younger,  $F(3,187)=5.66$ ,  $p=.001$  than the inconsistent and consistent groups. Caregivers in the Limited  $t(19)=8.17$ ,  $p<.001$ ,  $d=1.83$ , and Emerging implementation  $t(41)=7.20$ ,  $p<.001$ ,  $d=1.11$  groups improved significantly in their overall strategy use across intervention (and in all subdomains). Children of caregivers in the Limited implementation group made significant gains in their social-communication across intervention  $t(19)=3.84$ ,  $p<.001$ ,  $d=.86$ .

#### Conclusions:

Levels of NDBI strategy use prior to intervention vary highly across caregivers, independent of most caregiver characteristics. Caregivers with Limited or Emerging overall strategy use had children who were younger. Children of caregivers in the Limited or Emerging strategy groups had less mature language and social-communication skills. Caregiver use of NDBI strategies improved significantly for those starting with fewer overall skills and their children also showed greatest improvements in social communication.

#### **502.010** (Virtual Poster) Preliminary Evidence for the Feasibility and Acceptability of Group-Based Telehealth Parent Coaching for Sleep Problems in Children with ASD

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**Background:** Sleep problems affect between 45 and 86% of children with ASD and have been associated with impaired social communication, increased affective and behavioral disorders, and increased restricted and repetitive behaviors that may interfere with learning and inclusion. Without effective intervention, these sleep problems can persist throughout childhood and into adolescence and adulthood for individuals with ASD. Accordingly, there is a critical need to identify effective and feasible interventions for sleep disorders in children with ASD. Prior studies have demonstrated improved child sleep using individual and group parent coaching to teach parents to deliver behavioral sleep interventions; however, there have been no studies on group parent coaching for sleep problems delivered via telehealth to date.

**Objectives:** Primary: To determine feasibility and acceptability of a group-based parent coaching intervention delivered via telehealth to improve sleep for children with sleep problems and ASD. Secondary: To evaluate preliminary evidence for improved sleep in children with ASD using actigraphy, sleep diaries, and the Children's Sleep Habits Questionnaire (CSHQ).

**Methods:** 6 families with children with ASD and sleep problems completed a sleep assessment consisting of 10 days of actigraphy and twice-daily sleep diaries, and the CSHQ pre- and post-intervention. Parents were assigned to groups according to child age (2-4 years; 5-8 years) and were coached on targeted behavioral interventions in a small-group format via videoconferencing once per week for 6 weeks. Coaching sessions covered an introduction to sleep, optimal sleep environment, building consistent sleep habits, strategies to address night and early morning wakings, and addressing bedtime resistance. Social validity was assessed post-intervention using a 10-item questionnaire with ratings on a 5-point scale.

**Results:** The intervention was well accepted by parents, with all items rated as agree-strongly agree (see Figure 1). Parents reported increased self-efficacy when dealing with their children's sleep problems, and satisfaction with the group-based telehealth model. Improvement was demonstrated on each family's primary sleep goal and on subscales in the CSHQ for all participants. 2 of 6 participants fell from the clinical to subclinical range for total sleep problems on the CSHQ.

**Conclusions:** This short-term, low-cost intervention package was feasible and highly acceptable to families. This approach shows promise for improving sleep for children with ASD. If future research is consistent with these findings, this model may improve access to effective, acceptable, and contextually appropriate interventions to improve sleep problems in children with ASD.

**502.011 (Virtual Poster)** The Prevalence of Background Noise during Electronic Versus Traditional Toy Play: A Study of Young Children with Autism and Their Parents

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**Background:** Over the past two decades, electronic toys—toys that talk, sing, and/or have flashing lights—have become increasingly prevalent compared to traditional (i.e., non-technologically enhanced) toys. Though electronic toys are commonly marketed as having developmental benefits for infants and young children (including those with autism), a growing body of research indicates that electronic toys decrease the quality of parent-child interactions. For example, parents of children with autism say less and provide less rich language input during electronic than traditional toy play, which may exacerbate the language and communication delays experienced by many young children with autism. Here, we consider another way in which electronic toys may decrease the quality of parent-child interactions: by creating high levels of background noise that interfere with children's ability to comprehend spoken language.

**Objectives:** To determine the extent to which background noise overlaps with parent utterances during traditional and electronic toy play.

**Methods:** Participants were 14 children with autism (2–4 years old) and their parents. Parent-child dyads participated in two, 10-minute play sessions—one with a traditional toy set and one with an electronic toy set (order counterbalanced across participants). Both toys sets included a barn with animals, shape sorter, vehicles, and a puzzle. Play sessions were video-recorded and transcribed using Systematic Analysis of Language Transcripts (SALT) software. Parent utterances were coded as occurring in the presence of background noise if they overlapped with child vocalizations, child speech, or electronic toy noises (speech and non-speech).

**Results:** The mean percentage of parent utterances with background noise was 17% during traditional toy play and 53% during electronic toy play. On average, background noise overlapped with 3 parent utterances per minute in the traditional toy condition (median = 3.36, *SD* = 1.95) and 9 parent utterances per minute in the electronic toy condition (median = 8.03, *SD* = 3.37). A Wilcoxon Signed Rank Test revealed that the number of parent utterances with competing background noise was significantly higher during the electronic condition than the traditional condition (*p* = .001).

**Conclusions:** Though electronic toys are commonly marketed as having developmental benefits, the current findings add to growing evidence that electronic toys decrease the quality of parent-child play interactions. In the current study, over half of the utterances that parents produced during electronic toy play occurred in the presence of background noise, compared to less than 20% during traditional toy play. Based on a large body of experimental research, the high rates of background noise produced during electronic toy play are likely to make it more difficult for children with autism to understand what their parents say. This is concerning because children with autism experience substantial challenges with spoken language comprehension even in the absence of background noise. Traditional toys may be preferable for creating high-quality parent-child interactions that support language development in young children with autism.

**502.012 (Virtual Poster)** Treatment Mechanism of the Who Caregiver Skills Training

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**Background:** The WHO Caregiver Skills Training (CST) is an open access caregiver-mediated intervention for children with neurodevelopmental disorders and delays. CST, consisting of 9 group sessions and 3 home visits over 3 months, is based on naturalistic-developmental-behavioral methodologies and has shown good feasibility of delivery and acceptability of intervention components to caregivers in several low- and high-income countries. In Italy it was delivered in public health settings with excellent feasibility and acceptability showing favorable effects on the dyadic fluency of the interaction, child non-verbal communication, caregiver skills, self-efficacy and stress.

**Objectives:** The objective of the study was to examine the mechanism of effect of CST. In line with the intervention's theory of change, participation in CST is expected to lead to an improvement in the child and dyad outcomes through an increase in the caregiver's skills supportive of the interaction.

**Methods:** The study was a randomized controlled trial of CST provided by health professionals in child neuropsychiatry services in Italy. 86 parents (77% mothers, age: *M* = 36.7 years, *SD* = 5.53) of children with ASD (78% male, age: *M* = 44.8 months, *SD* = 9.48) were randomized to CST (*n* = 43) or treatment as usual (*n* = 43). The primary outcomes, measured at baseline (T1), immediately at the end of the intervention (T2) and 3 months after the intervention (T3), are derived from coding of parent-child interaction with the Brief Observation of Social-Communication Change



(BOSCC) and the Joint Engagement Rating Inventory (JERI). The JERI yields the following constructs: Flow of interaction, Joint Engagement, Child Availability to Interact and Parent Skills Supportive of Interaction. Codings were performed with high levels of reliability by two raters blind to group allocation and time (JERI items: Cohen's Kappa range: .89–1; BOSCC Total Score: ICC = .92).

**Results:** Serial mediation analyses showed that parent skills (JERI Parent Skills Supportive of Interaction) in the CST group improved significantly more than in the TAU group at T2 and T3, and this in turn led to an overall improvement of all the child and dyad outcomes, as reflected in the significant total indirect effects for all outcomes measured at T3: BOSCC Total Score [-2.58 (SE=1.04)], JERI Flow of interaction [0.63 (SE=0.19)], Joint Engagement [1.15 (SE=0.33)], and Child Availability [1.37 (SE=0.42)]. The direct effect was not significant for any of the outcomes, and therefore the effect of the intervention appears to be fully mediated by changes in parent skills. The total effect of the intervention was, however, not significant for JERI Child Availability to Interact, Joint Engagement and BOSCC Total Score.

**Conclusions:** CST works, as hypothesized, through the improvement of the caregiver's ability to support interaction. The pattern of findings highlights the need to test strategies to improve the effectiveness of CST in public health settings, including identifying additional treatment mediators or moderators and testing whether increasing the intervention dosage or providing more tailored support to caregivers who struggle most with implementing the intervention strategies will lead to detectable changes in child joint engagement and communication.

**502.013 (Virtual Poster)** Longitudinal Predictive Association of Interaction Features and Response Trajectories in Autism Spectrum Disorder (ASD) Early Developmental Intervention.

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Background:

Studying interaction is becoming increasingly important in the context of ASD intervention. Research highlighted the need to understand predictors and process variables to explain the high interindividual variability observed in treatment response (Frost et al., 2020; Wetherby et al., 2018). Further, NDBI models of intervention foster the quality of child-therapist relationship and exchanges, as well as exploiting child motivation, shared pleasure and interpersonal synchrony (Vivanti et al., 2020). However, interaction features are still under-investigated, mainly due to the lack of objective, quantitative and scalable instruments. This translational effort could be important for both research and clinical practice (Dawson et al., 2019).

Objectives:

This study aims at investigating longitudinal predictive relationships between interaction features and treatment response in ASD early developmental intervention.

Methods:

N=26 preschool children (mean age=38.36 months; sd=10.36) with ASD were monitored from diagnosis and after one year of NDBI intervention. GMDS-R (Luiz et al., 2006) and ADOS-2 (Lord et al., 2012) were administered before and after. Learning Rates (LR, Klintwall et al., 2015) were used to measure the developmental trajectory over time. A quantitative observational coding system (Bertamini et al., 2021) was employed to annotate 20-min segments of 4 video-recorded sessions of intervention (1%, 25%, 50%, 99%), as well as the pre- and post- ADOS-2 social routines. A set of interaction descriptors was automatically extracted and a pipeline for model selection and evaluation by means of regularized random forests, repeated-CV, AIC/BIC/BF and LASSO was employed to predict the LR at one year using interaction features at 1% and 25%.

Results:

A preliminary analysis indicated significant changes in interaction dynamics over time. Interactions tended to progressively become more synchronous ( $p<0.001$ ;  $BF>100$ ), more engaging ( $p<0.001$ ;  $BF>100$ ) and last longer ( $p=0.01$ ;  $BF=4.7$ ). In addition, children responded more often to therapists' involving attempts ( $p<0.001$ ;  $BF=87$ ) and interrupted the exchanges less frequently ( $p=0.001$ ;  $BF=24$ ). Longitudinal models pointed out the importance of early interaction features, beyond children's baseline characteristics, for overall treatment response prediction ( $F(2,21)=4.51$ ;  $p=0.023$ ). A decrease in both (1) the latency between synchronous behaviors ( $b=-0.34$ ;  $p=0.076$ ) and (2) the proportion of child's interruptions ( $b=-0.41$ ;  $p=0.025$ ) were significant predictors of the LR, explained a significant proportion of variance ( $\text{adj-}r^2=0.23$ ;  $10\times\text{cv-}r^2=0.45$ ;  $\text{loocv-}r^2=0.14$ ;  $\text{MAE}=0.32$ ) and were associated with better outcomes at one year. The variation in child's withdrawal rate was negatively correlated with the LR ( $r=-0.43$ ;  $p=0.036$ ).

Conclusions:

The dynamics of interaction features in the first part of the intervention seems to be relevant for treatment response. The analysis will be extended to symptom severity. The ADOS-2 pre- and post- annotations will be included, together with the variation between the other mid time points and baseline children's variables in order to improve model accuracy. The results will be discussed in terms of clinical implications.

**502.014 (Virtual Poster)** Parent-Child Intervention Delivered during the COVID-19 Lockdown in Italy

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Background: Accessing services for children with ASD was particularly difficult during the lockdown imposed by the COVID-19 health emergency in Italy (Levante et al., 2021). One way of increasing access to intervention was to teach intervention strategies to parents.

Objectives: The first aim of this project was to adapt an existing evidence based intervention, the Parent-Early Start Denver Model (P-ESDM) (Rogers et al, 2012), combining in person and online delivery in order to increase access to treatment during the lockdown within an Italian community context. The second aim was to examine the progress of the children enrolled in the study. The third aim was to evaluate whether parents learned intervention strategies.

Methods: The P-ESDM was delivered to 12 young children with ASD, between 18 and 50 months of age, and their caregivers. Each family participating in the study received two 1-hour session per week of the treatment, delivered once per week in presence and once per week online, for 24 weeks. Social-communication behaviors were measured by the Brief Observation of Social Communication Change (BOSCC) (Lord et al., 2016). Learning of the therapy strategies in the parents was measured by the ESDM Parent Fidelity Measure (Rogers et al., 2012)

Results: Preliminary data indicated gains in social-communication behaviors in children as measured by the BOSCC. After 24 weeks of intervention the children demonstrated a statistically significant decrease in the BOSCC ( $t=2.0$ ;  $p=.02$ ). Parents learned the therapy strategies as demonstrated by improved scores in the fidelity measure at the end of the intervention. Acceptability of the program was very good as indicated by retention of all participants except for one who left the program due to relocation.

Conclusions: Our preliminary results suggest that the P-ESDM delivered in a parent-child context with an online component may be useful to teach intervention skills to parents and to increase social communication in young children with ASD within an Italian community setting.

## Interventions - Non-pharmacologic - School-Age, Adolescent, Adult

### PANEL — INTERVENTIONS - NON-PHARMACOLOGIC - SCHOOL-AGE, ADOLESCENT, ADULT

#### 215 - Comprehensive Transition Programs for Autistic Youth: Efficacy in Targeting Immediate Outcomes and Beyond

**Panel Chair:** Laura Klinger, *TEACCH Autism Program; Psychiatry, UNC TEACCH Autism Program, Chapel Hill, NC*

**Discussant:** Brett Nachman, *North Carolina State University, Raleigh, NC*

**215.001 (Panel)** Self-Determination and Adaptive Behavior Outcomes of an EF Intervention for Transition-Age Autistic Youth  
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Background: Greater self-determination (knowledge, efficacy, and abilities surrounding decision-making, problem-solving, goal-setting, and self-management), adaptive, and executive function (EF) skills have been associated with positive post-secondary outcomes in autistic adolescents. Self-determination, EF, and adaptive skills are essential to independent functioning, but are substantially impacted in autistic youth. This presentation utilizes data from a school-based randomized effectiveness trial of an executive function intervention, Unstuck & On Target: High School (UOT:HS) in improving self-determination, and examines the impact of self-determination on later adaptive skills. UOT:HS targets self-advocacy, flexible problem solving, planning, time management, and independent goal-setting across 25 1-hour lessons.

Objectives: 1) Examine change in self-determination as a result of UOT:HS, 2) Determine the relationship between self-determination skills and later adaptive functioning in autistic adolescents.

Methods:

Participants included 49 adolescent autistic teens (8 female) aged 14-20 ( $M=16.3$ ,  $SD=1.3$ ) with  $FSIQ \geq 80$  ( $M=105.8$ ,  $SD=14.7$ ), who met DSM-5 criteria for autism supported by the Social Communication Questionnaire and/or ADOS. Eight schools were randomized to UOT:HS ( $n=29$  students) or treatment as usual (TAU,  $n=20$  students) using a clustered, parallel clinical trial design masked to outcomes. Teens and parents completed the AIR Self-Determination Scale (AIR-SDS; Wolman et al., 1994), which produces a total score and the following subscales: "Things I Do" (self-determination skills) and opportunities to practice self-determined behaviors at home ("What Happens at Home") and at school ("What Happens at School"). Parents completed the Adaptive Behavior Assessment System Third Edition (ABAS-3). Multiple regressions tested: 1) the impact of UOT:HS on parent/youth AIR-SDS total scores at endpoint controlling for demographics and baseline score, and 2) the influence of baseline parent-reported AIR-SDS subscale scores above and beyond the intervention on later ABAS-3 Conceptual, Social, and Practical scores.

Results: Parent-report of their child's total AIR-SDS score improved more in UOT:HS compared to TAU (Table 1). Specifically, parents in UOT:HS reported greater improvement in opportunities to practice self-determined behavior at home ( $t=3.19$ ,  $p=0.003$ ) than TAU parents ( $F_{4,36}=14.20$ ,  $p<.001$ ). Baseline parent and child self-determination ratings were not correlated in either group, but endpoint informant ratings were significantly

correlated in the UOT:HS group only ( $r=.53^{**}$ ). Higher baseline opportunities for self-determination at home predicted better endpoint ABAS Conceptual and Practical skills (Table 2).

**Conclusions:** UOT:HS led to improvement in parent-reported (but not self-reported) self-determination skills (e.g., opportunities to practice self-determination at home) with parent- and student-report of skills aligning more over time only in the UOT:HS group. Parent-reported opportunities to practice self-determination at baseline were associated with greater adaptive scores at endpoint, above and beyond intervention effects. We will utilize thematic analysis of the open-ended AIR-SDS responses about goal types and progress to better understand differences in parent- and self-report across groups. Self-determination skills have been improved through targeted skill building in youth with broad developmental disability (Wehmeyer et al., 2010), and may offer a novel treatment target for enhancing adaptive skills and independent living in transition-age autistic youth.

**215.002 (Panel)** Supporting the Transition to Adulthood for Autistic Youth: Results of a Community-College Based Randomized Control Efficacy Study

**L. G. Klinger<sup>1</sup>, B. Tomaszewski<sup>2</sup>, N. Bagatell<sup>3</sup>, K. Bowman<sup>4</sup>, E. M. Lamarche<sup>5</sup>, M. L. Cook<sup>1</sup>, C. B. Klein<sup>2</sup>, S. A. Stahl<sup>3</sup> and G. M. Osborne<sup>2</sup>, (1)TEACCH Autism Program; Psychiatry, UNC TEACCH Autism Program, Chapel Hill, NC, (2)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC, (3)University of North Carolina at Chapel H, Chapel Hill, NC, (4)TEACCH Autism Program; Psychology & Neuroscience, University of North Carolina, Chapel Hill, NC, (5)TEACCH, University of North Carolina at Chapel Hill, Carrboro, NC**

**Background:** Current vocational rehabilitation (VR) services supporting the transition to adulthood for autistic individuals have been minimally effective (Alverson & Yamamoto, 2017). Lack of access to effective evidence-based practices has contributed to the poor quality of life experienced by many autistic adults, including those without co-occurring intellectual disability, evidenced by high rates of unemployment, failure to complete postsecondary education, and mental health comorbidities. The TEACCH School Transition to Employment and Post-secondary Education (T-STEP) program was designed as a VR Pre-Employment Transition Service targeting key skills associated with a successful transition to adulthood, including executive function, emotion regulation, and self-determination.

**Objectives:** Use a randomized control waitlist design to examine the efficacy of the T-STEP intervention in improving (1) executive function; (2) employment readiness; (3) self-determination; (4) adaptive behavior and (5) emotion regulation including depression, anxiety, and coping self-efficacy.

**Methods:** Participants were 92 autistic adolescents and young adults (24 female) aged 16-21 ( $M = 18.61$ ,  $SD = 1.23$ ) with  $FSIQ \geq 80$  ( $M=106.83$ ,  $SD=2.43$ ; range 80-157) served under the diagnostic category of autism through a high school IEP and/or met community college criteria for disability services. The 12-week T-STEP intervention was provided at two community colleges and included 48 hours of intervention: a 24-session twice weekly 1.5 hour class focused on self-determination (goal setting), executive function (organization, time management), social communication (asking for help, professional social skills), and emotion regulation skills (coping with distress, acceptance corrective feedback) and 12 counseling sessions focused on self-advocacy linking students to college supports including disability services, career counseling, and academic advising. Students were randomized to a fall semester T-STEP intervention or to a waitlist control group who received a spring semester intervention. During COVID-19, the T-STEP transitioned from onsite at the community college to a virtual intervention conducted via Zoom. See Table 1 for a list of measures completed at baseline and at the end of the fall semester.

**Results:** Patterns were similar across both onsite and virtual programs and are combined. Controlling for symptom severity, we examined Intervention Condition (T-STEP vs. Waitlist Control) by Time (Pre vs. Post-assessment during the fall semester). Compared to waitlist control students, students participating in the T-STEP demonstrated improvements in caregiver-reported BRIEF executive function abilities ( $F(1,77.2) = 7.47$ ,  $p = .008$ ) and self-determination on the AIR SDS ( $F(1, 79.5) = 5.72$ ,  $p=.02$ ; Figure 1). T-STEP students self-reported significant improvements in self-determination capacity on the AIR-SDS ( $F(1, 81.4) = 4.13$ ,  $p = .04$ , emotion coping skills on the Coping Self Efficacy Scale ( $F(1,76.4) = 6.78$ ,  $p = .01$ ; Figure 1), and decreased anxiety on the STAI ( $F(1,76.1) = 9.02$ ,  $p = .04$ ). No changes were noted in depression, adaptive behavior, or employment readiness.

**Conclusions:** Results support the efficacy of the T-STEP as a transition to adulthood intervention program that improves key areas associated with successful postsecondary outcomes. Specifically, the T-STEP program was associated with improvements in caregiver and student-reported self-determination, executive function, emotion regulation and coping skills, and anxiety. Future research is needed examining long-term adult outcomes including college completion and employment.

**215.003 (Panel)** Distal Outcomes for Autistic Individuals Completing a Community College-Based Intervention

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**Background:** There has been an increase in the literature on transition to adulthood programs for autistic adults without co-occurring intellectual disability. While these programs have demonstrated preliminary efficacy in increasing self-determination, executive function, student adjustment to college, and immediate employment outcomes (White et al., 2019; Baker-Erickson et al., 2018), these studies have not examined employment and postsecondary education beyond the immediate post-treatment time point. The current study examined follow-up outcomes 3-months after completing the virtual TEACCH School Transition to Employment and Post-Secondary Education program.

**Objectives:** The objectives of the current study were (1) to describe the employment and college outcomes for autistic adolescents and adults after a 3-month follow-up period from completing the virtual T-STEP intervention program, and (2) examine intervention effects that predict employment and college performance.

**Methods:** 45 autistic adolescents and young adults with average to above-average IQ (Mean = 107.54, SD = 15.12) completed the 12-week T-STEP program and completed 3-month follow-up assessments (Mean Age at start of intervention = 18.40 years, SD = 1.14, Range = 16-21). 61.4% of participants were male, 13.6% were Asian, 20.5% were Black, 4.5% were Hispanic or Latino, and 63.6% were White. At pre- and post-test, caregivers completed measures of workplace readiness using the Becker Workplace Adjustment Profile (BWAP-2), measuring four domains, Work Performance, Interpersonal Relations, Work Habits, and Cognitive Skills, and executive function using the Behavior Rating Inventory of Executive Function- Adult version (BRIEF-A). At the 3-month follow-up visit, autistic adolescents and young adults reported their postsecondary education and employment status. They completed the Student Adjustment to College Questionnaire (SACQ) if they were currently enrolled in postsecondary education (N=26). Descriptive statistics, chi-square analysis, nonparametric tests of correlation, and profile analyses were performed.

**Results:** At 3-month follow-up, 36 students were graduated from high school and 9 students were still enrolled in high school (See Table 1 for the secondary, postsecondary, and employment outcomes of the sample. Of those students who graduated high school, 79% were employed and/or attending college (See Figure 1). Autistic students who reported being in college full-time had the most significant increase in parent-reported BWAP-2 work habits and attitudes (measuring time management, daily living skills, motivation) from pre- to post-test during the T-STEP intervention compared to students in part-time college, students not attending college but graduated high school, and students still in high school. Parent-reported increases in work habits and attitudes during the T-STEP were also associated with higher self-reported college adjustment scores on the SACQ (Spearman's  $\rho = .46, p = .04$ ). Students working and in college had higher Social Adjustment scores on the SACQ (M=122.50, SD=6.95) than students not currently working (M= 111.93 SD=10.76).

**Conclusions:** A majority of students were employed or in postsecondary education 3-months following the end of the T-STEP. Improvements in time management, daily living skills, and motivation during the T-STEP program were predictive of better self-reported college adjustment scores. Focusing on these skills in transition-based interventions may lead to future long-term intervention effects. Research examining even longer-term outcomes (e.g., college graduation) is needed.

#### **215.004 (Panel) The Cross-Cultural Adaptability of Transition Program for Australian Autistic Youth: A Feasibility Study**

**B. Afsharnejad<sup>1</sup>, J. Tang<sup>2</sup>, S. Kasiraman<sup>3</sup>, U. Jonsson<sup>4</sup>, E. A. Lee<sup>5</sup>, S. Bolte<sup>6</sup> and S. J. Girdler<sup>7</sup>,** (1)Autism Research Team, Telethon Kids Institute, Perth, WA, Australia, (2)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (3)Curtin University, Bentley, WA, Australia, (4)Karolinska Institutet, Stockholm, Sweden, (5)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, WA, Australia, (6)Center of Neurodevelopmental Disorders (KIND), Centre for Psychiatry Research; Department of Women's and Children's Health, Karolinska Institutet, & Stockholm Health Care Services, Region Stockholm, Stockholm, Sweden, (7)School of Allied Health, Curtin University, Bentley, WA, Australia

**Background:** Transitioning to adulthood is a significant developmental milestone for youth, requiring prior planning and preparation. To date, there is a paucity of evidence-based transition programs that are tailored for autistic youth. TRANSITION© is a program developed in Sweden to support youth through this transitional journey. However, the cross-cultural feasibility and efficacy of the program in an Australian context remains unknown.

**Objectives:** This feasibility study investigated the cultural validity and acceptability of the TRANSITION© program in supporting autistic youth to increase their skills, independence, and confidence in navigating their major life areas, including employment, education, finance, health, housing, leisure and relationships

**Methods:** After translating the TRANSITION© manual from Swedish to English, the content was amended and co-produced with an autistic advisory group, improving the language and relevance of the content in the program. The modified program was then delivered to 21 autistic youth aged 16 to 25 years (age = 18.96 years; SD = 2.08; 86% male; IQ>70) over 8 two-hour group sessions and sixteen 30-minute individual sessions with health professionals from a community-based service provider. Due to the global pandemic in 2020, the program was adapted to an online format continuing via an online format after six face-to-face sessions. The cross-cultural feasibility and preliminary efficacy of the TRANSITION© program were evaluated using a mixed methodology design. Changes in participants' adaptive functioning, self-efficacy and mental health were assessed using a pretest-posttest design before and immediately after the program utilising a random-effects regression model (linear mixed model). Focus groups were then conducted with the participants, their parents and group facilitators exploring their opinion about the acceptability of the program.

**Results:** During the pandemic, 10 participants discontinued the study. Findings indicated that TRANSITION© had significantly improved the participants' functioning in the leisure, self-direction, and home living categories of ABAS-III ( $p < 0.05$ ), with the effect size (Cohen's  $d$ ) ranging from 0.7 to 0.71. Autistic youth, their parents and group facilitators all expressed satisfaction with the TRANSITION© program, even if they discontinued it, but suggested ideas to improve the program in relation to the relevance of some topics. Additionally, although appreciating the comprehensiveness of the program, believed they might not need to complete all domains. Also, most participants reported that they preferred the online sessions or had no preference, except two participants reported that they preferred the face-to-face sessions.

**Conclusions:** Findings indicate that TRANSITION© has the potential to improve Australian autistic youths' skills and independence in managing their everyday life areas while transitioning to adult life. The feasibility study finalised the modification of the TRANSITION© program, preparing it for efficacy evaluation via a randomised controlled trial.

## ORAL SESSION - 1B — INTERVENTIONS - NON-PHARMACOLOGIC - SCHOOL-AGE, ADOLESCENT, ADULT

### 307 - Novel Ways of Engaging the ASD Community with Behavioral Interventions for Youth and Adults

**307.001** (Oral) Improving Outcomes in Minority Children with Autism Spectrum Disorder Affected By the COVID-19 Pandemic through the Evaluation of a Telehealth Family-Mediated Intervention

**M. Nava Palma<sup>1</sup>**, J. Trayvick<sup>2</sup>, J. Beltran<sup>3</sup>, S. Barkley<sup>4</sup>, L. Tolentino Espinoza<sup>5</sup>, L. Mayo<sup>5</sup>, H. Morsbach Sweeney<sup>6</sup>, J. H. Foss-Feig<sup>4</sup> and M. P. Trelles<sup>4</sup>, (1)Psychiatry, Seaver Autism Center at the Icahn School of Medicine at Mount Sinai, New York City, NY, (2)Seaver Autism Center at the Icahn School of Medicine at Mount Sinai, New York, NY, (3)Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York City, NY, (4)Seaver Autism Center for Research and Treatment, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (5)Centro Ann Sullivan Peru (CASP), Lima, Peru, (6)Center Ann Sullivan International - CASI, Lawrence, KS

**Background:** Evidence-based interventions in ASD are successful at improving outcomes, but rely on frequent contact with a multidisciplinary team of professionals. The COVID-19 pandemic and requisite social distancing underscored the inherent limitations of these programs. Caregiver involvement has been recognized as an essential component to ASD treatment; however, models of care have failed to systematize caregiver involvement, with few studies quantifying its impact, leaving parents underprepared to manage challenging behaviors. In the aftermath of the COVID-19 pandemic, it has become essential to evaluate the feasibility of family-centered and caregiver-mediated interventions for individuals with ASD. One such program is the Functional Natural Curriculum (FNC), developed by the Centro Ann Sullivan del Peru (CASP). The FNC provides caregivers with the necessary tools to teach their children essential skills to promote independence, facilitate academic learning, and enable inclusion in all aspects of life.

**Objectives:** This project aimed to evaluate a 16-week virtual program, based on the FNC, developed and delivered by CASP, on child and caregiver outcomes, in a group of Latino children with ASD and their caregivers living in New York.

**Methods:** 13 families with children between the ages of 3 and 17 years were randomly assigned to the control group (n=8, M<sub>age</sub>=10.75, 3 females) or the intervention group (n=5, M<sub>age</sub>=10.6, 2 females). The Aberrant Behavior Checklist (ABC) was used to measure child behaviors along five domains: Irritability, Lethargy, Stereotypy, Hyperactivity, and Inappropriate Speech. The PROMIS Emotional Distress/Depression Scale was used to measure caregiver distress. Absolute difference in scores were calculated between baseline and follow up. Between group T tests were used to examine the difference scores in the intervention group compared to the control group.

**Results:** On the ABC, the intervention group's change scores were significantly greater than those in the control group for the Irritability domain ( $t(12.5)=-2.24, p=0.04$ ) and the Lethargy domain ( $t(13.4)=-3.54, p=0.003$ ). The intervention group trended toward greater change scores in comparison to the control group on the Hyperactivity domain ( $t(10.42)=-1.96, p=0.08$ ) with a large effect size ( $d=0.86$ ). There was no significant difference between control and intervention groups in the Inappropriate Speech and Stereotypy domains. The PROMIS Emotional Distress/Depression scale for caregivers showed a trend towards improvement ( $t(10.02)=-1.56, p=0.15$ ) with a moderate effect size ( $d=0.67$ ), though these results did not reach significance.

**Conclusions:** Our early findings identify promising trends in the improvement of child behavior and caregiver distress levels in the intervention group, suggesting that the CASP virtual program may offer an effective framework for improving outcomes among Latino children with ASD and their caregivers. Furthermore, large and moderate effect sizes speak to the importance of further study in a larger cohort. Together, these results demonstrate the utility of telehealth, family-centered interventions to promote the wellbeing of children with ASD whose services have been affected by the COVID-19 pandemic. The intervention also holds promise for other under-resourced communities with limited access to care on a routine basis.

**307.002** (Oral) A Pilot Feasibility Trial of Telehealth-Delivered Trauma-Focused Cognitive Behavioral Therapy (TF-CBT) for Autistic Youth  
**C. G. McDonnell<sup>1</sup>**, T. M. Andrzejewski<sup>1</sup>, E. A. DeLucia<sup>2</sup> and J. Dike<sup>3</sup>, (1)Department of Psychology, University of Wyoming, Laramie, WY, (2)Department of Psychology, Virginia Polytechnic Institute and State University, Blacksburg, VA, (3)Virginia Tech, Blacksburg, VA

**Background:**

Autistic youth disproportionately experience traumatic events and associated traumatic stress, including symptoms of posttraumatic stress disorder (PTSD) and co-occurring elevations in mood, anxiety, and externalizing behavioral concerns. However, strikingly little research has evaluated the effectiveness of evidence-based interventions for reducing traumatic stress among autistic youth, and unaddressed trauma may contribute to lifelong health disparities for autistic people. Thus, the development of evidence-based treatment approaches for trauma among autistic youth is an urgent research priority. Developing strategies that can be effectively delivered using remote telehealth technology is critical for expanding the reach of these services, in order to (1) ensure service delivery during ongoing COVID-related restrictions, and (2) provide access to youth and their families who experience other barriers to in-person treatment, especially because barriers to service access are common among youth victimized by trauma.

**Objectives:**

The goal of the present study is to determine whether trauma-focused cognitive behavioral therapy (TF-CBT), one of the leading evidence-based interventions for reducing traumatic stress among non-autistic youth, is also effective for autistic youth. In particular, we evaluated (1) whether TF-

CBT was associated with significant reductions in traumatic stress, mood, anxiety, and behavior problems, (2) whether potential reductions were maintained 1-month post treatment completion, and (3) youth and caregiver satisfaction with treatment.

#### Methods:

In this pilot study, 10 autistic youth (ages 10-17, who had also experienced trauma and who were reporting traumatic stress) and their caregivers received 12 weeks of individually-delivered TF-CBT via telehealth. Autism diagnoses were confirmed via remote observation (CARS-2<sup>Obs</sup>) and parent report (Social Communication Questionnaire). Traumatic stress symptoms were assessed via clinical interview (ADIS Parent and Child Versions) and child (self) and parent report on the Child and Adolescent Trauma Screen (CATS). Assessments also included depression (child/parent report on the Short Mood and Feelings Questionnaire), anxiety (child/parent report on the Screen for Anxiety Related Emotional Disorders), and externalizing behavior problems (parent report on the Strengths and Difficulties Questionnaire). Full assessments were re-completed at the end of treatment and again one month later. Youth and their parents reported on multiple domains of treatment satisfaction.

#### Results:

Overall, paired samples t-tests showed significant and large reductions from pre-post treatment in posttraumatic stress symptoms according to both youth and caregiver report. Depression, anxiety, and externalizing concerns also significantly dropped over the course of treatment. Critically, these improvements were maintained at one-month follow-up (see Table 1 for all pre-post analyses). Lastly, youth and their caregivers reported high levels of treatment satisfaction across multiple domains, including satisfaction with the telehealth technology (see Table 2).

#### Conclusions:

Telehealth-delivered TF-CBT is a promising intervention approach for autistic youth. This pilot study shows that TF-CBT is feasible and effective when delivered remotely. Significant reductions were observed from pre-post treatment in youth PTSD symptoms, depression and anxiety, and externalizing behavior concerns. The intervention had high rates of treatment involvement and satisfaction. Clinical considerations and telehealth resources will be discussed. Future directions for more rigorously evaluating TF-CBT for autistic youth will be considered.

### **307.003 (Oral)** A Randomized Controlled Study and Replication of Compass to Improve Individualized Educational Planning for Students on the Autism Spectrum in an Australian Context

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#### Background:

The Collaborative Model for Promoting Competence and Success (COMPASS; Ruble et al., 2012) is an evidence-based and collaborative framework for improving the quality of services and individualized outcomes for students on the autism spectrum within school contexts. During the last several decades, researchers have identified effective educational procedures for students on the autism spectrum, but minimal evidence exists to support the dissemination and widespread application of those interventions in community-based settings. COMPASS has shown effectiveness in improving individualized student growth and quality of individualized planning (IP) goals, increased teacher and student engagement, and strengthened parent/teacher alliance through three randomized controlled trials in the US; however, we were interested in the application in an educational context outside of the US.

#### Objectives:

The purpose of this study was to replicate COMPASS in an Australian context and to explore the application of COMPASS in a setting exclusively for students on the autism spectrum. The primary research question was: *Do teacher-child pairs who participate in COMPASS have better IP goal attainment for targeted objectives than that of teacher-child dyads who do not participate in COMPASS?*

#### Methods:

We used a randomized-controlled methodology to trial COMPASS with 91 participants. This included two groups (an intervention and control group) and three participant categories: consultants ( $n = 15$ ), teachers ( $n = 36$ ), and students ( $n = 40$ ). Consultants ( $M_{age} = 43.8$  years,  $SD_{age} = 6.2$ ) had been in a consulting role for an average of 6.9 years ( $SD = 4.4$ ). Teachers ( $M_{age} = 41.0$  years,  $SD_{age} = 9.9$ ) had been teaching for a mean of 15.4 years ( $SD = 9.9$ ). Students were formally diagnosed with autism and ranged in age from 5-18 years ( $M = 9.3$ ,  $SD = 3.2$ ). Further demographic data (e.g., autism severity for students, autism training for teachers and consultants, etc.) were collected. Goal attainment scaling was used to analyze progress on IP goals for each student along with a range of fidelity, adherence, satisfaction, and attitude measures. Data was collected during the 2021 school year across four primary time points.

#### Results:

At the time of the submission of this abstract, the final data collection point remained and additional results will be included in the final presentation. Preliminary results demonstrated that the intervention group resulted in significantly more growth on student IP objectives for the domain of communication ( $t(35) = 1.95, p < .001, d = 1.42$ ) and social skills ( $t(36) = 14.46, p < .001, d = 0.86$ ). There was a significant difference in the number of goals and quality of goals, as measured by three different quality indicators.

#### Conclusions:

Preliminary results demonstrated that the replication of COMPASS in an Australian context showed high rates of satisfaction and adherence. Most importantly, student goal attainment scores improved over time for both groups, but the intervention group demonstrated more growth than the control group. The success of this intervention in improving the quality growth of IP goals for students on the autism spectrum demonstrates the need for a standardized intervention that supports teachers in this critical practice.

#### **307.004** (Oral) Public Perceptions of ABA on Facebook: A Preliminary Snapshot

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**Background:** The neurodivergent movement and disagreement on what constitutes evidence of effectiveness between members of the autistic and research community have resulted in two polarized perspectives of applied behavior analysis (ABA). On the one hand, ABA is perceived as the most promising class of interventions available to improve outcomes for individuals with ASD; on the other hand, ABA is perceived as harmful and dehumanizing. As parents of newly diagnosed children often turn to social media platforms like Facebook to inform intervention decisions, understanding what is publicly written about ABA on these platforms is crucial information to the field.

**Objectives:** We conducted a preliminary qualitative study that examines what is said about ABA on public Facebook pages. Such examination may help to indicate how socially valid ABA is. This information is critical for maximizing the reach and effectiveness of ABA while addressing and minimizing its risks.

**Methods:** Four coders analyzed 257 posts about ABA from April 2019, 2020, and 2021 from 18 public Facebook pages on NVivo using the constant comparison method. Facebook as a platform and the pages selected were informed by five interviews with members of the ABA and autistic community (two mothers, one autistic adult, two practicing BCBAs). Posts from April were selected because of heightened activity on pages during Autism Awareness/Acceptance Month. Professional ASD (e.g., Autism Science Foundation) and ABA (e.g., Applied Behavior Analysis International) pages were excluded. Posts that marketed ABA services, training, conferences, and job postings were also excluded.

**Results:** Facebook posts revealed overwhelmingly negative perspectives of ABA. Prominent themes included:

1. Harm (use of harmful tactics [conversion and electric shock therapy, punishment, restraint] and resulting trauma/abuse [PTSD, compliance training, loss of autonomy];
2. Lack of support from both research and the autistic community;
3. Dehumanization (ABA's poor understanding of autistics and behavioral functions, fixing/normalizing autistic individuals as the goal of ABA); and
4. History (ABA's connection to Lovaas and animal studies).

Positive themes highlighted the use of helpful tactics and that ABA was life-changing.

**Conclusions:** Our preliminary examination of ABA posts on Facebook point to the importance of improving ABA public relations to address the field's dark history, association with Lovaas and harmful therapies, and the perception of "fixing" as the goal of treatment. More importantly, results underscore the need to proactively address the ABA experiences of autistic clients. Intentional research to examine experiences of abuse and trauma reported by clients and ongoing collection of social validity data when conducting intervention research are needed.

## POSTER SESSION — INTERVENTIONS - NON-PHARMACOLOGIC - SCHOOL-AGE, ADOLESCENT, ADULT

### 403 - Interventions - Non-pharmacologic - School-Age, Adolescent, Adult

#### **403.040** (Poster) Autism & Gender: A Pilot Study to the Effects of a Peer Support Group for Adolescents with Autism Spectrum Disorder and Gender Dysphoria

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#### Background:

There is a growing interest in the co-occurrence of Autism Spectrum Disorder (ASD) and gender dysphoria (GD). Research has shown that people with ASD show more gender variance than people without ASD. Due to the difficulties associated with ASD (limited social skills, problems in information processing and difficulty with change), regular GD treatment does not seem to be adequately equipped for this specific group.

## Objectives:

In this study we want to gain insight into the clinical needs of adolescents with ASD and GD and their parents in the Netherlands and we conduct a pilot study to the effects of a specific peer support group for adolescents with ASD and GD.

## Methods:

The Autism and Gender support group consists of nine monthly meetings for the adolescents, covering topics such as autism and gender-related needs, psychoeducation on medical interventions, environmental factors, gender expression and practicing gender presentation skills. Several experts by experience guest speakers visit during the meetings. Simultaneously, parents can follow two parent meetings. A pre-post-test design is used. Prior to the start and at the end of the support group, the adolescents fill out a number of short questionnaires, on quality of life, psychiatric problems, self-esteem, degree of autism symptoms, degree of gender dysphoria symptoms. In addition, the adolescents evaluate the support group during each meeting with the ORS and SRS and at the end with an evaluation form.

## Results:

In March 2019 we started a first support group with 12 adolescents with ASD and GD. The second group started in January 2020 with 9 adolescents, the third in September 2020 with 12 adolescents and the fourth (and final in this pilot study) group started March 2021 with 10 adolescents. Currently, baseline data is available for the first three groups (33 adolescents), giving the following results: The average age of the participating adolescents is over 17 years old and 56% was born as a boy and 44% as a girl. The vast majority have a Western background and are not religious. The vast majority (82%) of the adolescents with ASD follow individual treatment in addition to the ASD and Gender group, mostly focussing on comorbid problems, for instance depression and anxiety. About a third also receive Autism specific counselling/coaching in their daily life. Until now, we have a low dropout; only 17.6% dropped out of the peer support group early. We will analyse the rest of the data in the following months.

## Conclusions:

At the start of the pilot study we were unsure whether we were able to find +/- 30 adolescents with ASD and GD to fill up three rounds of the peer support group, but during the study, we received so many applications that we have added a fourth group (and currently have a waiting list). This experience emphasizes the importance of developing specialized treatment options (and additional research) for this target group.

## **403.041 (Poster) Autistic Experiences and Perspectives on Dating and Romantic Relationships: Towards an Inclusive Dating Social Skills Program for Autistic Adults**

**A. Arias and T. W. Vernon, University of California, Santa Barbara, Santa Barbara, CA**

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**Background:** There is growing evidence that group social skills interventions can be efficacious for teaching social skills and increasing friendships for autistic adolescents and adults (Laugeson et al., 2012; McVey et al., 2016; Vernon et al., 2018). Recently, more attention has been focused on understanding the romantic relationship dating experiences and challenges of autistic individuals, with emerging evidence of less frequent dating/relationships and lower sexual knowledge than their neurotypical counterparts (Dewinter et al., 2017; Weiss et al., 2018). However, only one study has examined a dating-related program adapted for autistic adults to target dating skills and romantic relationship outcomes (Cunningham et al., 2016). Furthermore, no known studies have co-developed their dating curriculum with input from autistic adult community and as a result, existing programs may not address their unique strengths and challenges.

**Objectives:** The present study sought to understand the dating and romantic relationship experiences and challenges of autistic individuals, as well as their interest in topics to be covered in a future group socialization intervention focused on dating and romantic relationships.

**Methods:** Data collection of the sample comprised of 159 autistic adults who completed an online survey. Participants were recruited using a variety of social media posts and listservs. The survey queried participant demographics, previous romantic relationships and experience in those relationships, what participants are seeking in dating/romantic relationships, prior challenges in initiating and maintaining relationships, and what they would like to see in a future social skill program focused on dating. For the present study, we analyzed data from an open-ended item that assessed prior challenges in dating and helpful topics to include in the aforementioned future program, examined the level of knowledge reported on several dating skills, and conducted a descriptive analysis of endorsed qualities desirable of a relationship and of a romantic partner. A thematic content analysis (TCA) of the responses to the open-ended item will be conducted for the open-ended data.

**Results:** Preliminary results of the TCA revealed common themes of security/stability, trust, love, common interests, understanding, and intellectual bonding as characteristics sought in a romantic relationship. When asked about challenges related to initiating and maintaining romantic relationships, dealing with compromise/disagreements, finding common ground, building rapport and trust, using effective communication, and maintaining a relationship beyond initial infatuation emerged as central themes. Finally, common themes endorsed for topics to include in a future dating social skill program included: (a) consent; (b) communication of needs (particularly during time of distress) 3) interpreting social cues and understanding intention ; 4) flirting behaviors; 5) neurodiversity awareness and disclosure while dating.

**Conclusions:** This study provides insight into the unique needs and considerations of autistic adults who are pursuing romantic relationships. Understanding autistic experiences and integrating their input into a future dating skills program ensures that the resulting curriculum aligns with their priorities and relationship expectations .



**Background:** The prevalence of challenging behavior is especially pronounced in children with autism (Maskey et al., 2013). These behaviors are typically associated with increased family isolation, parental stress, and interference with education and interventional programming. Therefore, families with children on the autism spectrum are in desperate need of accessible and affordable, high-quality evidence-based treatments that simultaneously target disruptive behaviors and are congruent with busy family schedules. Parent Child Interaction Therapy (PCIT), one of the most supported evidence-based interventions for defiance (Greco et al., 2001), has shown promising results for families of autistic children (Parlade et al., 2020). Furthermore, recent PCIT adaptations suggest more intensive and time-limited approaches can yield promising gains and address historic barriers to treatment engagement (Graziano et al., 2020).

**Objectives:** To assess the effectiveness and feasibility of an intensive PCIT program delivered remotely to parents of children with autism.

**Methods:** The current study followed a rigorous non-concurrent multiple baseline experimental design across 3 subjects (ages 4:7, 5:0 and 3:6). The selection criteria included (a) a child chronological age of 2 -5, (b) participating caregiver being the primary caregiver (c) a formal diagnosis of autism (d) child disruptive behavior scores as measured by Intensity Scale of the Eyberg Child Behavior Inventory (ECBI) being 131 or above. Participants were randomly assigned to complete 4, 6 or 8 baseline sessions, during which a five-minute video was systematically coded for parents' use of PCIT skills. Participants also completed a series of online assessment batteries, which included parent-reported measures of child disruptive behaviors and adaptive functioning. These batteries were completed at four different time points: intake, mid-treatment, post treatment and 1-month follow-up. All participants received a two-week, 10-session Intensive PCIT treatment course delivered by trained PCIT clinicians through an online video-conferencing platform.

**Results:** Parent's use of PCIT skills remained relatively low during baseline sessions for all 3 participants, with a mean of 3.33 (SD = 2.1) and a range of 0 to 7 observed PCIT skills. During the CDI and PDI phase, positive parenting behavior increased across all three families. At post-treatment, a mean of 32.33 (SD = 9.29) PCIT skills were observed (Cohen's d effect size = 4.30, indicative of a large treatment effect), suggesting a high level of skill use when compared to the proposed proficiency level of 30. These numbers were maintained at the 1-month follow-up, with an average of 29.33 (SD = 9.05) skills observed. ECBI intensity pre-treatment scores fell in the clinical range (>131)(M = 178.66; SD = 6.66). Post-treatment scores fell below the clinical cutoff (M= 124; SD = 22.11, Cohen's d = 3.34) and follow up scores were markedly lower (M= 114.33; SD = 15.95, Cohen's d = 5.26).

**Conclusions:** Results from this study provide support for the functional relationship between exposure to a time-limited and intensive PCIT program and significant improvements in parent PCIT mastery and child behavior challenges. This study highlights a promising intervention approach that could maximize treatment accessibility and retention, while effectively promoting adaptive parenting skills.

**403.043** (Poster) Community-Informed Development and Pilot of the Emotion Awareness and Skills Enhancement Team-Based Program (EASE-Teams)

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**Background:**

Emotion dysregulation (ED), difficulty managing the intensity and duration of emotional reactions, is highly prevalent among autistic individuals across the lifespan <sup>1,2</sup>. Research suggests that autistic individuals, with and without intellectual disability, are predisposed to ED and it is a transdiagnostic mechanism that underlies co-occurring psychiatric conditions and suicidality in autism <sup>3-7</sup>. Despite this, psychosocial treatments for ED are lacking for autistic individuals, especially those with limited cognitive and verbal abilities <sup>8</sup>.

Mindfulness-based interventions offer a promising approach to target ED while remaining flexible to the heterogeneous needs across autistic individuals,<sup>9</sup> as meditation practices are easily individualized for varied cognitive and verbal needs.<sup>10</sup> The Emotion Awareness and Skills Enhancement (EASE) program was the first mindfulness-based intervention designed to target ED in autistic adolescents without intellectual disability (ages 12-17). The EASE pilot established feasibility, acceptability, and preliminary efficacy of improving ED ( $d=0.67-2.64$ ).<sup>11</sup>

**Objectives:**

The objective of this study was to adapt EASE for autistic individuals (ages 7-25) with and without co-occurring intellectual disability.

**Methods:**

Over three iterative, adaptation phases, we: 1) elicited stakeholder input to adapt EASE for autistic individuals with intellectual disability; 2) redesigned the adapted manual and expanded the target age range following a small "micro-trial" with a sample of autistic adolescents and adults with intellectual disability (n=6); and 3) demonstrated feasibility and acceptability of a caregiver-client team-based approach (EASE-Teams) in a sample of 10 autistic individuals with and without intellectual disability (ages 7-25) and their caregivers.

## Results:

We learned from conversations with community members and micro-trial participants that ED is a family process, warranting a team-based approach to improve ED where participant and caregiver work together to learn and practice new skills in session and at home (See Figure 1 for treatment details, which will be presented with the stakeholder-informed adaptation process in further detail). Ten pilot participants completed the treatment with 100% adherence. We found a high degree of caregiver involvement ( $M = 3.84$ ;  $SD = 0.41$  on a 1-4 scale) and participant involvement ( $M = 3.57$ ,  $SD = 0.66$ ) in each session. Most caregivers indicated that their child used mindfulness strategies *mostly every day* and they used the strategies *mostly every day*, suggesting excellent engagement in the team-based approach. EASE-Teams was acceptable ( $M = 4.8$ ,  $SD = 0.63$  on a 1-5 scale) and helpful ( $M = 4.5$ ,  $SD = 0.71$  on a 1-5 scale) to families. Statistically significant improvements were noted in participant ED ( $p < .001$ ;  $n = 10$ ), anxiety ( $p = .01$ ) and depression symptoms ( $p = .007$ ), and caregiver stress from their child's dysregulation ( $p = .01$ ). In a semi-structured exit interview, one caregiver emphasized the impact of the treatment in his daughter, stating: "Beforehand she felt 'I don't know what's happening to me' [...] now I feel like she goes 'okay, this is how I am expressing emotions and it's okay.'"

## Conclusions:

Results of this study suggest that this community-informed treatment, EASE-Teams, is acceptable and feasible for a wide range of developmental and cognitive needs. Future research to establish efficacy and refine EASE-Teams for delivery by community-based providers is needed.

### **403.044** (Poster) Effect of Daily Exercise on Body Composition of Adolescents with ASD

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## Background:

The prevalence of obesity in children with ASD is higher than in the general pediatric population and is related to unusual dietary preferences, noncompliant behavior, decreased exercise, social isolation, and medication side effects. Body mass index generally remains stable or worsens as children with ASD get older.

**Objectives:** To examine the effects of a mandatory daily exercise program on body composition of adolescents with ASD.

## Methods:

We conducted a 12-month, repeated-measures intervention study of adolescents with ASD ( $n = 29$ ), examining compliance with exercise participation and changes in BMI. Multiple strategies were used to encourage participation in the exercise program.

## Results:

Compliance with exercise participation was strong and significant improvements were seen in BMI.

## Conclusions:

Findings suggest that mandatory daily physical exercise can be successful in adolescents with ASD and contributes to improvements in body composition.

### **403.045** (Poster) Elaborative Reminiscence: A Feasible and Acceptable Intervention for Autistic Children

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**Background:** A growing body of research with typically developing children has reported significant, beneficial effects of training parents to use an "elaborative reminiscence" (ER) communication technique on a range of cognitive and communicative children's outcomes that are known areas of difficulty in autism (Waters et al. 2019, Salmon & Reese, 2016). These findings have prompted speculation that ER could be a beneficial intervention for autistic children (McDonnell, Valentino & Diehl, 2017). However, no randomised trials have yet evaluated whether ER is a feasible or acceptable intervention for this population.

**Objectives:** This study aimed to assess the feasibility and acceptability of training parents to use an ER intervention with their child. A two-arm, double-blind randomised controlled pilot trial was evaluated for the feasibility of trial procedures, training receipt and enactment, implementation fidelity and intervention acceptability for caregivers.

**Methods:** Thirty-six parents and children were recruited. Children were non-intellectually disabled and aged 7-11 years with a formal diagnosis of autism. Participants were randomly assigned to receive training in either ER or an active control intervention ("present tense talk"; PTT) and

instructed to use the intervention for 20 weeks, 6 out of 7 days each week for 5 minutes. Parents were asked to log their progress. Children were tested pre- and post-intervention for memory (CVLT-C: Delis et al., 1994), self-concept (SDQ-I; Marsh, H. W, 1992) and mental state understanding (Theory of Mind Battery: Peterson & Wellman, 2019; Abell, Happe & Frith, 2000). Trial procedures were evaluated for measure appropriateness, participant recruitment and retention. Parent-child conversations (recorded at baseline, week 1 and week 20) were transcribed and coded for parent conversation style (manual adapted from Reese & Newcombe, 2007) to assess training and intervention adherence. Parent logbooks examined implementation fidelity by comparing participants' actual vs prescribed dosage and frequency of intervention delivery. Intervention acceptability was evaluated by descriptively analysing quantitative data from caregiver surveys (administered at 10 and 20 weeks) and qualitatively analysing post-trial feedback interviews with ER participants using deductive thematic analysis.

**Results:** Preliminary analysis of interviews found most parents reported feeling that intervention benefits outweighed the costs. Preliminary analysis of parent logbooks suggests that 81% of intervention conversations adhered to the recommended dosage of 5 minutes or more. ER parents described 65% of conversations as requiring "almost no effort". Child and parent enjoyment of ER was rated as 4 or 5 (out of 5) for 85% and 75% of conversations, respectively. However, post-trial interviews indicated that dosage and logging procedures were causes of burden and negative attitude.

**Conclusions:** Preliminary analysis suggests that training parents to use ER could be both a feasible and acceptable intervention for parents of autistic children, especially if the dosage and logbook format are amended. We also predict that lowering these burdens would improve the retention rate for a larger-scale study. Even these preliminary findings support the development of a future fully-powered randomised controlled trial into the use of ER as a parenting intervention with autistic children.

#### **403.046 (Poster)** Evaluating Race As a Predictor of Treatment Gains in the UCLA PEERS® for Young Adults Program

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**Background:** Autistic young adults are more likely than neurotypical adults to experience social difficulties and loneliness (Ee et al., 2019), highlighting a need for effective and accessible social skills treatments for this population. Unfortunately, documented racial disparities indicate that autistic people of color (POC) experience less favorable outcomes in the transition to adulthood and are less likely than their White peers to receive supportive services at this critical developmental juncture (Eilenberg et al., 2019). However, less is known about racial disparities in the effectiveness of interventions for those on the spectrum (Smith et al., 2020). Given adverse outcomes in young adulthood, it is essential to ensure that all autistic individuals, regardless of race, benefit from available interventions. Though one previous study revealed no differences by race in treatment response following the Program for the Education and Enrichment of Relational Skills (PEERS®) for Adolescents intervention (Egbunu et al., 2016), this has yet to be examined in the PEERS® for Young Adults program (Laugeson et al., 2015), one of the few evidence-based social skills interventions for this age group.

**Objectives:** This study explores whether differences in treatment gains following the PEERS® for Young Adults intervention exist between autistic participants of color as compared to autistic White participants. Given null findings for the PEERS® for Adolescents program, we hypothesized no significant group differences in treatment gains between POC and White autistic young adults.

**Methods:** Participants included 87 young adults (81.6% male;  $M_{age}=22.7$ ,  $SD=3.9$ ) with pre-existing autism diagnoses who completed the PEERS® for Young Adults program. Per caregiver-report, 32.2% of participants were POC, while 67.8% were White. Treatment gains were assessed on the Social Skills domain of the Social Skills Improvement System (SSIS-SS; Gresham & Elliott, 2008), Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012), caregiver- and self-reported Quality of Socialization Questionnaire (QSQ; Adapted from Frankel et al., 2010), and Test of Young Adult Social Skills Knowledge (TYASSK; Laugeson & Frankel, 2010). Independent samples t-tests were utilized to compare the treatment response of POC and White participants on outcomes.

**Results:** On average, young adults significantly improved on all outcomes following PEERS® for Young Adults, with no significant differences between POC and White participants on SSIS-SS,  $t(74)=1.31$ ,  $p>.05$ , or SRS-2 change scores,  $t(76)=-1.63$ ,  $p>.05$ . Similarly, analysis of TYASSK change scores revealed no significant differences between groups,  $t(75)=0.12$ ,  $p>.05$ . Finally, both POC and White young adults increased their number of get-togethers, with no significant differences observed for either caregiver-report,  $t(76)=0.70$ ,  $p>.05$ , or self-report,  $t(69)=1.70$ ,  $p>.05$ .

**Conclusions:** Findings suggest no significant differences in treatment gains between POC and White participants presenting for social skills treatment, as observed across all scales. These results further support that the PEERS® intervention similarly benefits POC and White autistic young adults. Future studies might examine the impact of cultural and socioeconomic factors on treatment efficacy to ensure inclusivity and equity in interventions for autistic adults.

#### **403.047 (Poster)** Evidence-Based Review of the Parent-Implemented Video-Based Intervention to Teach Life Skills to Autistic Children

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**Background:** Independent functioning in daily life is an ultimate goal of education for autistic children as they grow into adults. Video-based intervention (VBI) can be used to further increase independent functioning and shift the instruction and prompting from the adult to the child. Prior literature on using a VBI to teach functional and independent living skills to autistic students have been conducted in school settings with the researcher as the interventionist.

**Objectives:** The purpose of this study was to empirically evaluate and synthesize the evidence base for using parent-implemented VBI to teach independent living to autistic children in home settings. We analyzed (1) the components of effective parent-implemented VBI studies, (2) the types and components of parent training methods in a parent-implemented VBI studies, (3) the effects of a parent-implemented VBI on the acquisition of

life skills among autistic children with a culminating aim of determining whether a parent-implemented VBI be classified as an evidence-based practice (EBP) to teach life skills to autistic children in home environments.

**Methods:** A systematic search of the literature yielded nine studies that met the inclusion criteria. These studies were published between 2010 and 2021. We coded and synthesized studies for certain elements of the VBI and parent training methods to create and implement these interventions, types of skills, settings, supplemental support strategies, and child and parent demographics. We then evaluated studies to determine the strength of the evidence base using the Reichow et al. (2008) evaluative method. Finally, we evaluated the studies per What Works Clearinghouse (WWC) design standards. We calculated cumulative effects using the Tau-*U* effect size measure.

**Results:** Parent-implemented VBI can be effective in improving independent living skill acquisition of autistic children in authentic environments. We found that when provided with appropriate training, parents can effectively create and implement VBI with high fidelity. The variation in child and parent characteristics, age ranges and characteristics of autism (2- to 17.1-year-old children), parental age ranges and backgrounds (18–54 years old with varying levels of education and some diversity in racial and ethnic backgrounds), parent training methods, and skill types across studies existed. Within the types of VBI, a variety of models, including parents, researchers, siblings, same-age peers and self-models were used in the form video modeling, video self-modeling, or video prompting. Seven of the nine studies met WWC design standards with or without reservations, six had a 100% success estimate and a strong effect size score per Tau-*U* method ( $d^3$  0.93). Parent-implemented VBI meets the criteria to be considered as a probable EBP.

**Conclusions:** The findings indicate that parent implemented VBI can be effective in improving skill acquisition of autistic children in home environments. Parent-implemented VBI can be classified as a probable EBP to teach life skills to autistic children. Findings also revealed that VBI can be used to create culturally and linguistically appropriate instruction and provide visual modeling using everyday technology, which makes it socially valid and accessible to parents and children from diverse cultural backgrounds as evident from the included studies.

#### **403.048** (Poster) Technology-Based Interventions to Teach STEM Skills to Autistic Students

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**Background:** Technology-based interventions can be effective in teaching a variety of skills to autistic students. When it comes to teaching science, technology, engineering, and mathematics (STEM) skills to autistic students using technology-based interventions, the literature that examines the evidence-base along with features of effective technology-based interventions specifically for autistic students, is lacking. Existing evaluations of evidence are either narrative in nature or focused on students with developmental disabilities.

**Objectives:** The purpose of this evidence-based systematic review was to evaluate the evidence of effectiveness for technology-based interventions to teach STEM content knowledge and skills to K–12 autistic students. Our aims were to (1) analyze (a) the effects and (b) components of technology-based interventions in teaching STEM content knowledge and skills to autistic students, and (2) to evaluate the evidence-base of technology-based interventions.

**Methods:** A systematic search of literature yielded 20 peer-reviewed articles published between 2012 and 2021 that met the inclusion criteria for the study. We coded and synthesized the studies for the types and characteristics of technology-based interventions, STEM content, participant and interventionist characteristics, and design characteristics. We evaluated the included studies per What Works Clearinghouse (WWC) design standards and the Reichow et al. (2008) evaluative method to determine the level of evidence to classify a practice as an evidence-based practice specific to autism research. We also calculated the effect size to analyze the quantitative effects.

**Results:** Fifty-nine autistic participants, ages 5–21, were included across the 20 studies. Studies used a variety of technology-based interventions, including video-based intervention ( $n=10$ ), virtual manipulatives ( $n=7$ ), computer-assisted instruction ( $n=2$ ), and e-texts ( $n=1$ ). Most studies also included behavioral supports such as, self-monitoring checklists, least-to-most prompting, and corrective feedback. Seventeen studies focused on math skills and three studies on science skills. Specific skills included science vocabulary and concept application, single and multi-digit addition and subtraction, number comparison, fractions, word problems, and functional mathematics skills, such as price comparison, recipe adjustment, and tip calculation. Only four studies included an authentic agent as the interventionist (e.g., teacher, therapist, paraprofessional). Seventeen studies met WWC design standards with or without reservations. Using the Reichow et al. (2008) evaluative method, we determined that technology-based interventions for teaching STEM skills to K–12 autistic students can be classified as an established evidence-based practice.

**Conclusions:** Technology-based interventions can be effective in teaching STEM skills to autistic students, however, the majority of studies used technology to teach mathematics skills. Future studies may need to examine the use of technology-based intervention in teaching other aspects of STEM skills. Further examination of training practitioners to implement a variety of technology-based interventions and their effects on student learning is necessary.

#### **403.049** (Poster) Feasibility of Implementing a Virtual Reality Police Safety Intervention Via Teletherapy

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**Background:** One fifth of adolescents with ASD will be stopped and questioned by police before their early twenties (Rava et al., 2016). Providing opportunities to practice this kind of encounter is essential because police interactions are challenging, unexpected, include unusual sensory

stimulation, require novel problem solving, and necessitate rapidly processing social situations in real time (Channon et al., 2001; Salerno-Ferraro & Schuller, 2020; Vanmarcke et al., 2016). The COVID-19 pandemic has exacerbated depression and anxiety among autistic people (Oomen et al., 2021) and rendered it near-impossible to safely implement in-person behavioral interventions. In this study, we describe how a virtual reality (VR) intervention was quickly adapted to be administered via video conference, thus providing individuals across the USA an opportunity to practice interacting with police officers in a safe, simulated environment.

**Objectives:** Describe how the Floreo Police Safety VR intervention was implemented via teletherapy and provide preliminary evidence for the feasibility of this approach with autistic adolescents and adults.

**Methods:** Participants completed a telephone screening interview and video-conferenced IQ test, and were then randomly assigned to a treatment-as-usual (TAU) group or intervention group. All participants were mailed a headset to keep, and an iPhone equipped with the Floreo app, which study staff controlled remotely using a paired iPad. Participants in the intervention condition joined three 1-hour teletherapy intervention sessions with study staff (via WebEx), each separated by approximately 1 week. VR lessons consisted of multiple short interactions with virtual police officers, during which participants were simultaneously coached by study staff to practice skills including self-disclosure of an autism diagnosis, eye contact, and following directions. All participants underwent three VR-based assessments of virtual police officer interactions and completed online surveys about their knowledge of and experiences with police at each timepoint. Assessments and the viewfinder inside the VR were recorded. The final sample will consist of 48 participants (24 in each condition), with pre-/post-assessments and a follow-up assessment all evaluating key skills.

**Results:** Implementing a fully virtual VR intervention during a pandemic is logistically challenging, but resulted in a sample with greater geographic diversity than prior in-person iterations (McCleery et al., 2020). To date, 36 autistic individuals from 9 states have participated, with 92% success in data collection. Data loss occurred due to internet connection issues or technological difficulties. In two instances, WebEx glitched and assessment recordings were not correctly exported. In another instance, a participant's internet severely affected recording video quality. Participants contributed valuable feedback on both the intervention and the video-conferenced format.

**Conclusions:** VR holds potential as a comfortable and motivating platform for autistic people to safely practice interacting with police officers. The remote administration of this intervention was successful in reaching a geographically diverse cohort and in collecting usable, rich data on intervention efficacy. Future directions include behaviorally coding teletherapy sessions for a complete sample of 48 participants.

#### **403.050 (Poster)** Generalization of Playground Social Skills Interventions and Identifying Potential Active Ingredients on Social Network Outcomes for School Aged Children with ASD

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**Background:** Autistic children are increasingly included in general education classrooms, and parents and teachers highlight the need for school interventions aimed at helping children socially connect to their peers. Several social skills interventions developed for school settings have demonstrated improvements in social outcomes, although the outcomes are often limited and effect sizes small. A goal of many interventions is to increase the connections between children but the mechanism underlying why the intervention succeeds at this outcome is often unexplored.

**Objectives:** This study aims to evaluate the intervention mechanism for increases in peer connectedness as the result of playground situated peer interaction interventions at school.

**Methods:** 140 children with ASD were drawn from two randomized intervention studies (Study 1: n=60; Study 2: n=120). Children were recruited from three school districts, aged 5-12 years old, predominately male (91.7%), ethnically diverse (64% non-white) and grades K-5<sup>th</sup>.

Both studies were delivered in the schools during recess. Each study applied a peer mediated intervention during recess compared to treatment as usual.

#### *Measures:*

The Playground Observation of Peer Engagement is an interval coding system that identifies durations of joint engagement with peers to solitary play (isolated from peers).

The Friendship Survey is a questionnaire used to assess children's friendships and social networks of peer relationships in the general education classroom. The survey yields social network variables of involvement in classroom (social network centrality-SNC: 0=isolated, 1=peripheral, 2=secondary, 3=nuclear), number of friends nominated (i.e. out-degrees), and connectivity (number of significant connections with classmates).

All measures are collected at pre and post intervention (after 6-8 weeks).

#### **Results:**

Regression models (i.e. generalized linear mixed models and linear models) were utilized to evaluate the effect of the intervention on social network outcomes from pre to post intervention and to determine the association between playground engagement with social network outcomes while controlling for study effects.

There were significant intervention effects for SNC ( $F(1,127)=6.82, p=0.01$ ) and out-degrees ( $F(1,127)=5.96, p=0.016$ ) where children who received PSS intervention had increased odds of having higher SNC and greater out-degrees from pre to post intervention compared to children in treatment as usual group. In addition, increased joint engagement on the playground at exit was significantly associated with increased connectivity in the classroom at exit ( $F(1,126)=4.28, p=0.04$ ), but not significantly associated with out-degrees ( $F(1,126)=0.32, p=0.57$ ).

**Conclusions:** These results suggest that increases in peer connections results from improvements of joint engagement with peers on the playground. These findings highlight the need to target joint engagement at school in order to foster stronger connections between children with ASD and their peers.

**403.051 (Poster) Group Selfi: Preliminary Results from an RCT of a Social Media Skills Group Intervention**

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**Background:** About 82% of autistic individuals report using social media, a rate similar to neurotypical peers (Ward et al., 2018). Autistic adults that use social media self-report closer friendships and higher friendship quality than those that do not socialize online (van Schalkwyk, 2017). While there are many benefits to having an active social media presence, difficulty adhering to social expectations has been associated with higher rates of cyberbullying and online harassment (Loomes, 2017). Considering that autistic individuals are more likely to engage in inappropriate behavior online (Spain and Blainey, 2015), it is important to understand how to support their online experience. The SELF program was developed to support autistic adults interested in developing and maintaining relationships using social media.

**Objectives:** The objectives of this study were to 1) develop a virtual social media skills group intervention and 2) pilot test the feasibility and acceptability of program materials and procedures.

**Methods:** A total of 68 participants were recruited and screened for eligibility to participate in the Group SELF program. Inclusion criteria included an ASD diagnosis, age 18-40 years, verbal ability score  $\geq 70$  assessed using the KBIT-2 (Kaufman, 2004), an active Facebook account, video chat capability, and a desire to use social media to connect with others. A total of 26 participants met inclusion criteria and were randomly assigned to start the 8-week SELF program immediately or after a 2-month waiting period. SELF program lessons and materials were developed considering participant goals and strategies identified in the literature as being prosocial and improving friendship quality. Intervention strategies included individual goal setting, use of typically developing peer mentors, skill modeling, didactic lessons, in-vivo practice, and self-management. Attendance, attrition, and a feedback survey from participants and peer mentor clinicians were used to gather post-treatment feedback. Recorded sessions (20%) were analyzed for treatment fidelity.

**Results:** Of the 26 eligible participants, two withdrew prior to treatment due to in-person work conflict -- 24 initiated SELF treatment. The active group consisted of 11 participants -- ten completed the program and one dropped due to social anxiety. All participants on the waitlist, except for two that were lost to follow up, completed the program. Total attrition for the 24 participants that initiated treatment was calculated at 12.5%. Total attendance for the 23 participants that completed treatment was 89.3%. Most participants reported satisfaction with the program and agreement in the domains of learning new skills, feeling more confident online, and use of SELF strategies to maintain friendships. Peer mentor clinicians provided feedback related to program procedures. Session fidelity of was rated at 100%.

**Conclusions:** The present study serves as a proof of concept for a virtual social media skills program that specifically targets online social communication. Results will be used for future intervention development. This innovative format has the potential to target a crucial area of social functioning that has not been targeted in autistic individuals. Further research is needed to understand the unique online social experiences and needs of individuals on the spectrum.

**403.052 (Poster) Open Trial of College Success Intervention: Increasing Executive Functioning and Social Skills in College Students with ASD**

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**Background:**

About 70,000 students on the autism spectrum (AS) exit high school annually. Unfortunately, the outlook for the transition to adulthood is bleak, with over 66% of young autistic adults failing to transition into postsecondary educational (PSE) institutions or employment shortly after leaving high school. For those who do participate in PSE, approximately two thirds do not obtain a degree. As the neurobiological basis of autism is further investigated, new interventions are focusing on remediating the core deficits specific to social and cognitive dysfunction in AS. Impairments in executive functioning are considerable in autistic individuals, and it is likely that these impairments are a leading cause of disability in AS.

**Objectives:**

A new, innovative program was developed, College SUCCESS to teach cognitive executive functioning and social cognitive functioning skills that are often referred to as "soft skills" necessary to succeed in college. This open trial research study investigated college students cognitive and social skills, functional ability and education outcomes as a result of receiving the College SUCCESS curriculum. Feasibility, acceptability and satisfaction data were collected.

## Methods:

A total of 25 autistic students ( $\mu = 22.6$  SD=4.1 yrs; range 18-34yrs) participated. The participants were male (76%), race/ethnically diverse (64%), average IQ ( $\mu = 64.6$  SD=15.6), 72% participated on University and 28% on Community College campuses, 76% receiving Disability Services. 32% received MH counseling and 13% on medication. The College SUCCESS curriculum was delivered 1-2xs totaling 90-180minutes per week (differing for quarter vs semester campuses) via an active group. Skills taught include executive functioning: attention, learning, memory, prospective memory, cognitive flexibility, problem solving, goal oriented thinking and contextual awareness and social cognition: social conversation (giving and receiving compliments, feedback and help), social relationships, initiations, social media, social networking and self-advocacy. Pre and post assessments included a full battery of assessments including 1) cognitive skills: self-, parent-report (BRIEF-A) & observation (Challenge Task-CT); 2) social skills: self-, parent-report (SRS-2), & observation (Social Skills Performance Assessment-SSPA); 3) academic functioning skills and 4) satisfaction. Data was gathered from standardized measures (participant and parent report) and college staff ratings.

## Results:

Two students had perfect attendance; average # of missed groups=3.67. Outcome analyses used paired sample t-tests. Findings reveal significant differences on cognitive ( $ES=.20-.63$ ), social ( $ES=.30-.67$ ) and functioning measures ( $ES=.37-2.05$ ) indicating medium to large effects across informants. (Refer to Tables 1-3). Also, 70-75% students improved academic skills and 100% were observed by the facilitator to use new skills in course. Further, 100% of participants and 100% of parents reported the College SUCCESS program overall was excellent and 92% students reported it helped them and 100% parents reported it helped their young adult.

## Conclusions:

This study demonstrates that a College soft skills intervention positively impacts autistic students. This College program revealed high satisfaction and promise towards improving academic outcomes for adults on the autism spectrum.

**403.053 (Poster)** Parental High Elaborative Reminiscing Predicts Improvement in Autistic Children's Episodic Memory and Theory of Mind  
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**Background:** Episodic memory (EM) is memory for past personal experiences and is foundational for the development of a wide range of human-specific, social-cognitive functions. One of these is theory of mind (ToM) which is developmentally and functionally intertwined with EM. Meanwhile, an impressive body of literature has documented that one particular caregiver interaction style (i.e., *elaborative reminiscing*) causally and positively impacts typically developing children's EM, ToM, and socio-cultural learning more generally. Despite its empirical basis and theoretical importance, no formal interventions have been developed to support EM in autism.

**Objectives:** The purpose of this study was to evaluate the effectiveness of a new caregiver-mediated EM intervention that adapts the principles of elaborative reminiscing in ways that align with best practices for supporting social cognition in children with autism. The following hypotheses were evaluated using an uncontrolled pre-post design to evaluate proof of concept and the intervention's potential for therapeutic outcomes: From pre- to post-intervention 1) parents will increase their use of an elaborative reminiscing interaction style, and 2) children will demonstrate improvements in EM and ToM.

**Methods:** Participants were 27 caregivers and their children (20 males; 7 females; ages 6-15 years;  $M = 9.93$ ) with a formal diagnosis of autism. Parent training in elaborative reminiscing (consisting of three modules; total time approximately 3 hours) was modeled after well-established training programs and manualized in a standard operating procedure. Following training, parents implemented the intervention techniques for eight weeks (5 minutes a day/5 times a week). To assess the quality of parental talk at pre-post, structured parent-child interactions were transcribed and coded reliably for the presence of elaborative statements, task support, and mental state terms. Children's EM was assessed using a modified cueing task (to tap EM specificity) and a Remember/Know task (to tap EM accuracy). Children's ToM competence was assessed via parent-report as well as tests of direct performance (alternate forms were used to control for test-practice effects).

**Results:** From pre- to post-intervention, parents increased their use of conversational devices for all indicators of elaborativeness. Children's cueing task scores demonstrated improvement in EM specificity. EM accuracy (i.e., Remember/Know task scores) also improved but only among children with high or age-appropriate language developmental levels. No effect was observed for caregiver-reported ToM (perhaps due to the short retest interval) but scores on direct tests of ToM did improve.

**Conclusions:** Parents of children with autism can be trained to use elaborative reminiscing in a relatively short period of time. Parental high elaborative reminiscing predicts improvement in children's EM and ToM, although the Remember/Know task is likely not appropriate for children with limited language. Our tentative findings suggest that caregiver elaborative reminiscing may be promising for supporting memory and social cognition in children on the autism spectrum. The results justify further study of the therapeutic potential of this novel caregiver-delivered intervention using experimental designs to address threats to internal validity.

**403.054 (Poster)** Qualitative Assessment of Autobiographical Memory in Autism Facilitates Treatment Planning of Parent-Led Interventions  
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**Background:** Autobiographical memory (ABM) is memory about the self, including facts about oneself (semantic memory [SM]) and recall for past personal experiences (episodic memory [EM]). SM and EM are integrated in typical ABM development but may diverge in autism; whereas SM appears relatively intact, disruptions in EM are well documented. Several theories have been proposed to explain ABM differences in autism and experimental research has implicated a variety of potential mechanisms and cognitive processes. Still, the most common task paradigms lack ecological validity and are not well suited for understanding how ABM in autism might operate in situations that are personally meaningful and relevant for the individual. This information is interesting from a theoretical orientation but crucial for understanding the heterogeneity and practical impact of ABM in autism and for the development of individualized interventions to support learning and cognition.

**Objectives:** The overarching question of this study was “What are parents’ impressions of their children’s ABM?” Using qualitative analysis, we sought to understand and accurately capture the testimony of parents of children with autism for two aims: 1) to understand each individual child’s ABM strengths and challenges to design family-centered interventions and 2) to identify themes across participants, to apprehend heterogeneity, and identify any new or interesting information that might emerge from the data.

**Methods:** Parents (n=31) of children with a diagnosis of autism (ages 5-13 years) completed the ABM Caregiver Interview (ABMCI) prior to their participation in an ABM parent-training intervention. The ABMCI is a semi-structured interview comprised of 12 open-ended, non-leading questions with standardized prompts. Initial questions are intentionally broad to be as inclusive as possible with regard to the potential variation in responses. Subsequent questions solicit information about specific ABM dimensions (e.g., detail, source, spontaneity) to capture the complex nature of ABM and inform treatment planning. ABMCI responses were analyzed using an inductive, open-coding process. In an initial analysis, ABMCI data were scrutinized by survey item and subthemes were developed to examine each topic across respondents. In a second phase, overarching themes were identified that cut across the data set as a whole.

**Results:** Parents provided information helpful for tailoring the specific recommendations made during parent training and for their subsequent implementation of the intervention. Preliminary analyses revealed the following themes in parents’ responses to the ABMCI: 1) relative strength in SM in the presence of impoverished EM, 2) a facilitative effect of task support, and 3) high degrees of variability in functions theoretically related to ABM (e.g., future thinking, spatial orientation). Some surprising reports also emerged (e.g., difficulty with the concept of time, memory/fantasy confusions).

**Conclusions:** Parents possess a high degree of insight into the nature of their child’s memory and this information is helpful in the development of family-centered interventions to support ABM in children on the spectrum. The themes identified in parent testimony largely corroborated existing research. Still, heterogeneity in the parent’s reports involving the quality of ABM and ABM-related functions was notable and points to directions for future research.

#### **403.055 (Poster) Quality Assessment of Intervention Studies for Transition-Age Autistic Youth**

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**Background:** Several scoping systematic reviews have attempted to evaluate literature on interventions for transition-age autistic youth, to determine whether specific practices can be identified as ‘evidence based’ (e.g., Steinbrenner, 2020). However, many of these systematic reviews do not examine whether primary studies adhere to quality standards. Meta-analytic work conducted on young children has suggested that study quality is lacking in autism intervention research, and there are too few high quality studies to reliably aggregate effect sizes (Sandbank et al., 2020). Scoping quality assessments of intervention research involving transition-age autistic youth are needed to determine the reliability of evidence supporting commonly used practices for this population.

**Objectives:** The purpose of this systematic review is to evaluate the quality of research focusing on transition-age autistic youth, and to determine if quality indicators have changed over time. We aimed to assess trends related to selection bias (randomization procedures), performance bias (masking participants and procedural fidelity), detection bias (masking of assessors and coders and adequate data collection), and adverse event reporting.

**Methods:** Systematic search procedures were conducted to identify all peer-reviewed studies of non-pharmacological interventions published in English between 1970 and 2020, that included participants with a diagnosis of autism between the ages of 14-22 years. After full-text screening, 191 articles met inclusion criteria, and were coded for study quality indicators. Single-case design studies (SCDs) were evaluated using the assessment tool developed by Reichow and colleagues (2018), and group design studies were evaluated using the assessment tool developed by the Cochrane Collaboration (Higgins et al., 2011). To identify trends regarding study quality by time period, quality indicators were aggregated separately by design type, and for studies published during the first and second half of the represented publication years. Because quality indicators vary as a function of the dependent variable, dependent variables were the unit of analysis.

**Results: (based on coding of 75% of included studies)** Included articles were published between 1984 and 2021, and the majority of studies were SCDs (90%). Study quality indicators are summarized in Figures 1 and 2; Figure 1 shows SCDs published between 1984 and 2002 (there were no group design studies in this time period). Figure 2 shows SCDs (upper panel) and group designs (lower panel) published between 2003 and 2021. Bias risks related to selection, performance, and detection remained high across years. None of the studies published between 1984 and 2002 reported on adverse events, and only 2.5% of studies published between 2003 and 2021 reported on adverse events.

**Conclusions:** Research conducted on transition-age autistic youth is lacking in quality, especially in regards to key indicators such as randomization and masking of assessors, and these issues have persisted over time. Additionally, the reporting of adverse events is nearly absent from this literature. This means that there is very little useful evidence to guide stakeholders in selecting practices that may be beneficial for transition-age autistic youth,



and virtually no basis by which to weigh potential benefits of interventions against potential harms.

**403.056 (Poster)** Remote-Delivered Listening Comprehension Intervention for Children with Autism: Feasibility and Initial Efficacy  
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**Background:** One in 54 children are diagnosed with autism spectrum disorder (autism), with 68% exhibiting IQs above 70 (CDC, 2020). Children with autism are often educated mainly in general education settings and frequently exhibit language and reading difficulties (Nation et al., 2006; Whalon et al., 2009), creating an educational imperative for effective practices for learners with autism. The COVID-19 pandemic created numerous disruptions in typical educational practice, revealing an increased need for evidence-based practices to support remote learning. While others have successfully piloted telehealth interventions for children with autism targeting functional skills such as social communication or behavior management (Ellison et al., 2021), there are no remote-delivered intervention studies examining academic-based skills such as reading. To fill this gap, we present data on a pilot study of the remote delivery of a listening comprehension intervention for school-aged children with autism.

**Objectives:** This study examines the feasibility and initial efficacy of remote-delivered intervention aimed at targeting listening comprehension and oral language skills for elementary-aged children with autism.

**Methods:** Fourteen children with autism (mean age 7:11) participated in researcher-led, one-on-one reading intervention sessions 2 days per week, for 11 weeks. All children had adaptive behavior ( $M=77.84$ ;  $SD = 7.75$ ; Vineland-3; Sparrow et al., 2016) and verbal IQ scores ( $M = 90.93$ ;  $SD = 14.05$ ; WASI; Wechsler, 2011) in the average range. All sessions were led over Zoom, a videoconferencing platform. The intervention program used in this study has been efficacious for learners with autism in school-based settings (Henry & Solari, 2020; Solari et al., 2020). Several amendments were made to the intervention to increase engagement online, including visual supports and the use of hand-held props. Each 30-min lesson consisted of a read-aloud (15 min), instruction in story vocabulary (5 min), and a journal activity (10 min).

**Results:** Out of all scheduled sessions, only 4% were no-shows. Procedural integrity was generally high, as instructors were able to adhere to 89.6% of the intended intervention components. All parents reported being “extremely satisfied” or “satisfied” with the implementation of the intervention and 80% reported being “extremely satisfied” or “satisfied” with their child’s progress. Wilcoxon signed-rank tests indicated that participants did not show growth on standardized measures of expressive vocabulary ( $z = -0.87$ ,  $p = 0.39$ ,  $r = -.23$ ) or narrative memory ( $z = -1.15$ ,  $p = 0.25$ ,  $r = -.31$ ). However, they demonstrated statistically significant improvement on listening comprehension,  $z = -2.06$ ,  $p = 0.04$ ,  $r = -.55$ .

**Conclusions:** The results of this study suggest that the listening comprehension intervention is feasible and potentially efficacious for children with autism. This intervention was reliably implemented remotely in short sessions and was ranked high in terms of acceptability and parent satisfaction. Additionally, this intervention targets multiple areas of concern for children with autism including oral language, vocabulary, and listening comprehension. We will discuss future directions in adapting this intervention for remote delivery for children with autism, such as the inclusion of more visual supports and increasing engagement with a virtual reward system.

**403.057 (Poster)** SPARK Research Match: Supporting Clinical Trial Recruitment  
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**Background:** The Simons Foundation Powering Autism Research for Knowledge (SPARK) is an online, longitudinal research study that enrolls individuals with a professional diagnosis of autism and their family members. All participants consent to be contacted about future autism research studies. To date, there are over 260,000 participants enrolled, including more than 100,000 individuals with ASD. Research Match (RM) is a core component of SPARK that facilitates study recruitment for researchers – a major challenge in clinical trials. RM services are available to researchers at no cost. In return, researchers agree to share their study data with SPARK to strengthen its core dataset.

**Objectives:**

- Describe the research match process for clinical trial recruitment
- Report recruitment metrics for clinical trials using RM services

**Methods:** The SPARK cohort is accessible to approved investigators. Applications are submitted online (<https://base.sfari.org/>) and reviewed by the SPARK participant access committee, which includes researchers and community representatives. Studies are approved to recruit for one year with the possibility of renewal. Eligible participants are identified based on study inclusion/exclusion criteria and geographic location. Participants are invited via email and respond whether they are interested in the study. Interested participants provide authorization for SPARK to share contact information with the study team. Investigators must agree to bi-directional data sharing and are required to track participant enrollment. Participant and researcher feedback are captured upon study completion.

**Results:** As of October 2021, SPARK approved 21 applications for interventional studies registered on ClinicalTrials.gov. For 16 recruiting studies (5 completed, 11 active), the number of potentially eligible SPARK participants ranged from 78 to 3,091 (median=481). Participants indicating initial interest in each study ranged from 18 to 654, with per study response rates between 8%-37%. Enrollment of SPARK participants ranged from 0 to 93

individuals, with one study reaching 70% of their overall recruitment goal. Factors associated with increased recruitment, as well as researcher and participant feedback, will be shared.

**Conclusions:** SPARK Research Match is an effective platform for supporting recruitment for autism intervention studies.

**403.058 (Poster)** School-Provided and Private Intervention Service Rates in School-Age Children with Autism with and without Co-Occurring Conditions

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**Background:** Children with autism spectrum disorder (ASD) represent 11% (830,000) of students served by the Individuals with Disabilities Education Act and often receive intervention services to support social, behavioral, and linguistic development in school as part of a special education plan or out-of-school through private intervention services. The intervention needs of children with ASD may differ as well due to the presence of additional co-occurring conditions, including intellectual disability (ID), attention-deficit/hyperactivity disorder (ADHD), or language disability (LD).

**Objectives:** To examine if differences exist among school-age children with ASD with and without ID, ADHD, or LD in terms of receiving school-provided or private intervention services in social skills, speech/language, and behavior services.

**Methods:** This study uses information collected from parents participating in the Simons Foundation Powering Autism Research initiative, a large database of families with verified ASD diagnoses. The current study includes four subgroups of children: 1) ASD ( $n=6,554$ ; 74% male; age=9.13[4.32]); 2) ASD+ID ( $n=491$ ; 78% male; age=9.98[5.15]); 3) ASD+ADHD ( $n=5,642$ ; 81% male; age=11.44[3.47]); 4) ASD+LD ( $n=7,790$ ; 79% male; age=7.43[3.99]). All children received special education services from their school. Parents indicated if their child had received in-school special education services or out-of-school private services related to behavior, speech/language, and/or social skills.

**Results:** 2x2 contingency tables were examined by group for each intervention. All chi-square tests were significant ( $p<.001$ ); effect sizes varied by group and intervention category. Largest effect sizes were found for social skills interventions ( $\Phi=0.52-0.58$ ), followed by speech language interventions ( $\Phi=0.18-0.49$ ) and behavioral interventions ( $\Phi=0.19-0.31$ ). Across groups, the overall trend showed more individuals were observed than expected in having received neither or both interventions for all interventions; in contrast, fewer individuals received a particular intervention in only one context. All four groups showed the largest effect for social skills interventions ( $\Phi=0.52, 0.51, 0.50$ , and  $0.58$  for ASD, ASD+ID, ASD+ADHD, and ASD+LD, respectively). The ASD and ASD+ADHD groups showed larger effects in speech language interventions ( $\Phi=0.42$  and  $0.49$ ) as compared to behavioral interventions ( $\Phi=0.23$  and  $0.19$ ). The ASD+ID and ASD+LD groups showed the opposite effect with a larger effect in behavioral interventions ( $\Phi=0.31$  and  $0.29$ ) compared to speech language interventions ( $\Phi=0.18$  and  $0.17$ ). Within-group findings will be discussed with reference to calculated standardized adjusted residuals.

**Conclusions:** Children with ASD often receive a wide array of interventions provided through school-based services and/or private means. Findings highlight a general trend that children are more likely to receive particular interventions in both settings as opposed to either setting. However, the size of that difference depends on both the intervention type as well as the presence and type of a co-occurring condition. Further applications to intervention services will be discussed to supporting students with ASD with and without co-occurring conditions.

**403.059 (Poster)** Sexuality and Relationship Education for Autistic Adults: A Pilot Program Based on an Evidence-Based Teen Model

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**Background:**

Sexuality and relationship education (SRE) programming geared toward autistic adults is limited. Too often, autistic adults report wanting information about topics that are not commonly covered in SRE programs, including gender identity, sexual orientation, and the social aspects of relationships (Brown-Lavoie et al., 2014; Hillier et al., 2020; Strunz et al., 2017). An evidence based SRE program for autistic teens (Tackling Teenage Training; TTT, Visser et al., 2017) was adapted for use with adults.

**Objectives:**

To measure the impact of an SRE program based on an evidence-based adolescent SRE program, for autistic adults

To identify areas of strength and weakness for future iterations of group programming

**Methods:**

First, the TTT curriculum was adapted to meet the learning needs of autistic adults, and to a virtual group format. The number of exercises was reduced, and didactic sections were shortened for some topics (e.g., reproduction, basic puberty information) and more information about gender

identity and sexual orientation was included (e.g., introducing the gender unicorn). Then, 11 autistic adults participated in a 16-week program (10 men, 1 woman). Participants completed a modified Teen Transition Inventory (TTI; Dekker et al., 2017) pre and post program, as well as qualitative ratings each week on the relevance, novelty, and interest in hearing more about each topic.

#### Results:

Five TTI subscales (identified prior to analyses due to relevance to the adult programming) compared pre and post. Three subscales within the Psychosexual socialization domain, Friendship Skills, Perceived romantic competence/romantic ability, and Personal openness about intimacy, all improved compared to the pre-program assessment. A fourth scale within that domain, Social acceptance by peers, got worse over the course of the program. Within the psychosexual selfhood domain, Perceived social competence/Relational confidence also improved post program. Of note, these comparisons are simply trends due to the small sample size for this pilot. Weekly and overall ratings of the program were high. Online dating and Masturbation resulted in the highest relevance ratings, novelty was highest for Online dating and Terms relating to identity/Intersex, and interest in learning more was highest for Masturbation and Gender identity/sexual attraction. Most enjoyed aspects of the training were “role-playing” and “hearing different perspectives/discussions.” Participants identified discussion of peer pressure and emotions in relationships as additional topics they would like to see covered.

#### Conclusions:

TTI results are preliminary but promising; future work should explore whether observed improvements in scores persists in larger groups. For this early stage of this group program adaption, the qualitative results are key to capture stakeholder interest in the program. Highly rated topics were consistent with previous research on what autistic adults want from a sexuality and relationship program (Crehan et al., 2021). This indicates that the teaching materials were of interest and on topics that were important to the adults. Future programming should incorporate areas identified by the participants as currently missing, and should utilize the teaching tools (e.g., role play and discussions) identified as useful by the participants.

**403.060 (Poster)** Systematic Review and Meta-Analysis on Psychotherapeutic Interventions for Co-Occurring Symptoms of Depressive-, Anxiety- and Obsessive-Compulsive Disorders in Autism Spectrum Disorder

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#### Background:

The most frequently co-occurring psychiatric disorders in autism spectrum disorder (ASD) include depressive-, anxiety- and obsessive-compulsive disorders (Meng-Chuan et al. 2019). There is evidence from previous meta-analyses that cognitive behavioural therapy (CBT) is an effective treatment for anxiety in children with ASD (Ung et al. 2015; Perihan et al. 2020). However, it is currently unclear whether: 1) other psychotherapeutic interventions are effective, and 2) CBT is effective for adults or for treating other psychiatric problems that affect individuals with ASD.

#### Objectives:

To systematically review any form of psychotherapeutic intervention for co-occurring symptoms of depression, anxiety and OCD in children and adults with ASD.

#### Methods:

Database searches were undertaken until May 2021 using EMBASE, PsycINFO and PubMed. Only randomized controlled trials (RCT) published in peer-reviewed journals were included investigating any form of psychotherapeutic intervention. If 3 or more RCTs were available, a meta-analysis was conducted. Subgroup analyses were performed to compare individual versus group therapy and family-based versus non-family-based therapy.

#### Results:

For CBT 26 RCTs ( $n = 1251$ ), and for social skills interventions 6 RCTs ( $n = 217$ ) met criteria for inclusion. For other psychotherapeutic treatments less than 3 RCTs were available and they were therefore excluded. The pooled effect sizes were moderate for reduction in anxiety symptoms in children ( $g = 0.53$ ), which was most extensively studied (21 RCTs) and small for reduction in depressive symptoms in adults ( $g = 0.43$ ), including 4 RCTs. For OCD symptoms, 3 RCTs were available with mixed age groups, yielding a moderate effect size ( $g = 0.59$ ). There was no difference in overall effect size between individual and group CBT design (both  $g = 0.56$ ). However, combined individual and group sessions resulted in a lower effect size CBT ( $g = 0.23$ ). Pooled effect size of family-based CBT ( $g = 0.90$ ) exceeded non-family-based CBT ( $g = 0.27$ ). For social skills interventions overall effect sizes were small for reduction of anxiety symptoms ( $g = 0.38$ ) and moderate for reduction of depressive symptoms ( $g = 0.62$ ) in children with ASD.

#### Conclusions:

Current available evidence for psychotherapy in individuals with ASD suggests that CBT is an effective treatment for reducing anxiety symptoms in children and to a lesser extent for depressive symptoms in adults. Furthermore, social skills interventions are mildly effective for reducing anxiety symptoms and moderately effective for depressive symptoms in children with ASD. For CBT, it is recommended to apply a family-based approach. As most studies were conducted in children, more future studies should focus on adults with ASD. Also, other psychotherapeutic interventions frequently applied in clinical settings in ASD (e.g. mindfulness based cognitive therapy) should be included in future trials.

**403.061 (Poster)** Systematic Review: Emotion Dysregulation and Challenging Behavior Interventions for Children and Adolescents with Autism with Graded Key Evidence-Based Strategy Recommendations

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**Background:** Challenging behavior, behavior that is dangerous to the learner or others or interferes with learning or development, such as aggressive or injurious behaviors towards self or others, is common in children and adolescents with autism and can have a devastating impact. Emotion dysregulation is a common feature related to these behaviors. These youth often have difficulty employing proactive emotion regulation and coping strategies. There is a growing body of research in emotion dysregulation in ASD, and several reviews of challenging behavior interventions; however, these reviews have not included group designs or interventions that target emotion dysregulation.

**Objectives:** We systematically reviewed behavioral and psychosocial interventions targeting emotion dysregulation and challenging behavior to determine which evidence-based strategies have the most empirical support in children and adolescents with autism.

**Methods:** We identified 105 eligible studies (84% agreement;  $\kappa = .61$ ), including 28 group designs, 65 single-case designs, and 12 case reports/series on interventions for preschool children to adolescents. We excluded non- psychosocial interventions, interventions tested on adults only, or targeting internalizing symptoms only. We applied a coding system to identify discrete strategies based on well-established autism practice guidelines from the National Clearinghouse on Autism Evidence and Practice (NCAEP), including common strategies among childhood mental disorders. We used an evidence grading system for discrete strategies across studies (Harbour & Miller, 2001) and focused our analysis on strategies from RCTs (rated as 1+ or 1- based on study design rigor).

**Results:** Most studies included preschool (27%) or elementary school (56%) students. Only 11% involved middle school students and 5% high school students. Around one-third of studies report on race/ethnicity and IQ. Those that did documented some diversity (61% white) and variability in IQ (57% included children/adolescents with below-average IQ). Most studies (89%) found a positive effect on behavior or emotion dysregulation outcomes. The five strategies with the most substantial evidence (from 10+ group design studies including multiple RCTs rated 1+ [with low risk of bias]; see Figure 1) were Parent-Implemented Intervention, Emotion Regulation Training, Reinforcement, Visual Supports, and Antecedent Based Interventions. Only 23% of null/negative effect studies performed a Functional Behavioral Assessment (FBA) to inform strategy selection, and only 12% of studies included outcome measures on emotion dysregulation/regulation.

**Conclusions:** Many of the strategies targeting challenging behavior or emotion dysregulation teach replacement skills and techniques to reduce stress indirectly. This review highlights the importance of explicitly teaching emotion-regulation skills to children and adolescents with autism, positively reinforcing replacement or alternative behaviors, providing visual aids, addressing stressors proactively, and involving parents in treatment. It also underlines the importance of conducting an FBA to inform strategy selection and calls for more rigorously designed studies that include emotion dysregulation as an outcome/mediator in future intervention studies.

#### **403.062 (Poster) Facing Your Fears on Campus: Development of a Group-Based Anxiety Intervention for College Autistic Students**

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**Background:** Autistic college students often identify mental health support as an unmet need on college campuses (Monahan et al., 2021). While there has been an increase in recent support at colleges and universities specifically designed for autistic people, these often do not include mental health interventions (Cox et al., 2020). Considering the high rates of mental health challenges of college students in general (CCMH, 2021), and the high prevalence rates of mental health challenges among autistic people specifically (Hollocks et al., 2019), the development of evidence-based interventions to support autistic college students represents an urgent need. There are a growing number of evidence-based mental health interventions for children and adolescents on the autism spectrum (e.g., Reaven et al., 2011). While these can be considered for modification for use with college autistic students, this should be done in collaboration with autistic people.

**Objectives:** The purpose of this study was to:

- Adapt an existing mental health intervention (Facing Your Fears) for use with college autistic students.
- Utilize participatory action research strategies to ensure that the adaptations and modifications of the intervention were informed by the end users.
- Examine individual changes of participants following a 15-week pilot of the intervention.

**Methods:** The FRAME system (Stirman et al., 2019) was used to develop adaptations and modifications to Facing Your Fears (Reaven et al., 2011), an evidence-based intervention for autistic youth experiencing anxiety. Once a draft of the full intervention ("Facing Your Fears on Campus") was finalized, a pilot was conducted with three autistic undergraduate students enrolled at the University of Delaware using an iterative, participatory approach. Pre-/Post-assessment included the measurement of mental health challenges using the CCAPS-62 and the Anxiety Scale for Autism-Adults (Locke et al., 2011; Rodgers et al., 2020). Evaluative feedback was collected after each session from the intervention facilitators and participants to promote a feedback system to guide additional modifications. Continuous meetings with an Autistic Advisory Panel also ensured that the intervention was designed to meet the needs of autistic college students. At the completion of the semester (December 2021), we will conduct a focus group with the intervention participants to learn about the benefits and areas for improvement as identified by the students.

**Results:** Preliminary feedback from treatment facilitators and participants, as well as the Autistic Advisory Panel, suggest that the treatment was well-designed in terms of being appropriate for this population. Individual scores on the two mental health measures conducted pre-/post-treatment will be examined upon completion of the pilot (December 2021) and shared in order to consider the intervention's preliminary efficacy.

**Conclusions:** Continued research is needed on the development of mental health interventions that directly target the needs of autistic college students and are informed by autistic people. Additional modifications for Facing Your Fears on Campus, based on the results of this pilot, will be described. Researchers will also share how these modifications were incorporated into future implementation including a Randomized Controlled Trial using a wait-list control group (anticipated Spring 2022).

**403.063 (Poster)** Telehealth Delivery of the Secret Agent Society Group Social Skills Program during COVID-19

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**Background:** Autism Spectrum Disorder (ASD) is characterized by peer socialization difficulties. In-person social skills groups, such as the Secret Agent Society (SAS), are a common evidence-based approach to addressing these challenges in children. However, COVID-19 has severely disrupted these services. The effectiveness of telehealth delivered social skills groups is largely unknown, with published papers lacking autism-specific samples (Gale, Greenberg & Ireland, 2021) or providing no indication of program outcomes (MacEvilly & Brosnan, 2020). This issue requires urgent attention given the potential of COVID-19 to exacerbate the social impairments of children on the spectrum.

**Objectives:** This pilot project aimed to explore advantages, disadvantages, considerations and recommendations for telehealth delivery of a SAS social skills group. It also aimed to examine how the intervention impacted children's re-entry experience after COVID-19 social distancing restrictions were eased.

**Methods:** Five children, 3 boys and 1 girl, with ASD (mean age = 9 years, 1 month; range=8;7-9;11) and their parents participated in SAS via telehealth from October 2020 to March 2021. Eighteen weekly 45-minute online parent- and child-group sessions were run concurrently according to the manualized CBT protocol. Within 3 months of the program ending, participants were asked to complete a qualitative feedback questionnaire about the program, how it impacted their re-entry experience as social distancing restrictions eased, and the pros and cons of the telehealth format.

**Results:** Four of the five children noted that SAS helped them deal with challenges (e.g., bullying) and improved their emotion regulation skills. The fifth child reported that he felt more confident to speak up in SAS group and at school. Two parents also noted improvements in their children's emotion regulation skills, knowledge of coping skills, emotional intelligence, and problem-solving skills. One parent reported that while the transition back to in-person school was challenging, SAS helped their child adapt.

Two children commented that they enjoyed connecting with peers online during a time of limited social contact. Two parents also expressed gratitude for the program's availability when most other social groups were unavailable. Two parents reported that the telehealth format was more accessible and convenient than in-person services. One child also described liking the ability to share favorite objects virtually in-session.

Despite these strengths, two parents and two children expressed a preference for in-person group meetings. Technical difficulties were a telehealth challenge noted by two children, and two parents commented on their children struggling to stay focused virtually. Recommendations for improvement included providing more informal socialization opportunities for children and parents in telehealth sessions and subdividing the child group into smaller break-out rooms to provide more opportunities for active participation.

**Conclusions:** Pending further empirical investigation, telehealth social skills groups hold promise in supporting the social skill development of children with ASD during COVID-19 and beyond. Program engagement and satisfaction may be enhanced by creating in-session opportunities for informal socialization for children and parents, proactively providing tech support for families and incorporating popular multi-player games into child group sessions.

**403.064 (Poster)** The Effect of a Music-Making Program on Student-Teacher Relationships in Adolescents on the Autism Spectrum and with Intellectual Disability.

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**Background:** Research has demonstrated that student-teacher relationships (STRs) are critical for academic and social adjustment within a school setting. STRs are a predictor of concurrent and long-term adjustment, and are important for behavioral, social, and emotional development. STR quality of students on the AS is relatively poor, with decreased closeness and increased levels of conflict when compared to students with typical development (TD) and students with intellectual disability (ID). However, students on the AS who can develop quality relationships with their teachers are more likely to have positive developmental outcomes, such as more social inclusion and less problematic behaviour in the classroom. Preliminary evidence suggests that music programs can foster measurable improvements in student-teacher relations. Given that musical interests and abilities have been shown to be a relative strength for people on the AS, student-teacher relationships of students on the AS may benefit from music programs.

**Objectives:** This study aimed to test whether the joint participation of students and teachers in a school-based 11-week music-making program could yield a change in teacher-perceived student-teacher closeness and conflict, as well as show differences in the proportion of change between students on the AS and with ID.

**Methods:** Thirty-seven adolescent participants with ASD (n= 25) or ID (n= 12) participated in this study implemented in a high school setting. Four classrooms comprised of 6 to 14 students and 3 classroom teachers each followed an 11-week music-making curriculum instructed by a community organization of music teachers who conduct school-based music programs for children and adolescents with developmental disorders. Students and teachers learned to play the djembe primarily as well as other percussion instruments and learned a set of 30 group dependent rhythms. Both the students' classroom and music teachers completed the Student-Teacher Relationship Scale-Short Form (STRS-SF), before and after the music program, to measure potential changes in teacher perceptions of student-teacher closeness and conflict.

**Results:** Paired-sample t-tests revealed improvements in music teacher reports of student-teacher closeness for the AS and ID groups ( $ps < .05$ ) and decreases in student-teacher conflict for the ID group ( $p < .05$ ) as a result of the music-making program. Paired-sample t-tests also showed significant improvements in the classroom teacher reports of student-teacher closeness for the AS group only ( $p < .05$ ).

**Conclusions:** Our finding of improved student–classroom teacher relationships following joint participation in a music program may stem from opportunities for reciprocal and positive interactions between students on the AS and their teachers that is inherent to group music making. Incorporating group music programs in education curricula for students on the AS can foster better student–teacher relationships, which could give rise to better social, cognitive, and academic results.

**403.065 (Poster)** The Implementation and Teaching of Health Practices for Children with Autism Spectrum Disorders during the COVID-19 Pandemic

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**Background:** The Summer Treatment Program (STP) is an outpatient treatment setting which includes social skills instruction, behavior modification, and sports practice. It aims to provide a space for children with autism spectrum disorders and attention-deficit/hyperactivity disorder to practice social and behavioral skills within age-appropriate group recreational activities. The University of Washington Autism Center implemented this treatment program during the summer of 2020 in the context of the global COVID-19 pandemic.

**Objectives:** To describe the implementation, teaching, and outcomes of an outpatient summer treatment program for children with autism spectrum disorders during the COVID-19 pandemic.

**Methods:** Children were divided into groups of 7 with at least 3 counselors assigned to each group. Counselors taught and supported health practices using the existing framework of the summer treatment program, including modeling, social reinforcement, and awarding points for following activity rules, which could be used to earn small prizes.

Extensive strategies were used to reduce the risk of COVID-19 transmission. Practices included masking, physical distancing, hand-hygiene, frequent sanitization of materials and surfaces, modification of activities, daily symptom screening, and prioritizing outdoor programming. Parents reported on their satisfaction with specific practices implemented at the day treatment program. They also reported on their child's following of health practices outside of the program.

**Results:** The 2020 sample included 104 children ages 6-12 with a mean (SD) age of 8.9 (1.7) years. There were 94 unique families, and 48 (51%) completed the satisfaction survey.

Parents reported being very satisfied with the following practices implemented at the day program: 47 (96%) with the masking policy, 46 (94%) with physical distancing, 48 (100%) with hand-hygiene, 48 (100%) with frequent sanitization of materials and surfaces, 47 (98%) with modification of activities, 42 (88%) with daily symptom screening, and 48 (100%) with outdoor programming.

Parents reported improvement in the following behaviors at home by the end of the program: 36 (75%) indicated improvement in their child's masking, and 12 (25%) indicated no change. For physical distancing, 27 (56%) indicated improvement, and 20 (42%) indicated no change, and 1 (2%) indicated distancing ability worsened. For hand hygiene, 24 (50%) indicated improvement, and 24 (50%) indicated no change.

**Conclusions:** Additional strategies were necessary to implement a summer treatment program during the global COVID-19 pandemic. Children were required to learn and practice new behaviors and adjust to new norms. Our results indicate parents were overall satisfied with the implementation of health practices, and that some children were able to successfully learn and adopt new practices and generalize them to other settings. Limitations to the generalizability of these findings include a high staff-to-child ratio and a sample of children with ASD who have verbal and conversational language abilities of approximately 6 years or greater, required to meaningfully participate in this standardized summer treatment program.

**403.066 (Poster)** "What Do We Do after We Fail? We Try Again": Autistic Students' Experiences of Project Failures in an Interest-Based Afterschool Maker Program

**Background:** Extant literature encourages the inclusion of engineering concepts as a crucial part of the K-12 educational curriculum. Included in this is the Engineering Design Process (EDP), a cyclical framework that enables engineers to solve design-related challenges. This process enables engineers to identify, plan, brainstorm, collaborate, design, iterate (redesign), and finalize design solutions. As EDP includes iterations (when designs fail) as a core component of its framework, it can be taught to students as a problem-solving strategy that enables them to learn from their failures in a positive manner. We developed inclusive Maker clubs for autistic and non-autistic students with an aim to teach EDP so students can use a strength-based problem-solving approach to succeed in their design challenges.

**Objectives:** We present the experiences of autistic and non-autistic students and teachers about design failures and the use of EDP to rectify and improvise their prototypes within the Maker club context.

**Methods:** Data collection spanned between two school years 2018-2020 and data was collected from nine teachers and 26 students (17 autistic students) between grades 6-8 participating in an inclusive, interest-based Maker extracurricular program in three public middle schools in the Northeast US. Data was collected through student and teacher interviews, detailed teacher logs, researcher observations and photos.

**Results:** Thematic analysis generated four themes. (1) *Developing perseverance in face of challenges:* field observations and teacher interviews suggest that both autistic and non-autistic students demonstrated increased perseverance to work through challenges when activities resonated with their interests. Through this exercise they demonstrated improvement in emotion regulation in face of failure. (2) *Flexibility for problem-solving:* teachers' facilitation of EDP supported students' problem-solving for project failure. Positive reinforcements from teachers and peers also supported students in developing flexibility to solve design problems. Students collaborated and exchanged failure experiences and strategies, through which process they identified alternative solutions to their design problems. (3) *Resourcefulness in problem-solving:* students iteratively tested and refined their prototypes, generating highly effective design solutions that exceeded their initial design problems. Also, students used a variety of materials like cardboard, wooden blocks, design software (TinkerCAD) and 3D printers to develop solutions to their design challenges. This provided them with an array of resources to develop their final projects. Students could also seek support from teachers, makers and engineering experts who guided them through the process using the EDP. Choosing their own materials, design ideas and resources led students to develop autonomy and choice making. (4) *Accepting failure as a normal process:* students learned to accept failure as a normal process in designing and making through their shared experiences of project challenges with peers. Instead of developing a negative identity or internalizing failure, students accepted it as a routine part of the maker club experience.

**Conclusions:** Experiencing failure in design challenges fostered students' determination to overcome design challenges through adaptability and resourcefulness. A mind shift was therefore created where students didn't view failure as a negative part of their identity or lack of skills but rather a normalized routine of the maker club activities.

#### **403.067 (Poster)** Improvements in Social Skills Accompanied By Decreases in Mental Health Symptoms: A Pilot Study with UCLA PEERS Program

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**Background:** Social skills training (SST) is a commonly sought-after evidence-based intervention for adolescents with autism, with most improvements reported in social knowledge and skills. Some studies have explored the secondary impact of SST programs on changes in internalizing symptoms, with two studies showing decreased levels of anxiety and depression after participation in UCLA PEERS® for Adolescents social skills training program (Schohl et al., 2014; Yoo et al., 2014). But no study so far has directly explored the associations between changes in social skills and mental health symptoms as a result of SST programs.

**Objectives:** Using pre- and post-treatment data from the PEERS groups, we first examine the treatment effects on adolescents' social knowledge, skills, and mental health symptoms (i.e., anxiety, depression, and loneliness). Then we explored associations between social skills improvements and changes in mental health symptoms.

**Methods:** Thirty-nine adolescents and their caregivers participated in the eight PEERS groups between 2016-2021 (seven in-person groups, one virtual group). The sample consisted of 26 boys and 13 girls aged from 11-18 years old ( $M=14.38$ ,  $SD=1.71$ ), with 26 adolescents having a primary diagnosis of ASD (see Table 1 for sample characteristics). Participants attended 84.88% of the provided sessions on average. Multi-informant measures were completed before and after the groups: adolescents completed the Child Depression Inventory-2 (CDI-2), Loneliness and Social Dissatisfaction Questionnaire (LSDQ), and the Test of Adolescent Social Skills Knowledge (TASSK), while parents completed the Social Skills Improvement Scale (SSiS); both adolescents and parents filled out the Social Anxiety Scale (SAS) and reported numbers of get-togethers hosted.

Descriptive statistics were generated for pre- and post-treatment measures. Paired *t*-tests were conducted to examine the treatment effects on social and mental health outcomes in adolescents with autism, and correlations between change scores in social outcomes and mental health symptoms were generated.

**Results:** Adolescents showed significant positive improvements in parent-report social skills (SSiS- social skills), the number of get-togethers hosted, and self-report social skills knowledge (TASSK total score); and significant decreases in their feelings of loneliness (LSDQ total score; see Table 2 for descriptive statistics and paired t-test results on outcome measures pre- and post-treatment). Even though changes in the depression and social anxiety were not significant in response to the PEERS intervention, decreases in self-reported depression and parent-reported anxiety were associated with increases in parent-report get-togethers hosted ( $r=-0.35$  and  $-0.41$ ).

**Conclusions:** Consistent with previous studies, we observed improvements in social outcomes after participation in PEERS, together with significant decreases in self-reported feelings of loneliness. Moreover, moderate correlations indicated that increases in get-togethers hosted were associated with decreases in depressive symptoms and social anxiety. These findings provide preliminary evidence that improving social engagement with peers may result in decreased mental health symptoms in this population. Given that anxiety and depression are prevalent in adolescents with ASD and are often difficult to treat (especially depression), future studies need to investigate the potential opportunities for improving psychological well-being through increased positive social experiences, as well as associations between improvements in social skills and mental health.

**403.068 (Poster)** Comparing Telehealth and Face-to-Face (F2F) Academic, Seated Play Interventions and Their Assessment for Children with Autism Spectrum Disorder (ASD)

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**Background:** Children with Autism Spectrum Disorder (ASD) present with significant fine-motor impairments in visuomotor integration and manual dexterity (Kaur et al., 2018). These impairments are associated with core social communication impairments and severity of repetitive behaviors (Bhat, 2021). In an ongoing randomized clinical trial (RCT), we are comparing the effects of creative, whole-body movements (or Play group) to seated play, standard-of-care interventions (or Seated Play, Su et al., 2020; Srinivasan et al., 2021).

**Objectives:** At the onset of the pandemic, the RCT design transformed from a face-to-face (F2F) intervention to offer a virtual/telehealth (TH) format of each intervention type (Play, Seated play, Bhat et al., 2021). At study conclusion, we will have an equal number of children observed in both groups (F2F and TH, N=15 per group). We have obtained feedback from all stakeholders (parents, trainers, testers, and coders) on the benefits and challenges of receiving, providing, and analyzing F2F vs. TH format of intervention delivery.

**Methods:** 30 children with ASD between 6 and 14 years participated over 10 weeks with pretests and posttests conducted during the first and tenth weeks. Children were matched on age, gender, and level of functioning and then randomly assigned to either Play or Seated Play groups. Each child received 8 weeks of training @ 2 sessions/week conducted with an expert trainer and an adult model. The Play group engaged in instrument play promoting imitation/synchrony and bimanual coordination skills. The SP group engaged in tabletop activities such as reading, building, and art-crafts to promote social communication and fine motor skills. Each stakeholder group completed questions based on a 5-point Likert scale to rate the feasibility, acceptability, challenges, and validity of the interventions offered in each format (F2F or TH). Additionally, we will compare percent of socially-directed verbalization, session length, and effect sizes for motor outcomes using Bruininks-Oseretsky Test and task-specific coordination measures.

**Results:** Based on our preliminary analysis of parent and trainer surveys, parents and trainers reported that both formats were feasible and acceptable. Parents felt that they received appropriate training, instructions, and materials to complete the training sessions. For children needing more support, greater parent effort and reduced child engagement was reported for the TH delivery format. We hypothesize that the magnitude of fine-motor intervention effects will not differ between TH and F2F formats as long as a drawing model and parent-led instructions are provided. The TH format of intervention delivery will promote more parent-child interactions whereas the F2F format of intervention delivery promotes more expert-child interactions.

**Conclusions:** The study will add to our past studies (Srinivasan et al., 2015, 2016a, 2016b, Kaur & Bhat, 2021) showing the value of seated play to facilitate social communication and fine motor skills of children with ASD. Moreover, we will add to the evidence on efficacy and feasibility of telehealth-based social communication, academic, and fine-motor interventions. Speech and occupational therapists/special educators may consider conducting certain types of fine-motor/speech assessments via telehealth (natural conversations, manual dexterity and building tests) as an alternative to F2F interventions during future pandemics.

**403.069 (Poster)** Comparing Telehealth and Face-to-Face Creative Movement Interventions and Associated Assessments in Children with Autism Spectrum Disorder

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**Background:** Children with Autism Spectrum Disorder (ASD) demonstrate core impairments in social communication as well as comorbid impairments in praxis and imitation/interpersonal synchrony (APA, 2013; Kaur et al., 2018). In an ongoing randomized clinical trial (RCT), we are comparing the effects of a creative movement intervention (CM) and a standard of care, seated play intervention (SP) for children with ASD (Srinivasan et al., 2021, Bhat et al., 2021).

**Objectives:** At the onset of the pandemic, our RCT design was transformed from a face-to-face (F2F) intervention to offer a virtual/telehealth (TH) format for both intervention types (CM, SP). We have about an equal number of children observed in both groups (F2F and TH, N=15 per group) and



have obtained feedback from all stakeholders (parents, trainers, testers, and coders) on the benefits/challenges of receiving, providing, and analyzing F2F vs. TH intervention delivery format for the CM and SP interventions.

**Methods:** 30 children with ASD between 6 and 14 years were matched on age, gender, and level of functioning then randomly assigned to either CM or SP groups. Each child received 2 training sessions per week for 8 weeks. Pre- and post-tests were conducted before and after the training period. The CM group engaged in music, dance, and yoga-based activities promoting imitation/synchrony, bilateral/multilimb coordination, and balance skills; while the SP group engaged in tabletop activities such as reading, building, and art-crafts to promote academic, communication, and fine motor skills. Each stakeholder group completed questions based on a 5-point Likert scale to rate the feasibility, acceptability, challenges, validity, and efficacy of the interventions offered in each delivery format (F2F or TH). Additionally, we assessed session length and effect sizes for praxis/imitation, coordination, and balance performance using standardized Bruininks-Oseretsky Test of Gross Motor Development and Sensory Integration and Praxis Tests as well as task-specific yoga pose imitation and interpersonal synchrony measures.

**Results:** Based on our preliminary results from parent/trainer surveys, both delivery formats are feasible with their own pros and cons. For the TH delivery format, parents reported decreased effort in traveling between sites, and more opportunities for parent-child interactions but more challenges in demonstrating/adjusting their child's movements during imitation tasks, and maintaining synchrony during interpersonal synchrony tasks. We hypothesize that TH intervention will have lower intervention effects on some measures (imitation accuracy and synchrony) but not others (motor coordination, balance, etc.).

**Conclusions:** The study will add to the mounting evidence from our lab (Kaur & Bhat, 2019, 2021; Srinivasan et al., 2015, 2016a, 2016b) on the value of using creative movement in addressing comorbid motor and social impairments in ASD. Moreover, we will add to the pre-pandemic evidence on the efficacy of telehealth-based interventions and their feasibility, acceptability, challenges, and test validity.

**Clinical Relevance:** OTs, PTs, and adaptive physical educators could use creative movement interventions to target a variety of motor and social communication skills in children with ASD. Both TH and F2F are feasible training delivery formats and should be chosen carefully based on the family's preference.

**403.070 (Poster)** Comparing Telehealth and Face-to-Face (F2F) General Movement Interventions & Their Assessment in Children with Autism Spectrum Disorder (ASD)

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Background: Children with Autism Spectrum Disorder (ASD) demonstrate significant motor impairments in visuomotor and body coordination, agility, and strength (Srinivasan et al., 2018). These motor impairments are associated with core social communication impairments and severity of repetitive behaviors (Bhat, 2021). In an ongoing randomized clinical trial (RCT), we are comparing the effects of a general movement (or Move Group) intervention and seated play, standard of care interventions for children with ASD (or Seated Play, Cleffi et al., 2021).

Objectives: At the onset of the pandemic, our RCT design was transformed from a face-to-face (F2F) intervention to offer a virtual/telehealth (TH) format for both intervention types (Move, Seated Play, SP). We have an about equal number of children observed in both groups (F2F and TH, N=15 per group, 30 total). We have obtained feedback from all stakeholders (parents, trainers, testers, and coders) on the benefits and challenges of receiving, providing, and analyzing F2F vs. TH format of intervention delivery for the movement and standard of care interventions.

Methods: 30 children with ASD between 6 and 14 years participated over 10 weeks with pretests and posttests conducted during the first and tenth weeks. Children were matched on age, gender, and level of functioning and then randomly assigned to either Move or Seated Play (SP) groups. Each child received 8 weeks of training @ 2 sessions/week conducted with an expert trainer and an adult model. The Move group engaged in strengthening exercises, ball games, and obstacle courses to promote strength, agility, and dual-limb coordination skills. The SP group engaged in tabletop activities such as reading, building, and art-crafts to promote academic, communication, and fine motor skills. Each stakeholder group completed questions based on a 5-point Likert scale to rate the feasibility, acceptability, challenges, and efficacy of the intervention formats (F2F or TH). We will report differences in session length as well as effect sizes for motor outcomes using Bruininks-Oseretsky Test, Test of Gross Motor Development and task-specific strength and coordination measures.

Results: Based on our preliminary analysis of parent and trainer surveys, parents and trainers reported that both formats were feasible and acceptable. Parents felt that they received appropriate training, instructions, and materials to complete the training sessions. For children needing more support, greater parent effort and reduced child engagement was reported for the TH delivery format. We hypothesize that the magnitude of intervention effects will not differ between TH and F2F format. The TH format of intervention delivery will promote more parent-child interactions whereas the F2F format of intervention delivery promotes more expert-child interactions.

Conclusions: This study will build on our past work (Kaur & Bhat, 2019, 2021; Srinivasan et al., 2015, 2016a, 2016b) to support use of general movement interventions in addressing comorbid motor impairments in ASD. Moreover, we will gather evidence on the efficacy of telehealth interventions and their feasibility, acceptability, challenges, and test validity. Gross-motor interventions should be included in the standard-of-care for children with ASD and movement clinicians (OTs/PTs) should be motor advocates for this population.

**403.071 (Poster)** Effects of a Rhythm-Based, Creative Movement Intervention on Gross-Motor Coordination, Locomotor Skills, and Functional Strength of Children with ASD

**Background:** 87% of school-age children with Autism Spectrum Disorder (ASD) are at risk for motor coordination impairments which contribute to increased sedentary behavior time and decreased physical activity (Bhat, 2020). In our past studies, musical or yoga-based interventions led to generalized and task-specific improvements in gross-motor performance (Srinivasan et al., 2015; Kaur & Bhat, 2019). The present study includes another whole-body, Creative Movement (CM) intervention combining music, dance, and yoga, as well as a standard-of-care, Sedentary Play (SP) intervention focused on fine-motor skills and reading.

**Objectives:** We will compare the effects of the CM and SP interventions on the gross-motor coordination, locomotor skills, and functional strength performance of children with ASD. Due to the COVID-19 pandemic, our team provided the CM and SP interventions face-to-face as well as via telehealth and we plan to compare the effects of the different delivery methods on motor skill improvement as well.

**Methods:** The study included 30 children with ASD between 5 and 14 years of age. Each child was seen for 10 weeks with pretests and posttests conducted during the first and tenth weeks. The children were matched on age, gender, and level of functioning and then randomly assigned to either the CM or SP group. Each child received 2, ~1hr training sessions per week over 8 weeks. The CM group engaged in whole-body, music, dance, and yoga-based activities promoting interpersonal synchrony, visuo-motor, bilateral, and multi-limb coordination, as well as postural control and balance skills. The SP group engaged in tabletop activities such as reading, building, and arts and crafts to promote social interactions and develop fine motor skills. The Bruininks-Oseretsky Test of Motor Proficiency, Test of Gross-motor development were administered as a pre- and post-test. We also measured training-specific changes in whole-body coordination and locomotor skills during an early and late training session to assess movement form/modulation.

**Results:** Preliminary data from a subset of 13 children suggests significant generalized training improvements in running speed and agility (CM pretest =13.42(10.63); CM posttest=19.86(13.50),  $p<0.05$ ), bilateral coordination (CM pretest =18.57(5.41); CM posttest=20.86(4.18),  $p<0.01$ ), strength (CM pretest =9.71(5.50); CM posttest=15.57(4.65),  $p<0.05$ ), as well as locomotor (CM pretest =35.71(6.05); CM posttest=42(5.72),  $p<0.001$ ) skills on the BOT & TGMD standardized tests. Whole-body coordination analysis showed that CM group spent maximum time in multilimb coordination during the Moving Game (50.02%) and Yoga (36.98%) compared to other conditions (3-15.5%). 7-8 / 9 children showed improved multilimb coordination during the late session vs. an early session in the warmup (late-early% = 6.4) and yoga (late-early% = 6.9%) conditions.

**Conclusions:** CM interventions can be used to promote gross-motor coordination, locomotor skills, and functional strength in children with ASD. PTs/OTs working with children with ASD can use creative movement approaches to target their clients' motor coordination/locomotor skills. This work will provide the support for inclusion of whole body, rhythmic movement experiences in the standard-of-care for ASD.

#### **403.072 (Poster) Effects of a Whole-Body Exercise Intervention on Gross-Motor Skills and Functional Strength of Children with ASD**

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**Background:** 87% of school-age children with Autism Spectrum Disorder (ASD) are at risk for motor coordination impairments which create a significant barrier for adaptive functioning (Bhat, 2020). Postural strength and control are lacking in this population, but are important for broader movement goals, social interactions, and activities of daily living (Bhat et al., 2010). In our past studies, creative and rhythmic whole body interventions led to generalized improvements in gross-motor performance.

**Objectives:** The present study expands on this work by testing a General Movement (GM) intervention combining strength, endurance, and flexibility exercises versus a Sedentary Play (SP) intervention focused on fine motor and academic skill development. We will compare the effects of the GM and SP interventions on the gross-motor coordination and functional strength of children with ASD. Due to the COVID-19 pandemic, our team provided the GM and SP interventions face-to-face as well as via telehealth, so we will also compare the effects of the different delivery methods.

**Methods:** 30 children with ASD between 5 and 14 years were seen for 10 weeks with pretests and posttests conducted during the first and tenth weeks. The children were matched on age, gender, and level of functioning and then randomly assigned to either GM or SP groups. Each child received 2, ~1hr training sessions per week over 8 weeks. The GM group engaged in whole-body obstacle course games, strength exercises, and ball skill activities in a turn-taking format to promote social reciprocity, visuo-motor, bilateral and multi-limb coordination, functional strength and endurance, flexibility, and locomotor and agility skills. The SP group engaged in tabletop activities such as reading, building, and arts and crafts to promote social interactions and develop fine motor skills. The Bruininks-Oseretsky Test of Motor Proficiency Strength Subtest was administered as a pre- and post-test. In addition, upper and lower body strength was assessed at pretest and posttest as well as during training sessions (early, mid, late) using multiple functional exercises. Specifically, we coded for changes in movement modulation, movement quality, and form during these exercises.

**Results:** Preliminary data from a subset of participants in the GM group suggests improvements in the BOT Strength subtest (Mean(SE): Pretest =11.85(3.49); Posttest=16.57(3.33),  $p<0.05$ ). We also found improvements in movement modulation and movement form during performance of upper and lower body strength exercises both within and outside the training context. We hypothesize that the GM group will demonstrate more

gross-motor coordination and functional strength improvements on standardized and training-specific outcomes compared to the SP group who will demonstrate more fine-motor improvements.

**Conclusions:** This study highlights the value of whole-body exercise interventions to promote gross-motor coordination and functional strength in children with ASD. Moreover, we will also assess the effectiveness of delivering GM interventions using telehealth platforms and provide best practice guidelines. This work provides the support for inclusion of whole-body movement interventions in the standard-of-care for ASD. Movement clinicians (OT, PTs) should be motor advocates for their clients with ASD to target gross motor skill impairments.

**403.073 (Poster)** Appropriateness, Acceptability, and Feasibility of a Neurodiversity-Based Self-Determination Program for Autistic Adults  
**T. A. M. McDonald<sup>1</sup>, S. Lalan<sup>2</sup>, I. Chen<sup>3</sup>, C. Cotton<sup>3</sup>, L. Jeradeh Boursoulain<sup>4</sup> and B. A. Malow<sup>1</sup>,** (1)*Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN, (2)Neurology, Vanderbilt University Medical Center, Nashville, TN, (3)Vanderbilt University Medical Center, Nashville, TN, (4)Department of Pediatrics, Vanderbilt University Medical Center, Nashville, TN*

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**Background:** Many autistic adults without a co-occurring intellectual disability struggle with transitioning out of high school and face a “services cliff” as they deal with the demands of adulthood, such as employment, education, physical health and wellbeing, living arrangements, transportation, and social relationships. Autistic adults may benefit from self-determination support to address these challenges, since greater self-determination is associated with positive transition outcomes related to employment, socialization, advocacy, positive identity, and stress management. However, previous research on self-determination programs have reported high attrition and low acceptability. Since autistic adults vary greatly in their characteristics, needs, and resources, a one-size-fits-all model for self-determination may be untenable for this population which may require a more person-centered approach.

**Objectives:** To determine the feasibility, acceptability, and appropriateness of a neurodiversity-based self-determination program designed to support autistic adults in the pursuit and attainment of self-determined goals.

**Methods:** We designed a multi-component (goal setting, self-care, self-advocacy, mindfulness-based stress reduction, community engagement, and coaching) self-determination program, grounded in the neurodiversity paradigm, to help autistic adults achieve goals to improve their quality of life. The first phase involved five days of psychoeducation, practice, and social events; the second phase included three months of telecoaching; and the third phase included follow-up. Thirty-four university students coached 31 autistic adults (males, n = 20; females, n = 11) on three evolving goals. During phases 1 and 2, autists identified goals important to them as well as the action steps needed to attain them. During phase 2, autists received telecoaching provided by university students trained on the neurodiversity paradigm. Data were gathered on program feasibility, appropriateness, and acceptability using multiple measures (e.g., daily questionnaires, post-study surveys, weekly goal reports).

**Results:** Participants set goals across a wide range of domains (e.g., recreation/leisure, employment/vocation, social skills/emotion regulation, relationships, health and well-being, daily skills/self-care, finances, and transportation). Most reported improvements in social factors (85%; e.g., confidence and self-advocacy), managing stress (62%), and managing conflicts (54%). On a Likert scale of 1 (“Highly Dissatisfied”) to 5 (“Highly Satisfied”), most participants rated the immersion week (M = 4.58, SD = 0.63) and the coaching sessions (M = 4.42, SD = 0.99) as highly acceptable. Approximately 80% of participants would recommend the program and 19% might recommend the program. Reasons for recommending the program included the program’s impact on goal setting and problem-solving, appropriateness for the autistic community or identity, improvements in life outlook, and an opportunity to engage in social activities with others. Most participants indicated that the amount of coaching time was just right. On average, participants completed one goal per week indicating the program was appropriate for helping autistic adults set and attain self-determined goals. Although the program was feasible, the feasibility of supporting self-determination was impacted by parent involvement, communication challenges, and obstacles with goal setting and attainment.

**Conclusions:** The success of our self-determination program supports that programs and services based on the neurodiversity paradigm may empower autistic and other neurodivergent populations. Future research should examine program efficacy using a randomized control trial.

**403.074 (Poster)** Effects of Creative and Fine-Motor Interventions on Fine Motor Skills and Executive Functioning of Children with ASD  
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**Background:** Children with Autism Spectrum Disorder (ASD) have primary and secondary impairments in social communication skills, fine/gross motor performance, and executive functioning. In the past, our research group reported greater improvements in gross motor skills in children with ASD after receiving rhythmic and yoga-based interventions compared to a fine motor-based (FM), standard of care intervention. In the current ongoing randomized controlled trial (RCT), we compared the effects of creative movement (CM, using music and movement) and seated play, fine motor interventions (FM, using building and art activities, standard of care) on fine motor skills and executive functioning.

**Objectives:** In the current analysis, we will compare the effects of CM and seated play, FM interventions on the fine-motor and executive functioning skills of children with ASD.

**Methods:** Thirty children with ASD between 6 and 14 years were recruited and randomly assigned to the CM or FM groups. Both groups received 16 training sessions (2 sessions/week), over 8 weeks. The CM group engaged in whole-body movements using music, dance, and yoga to promote IPS, imitation, coordination, and balance; whereas the FM group engaged in tabletop activities such as reading, building, and art-craft to promote social interactions and fine-motor skills. Each child completed the following tests before and after the intervention period: a) The fine motor integration,

fine-motor precision, and manual dexterity subtests of Bruininks-Oseretsky Test of Motor Proficiency, edition 2 (BOT-2- FMI, FMP, MD), and b) The Flanker task assessing for inhibitory control (i.e., point accuracy and reaction time during congruent (CONG) and incongruent (INCONG) conditions). We also assessed their task-specific performance during Lego and Playdoh building tasks before and after interventions.

**Results:** Our preliminary data in 24 children with ASD (13 in CM and 11 in FM) suggests positive results after CM and FM training. Both CM and FM groups showed improved BOT-2 FMI and FMP scores ( $ps < 0.05$ ) with no significant changes in the BOT-2 MD scores ( $ps > 0.05$ ). The CM group showed decreased reaction time during CONG and INCONG conditions (RT in sec (Mean $\pm$ SE), Pre = 2.56 $\pm$ 0.69 (CONG), 3.13 $\pm$ 0.79 (IN); Post = 1.36 $\pm$ 0.63 (CONG), 1.71 $\pm$ 0.89 (IN);  $p = 0.03$  and  $0.04$ ); while the FM group showed decreased reaction time during CONG condition only (RT in sec, Pre = 1.63 $\pm$ 0.19 (CON); Post = 1.21 $\pm$ 0.20 (CON);  $p = 0.01$ ). In terms of task-specific performance, 50% children in the FM group (N=10) showed a trend of reduced spatial errors during the Lego task (# of errors, Pre = 4.71 $\pm$ 2.08, Post = 0.29 $\pm$ 0.29;  $p = 0.06$ ) and showed a trend for reduced movement errors during the Playdoh task after intervention (% error, Pre = 45.5 $\pm$ 17.4, Post = 20.0 $\pm$ 14.1;  $p = 0.08$ ).

**Conclusions:** These findings support the use of CM and FM interventions in promoting fine motor skills and inhibitory control in children with ASD, with the CM group showing greater improvements compared to the FM group. ASD clinicians should consider adding creative components (music, synchrony) to their standard of care intervention.

#### **403.075 (Poster)** Implementation Fidelity of T-STEP Program for Transition-Age Autistic Adults

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**Background:** There is a critical need for effective vocational rehabilitation services for transition-aged autistic young adults (Alverson & Yamamoto, 2017; Burgess & Cimera, 2014). The TEACCH School Transition to Employment and Post-secondary Education (T-STEP) program includes a comprehensive curriculum (i.e., 24 ninety-minute classes across 12 weeks) that teaches strategies for successfully navigating the challenges with transitioning to adulthood for autistic adults. Though fidelity of intervention implementation is often under-reported in intervention research (Hume et al., 2011), it is critical both for the generalizability of treatment effects and the feasibility of dissemination to other clinicians particularly to the ability for community clinicians to implement an intervention beyond the university environment.

**Objectives:** In evaluating the degree to which the manualized T-STEP intervention was delivered as intended to optimize participant outcomes, we aimed to examine treatment fidelity for outpatient clinicians from the UNC TEACCH Autism Program and community college instructor partners. Specifically, we examined 1) the breadth of content taught during each session, and 2) the types of implementation strategies used by facilitators delivering the intervention.

**Methods:** The T-STEP was conducted for four semesters across two sites with one TEACCH outpatient clinician and one community college instructor serving as interventionist at each site. After attaining a minimum reliability of 80%, research staff were randomly assigned to review video-recorded sessions with 30% double coded for reliability. Interventionists were scored on both the quantity (i.e., amount of content covered) and quality (i.e., number and type of instructional and engagement strategies utilized) of their intervention delivery.

**Results:** Reliability between coders was high ( $> 91\%$ ). Overall, interventionist fidelity across both quantity and quality of intervention delivery was strong. On average, interventionists scored 8.61 out of a maximum score of 9 in the quantity of content items covered across 54 sessions. Average scores in quality were calculated from the number of instructional and engagement strategies utilized; facilitators scored an average of 8.78 out of 9 across all coded sessions. The two instructional strategies that were most frequently used by facilitators were prompting students to use a tool or routine strategy from a previous lesson (e.g., visual reminders) and including or soliciting personal stories or other student examples. The least used instructional strategy was modeling (e.g., live, video) to demonstrate specific skills.

**Conclusions:** Interventionists covered 100% of the content for 50 of the 54 intervention sessions. Across sessions, four different interventionists demonstrated consistently high-quality intervention delivery. Interventionists utilized a variety of evidence-based engagement (e.g., acknowledges or restates student comments) and instructional (e.g., uses visual supports or visual reminders) strategies. Visual reminders were the most common routine strategy prompted by facilitators and have been shown to support planning and organization skills for autistic individuals, with associated increases in both on-task behavior and task completion (Hume & Odom, 2007). Overall, findings support the feasibility of implementing the full T-STEP curriculum to fidelity. Results suggest the T-STEP intervention may be a highly feasible and generalizable treatment approach to meet a critical need for transition-based services for autistic individuals.

## **VIRTUAL POSTER SESSION — INTERVENTIONS - NON-PHARMACOLOGIC - SCHOOL-AGE, ADOLESCENT, ADULT**

### **503 - Interventions - Non-pharmacologic - School-Age, Adolescent, Adult --- (V)**

#### **503.015 (Virtual Poster)** A Realist Evaluation of a Mealtime Service for Autistic Children

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## Background:

Mealtimes are complex multi-sensory experiences involving various textures, tastes, smells, appearances of food, and auditory input from the environment. Autistic children are more likely to experience feeding and mealtime difficulties compared to their neurotypical peers, with estimates suggesting that over 50% of autistic children experience difficulties at mealtime. Given the complexities of autism and the mealtime difficulties, addressing the needs of autistic children in intervention is difficult, and little is about the active ingredients required for an effective mealtime interventions.

## Objectives:

This study aimed to explore caregiver and therapist perceptions of the contexts, mechanisms, and outcomes of a transdisciplinary mealtime intervention for autistic children.

## Methods:

A qualitative approach guided by the Realist Evaluation framework was used to determine the contexts, mechanisms, and outcomes of a transdisciplinary mealtime program for autistic children. A Realist Evaluation approach is increasingly used to evaluate complex interventions, acknowledging that contextual elements can influence interventions and their outcomes. Based on the Realist Evaluation research design, individual interviews were conducted with caregivers and therapists to explore their perceptions of specialised mealtime management support provided by Therapy Focus' Mealtime Eating Allied Health Liaison Service (MEAHLs) in Western Australia. A total of 10 therapists and 6 caregivers participated, with data analysed thematically using a Realist Evaluation approach framework.

## Results:

Data analysis resulted in 11 context codes, 19 mechanism codes, and three outcome codes which were organised into four context themes, three mechanism themes, and two outcome themes. Contextual factors including child-related factors (interests and mealtime difficulties of the child), family-related factors (caregiver stress and family capacity), therapist factors (case-load and clinical experience) and institutional parameters influenced the caregiver engagement in the mealtime programme and the services that therapists provided. Contexts interacted with programme mechanisms including transdisciplinary collaboration (communication within the team, the role of therapists and contribution of expertise to service delivery), child-centred approach (child's and family's needs and adapting service provision to the child) and managing caregiver expectations (caregiver education and goal setting) to trigger outcomes. Outcomes of the mealtime programme included increased readiness for mealtimes, increased food acceptable, changes in mealtime behaviour and reduced caregiver stress during mealtimes.

## Conclusions:

The realist evaluation applied in this study has demonstrated the complex interaction between the contexts, mechanisms, and outcomes associated with a mealtime programme for autistic children. Taking into account the contextual factors of the child, family and therapist prior to entering into service provisions is required to adapt service provision to effect positive mealtime outcomes. Findings suggest a child-centred transdisciplinary programme that adapts to the unique mealtime needs of autistic children and their caregivers is required to improve mealtime outcomes.

## **503.016** (Virtual Poster) Adaptation of the De-Stress and Progress© Program for Autistic Adolescents: Preliminary Results of Implementation in High Schools

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**Background:** Changes and challenges encountered during adolescence increase the vulnerability to the negative effects of stress and may predispose the onset of mental health disorders. The autistic teenager is no exception. Adolescents with an autism spectrum disorder (ASD) might experience more stress during social interactions than those not on the spectrum, as suggested by high cortisol activity during the interaction. Furthermore, certain characteristics of ASD, such as behavioral deficits related to social skills and emotion regulation, could generate additional vulnerability to various stressors. Compared to children without autism, those on the spectrum may use more frequently avoidance, physical forms of ventilation such as self-stimulation to regulate their internal state and less frequently constructive strategies such as seeking help or comfort. Thus, from a perspective of preventing consequences of stress, it is essential to support adolescents to encourage their optimal adaptation and development. In close collaboration with those working in schools, we have implemented the De-stress for Success® (CESH, Lupien et al., 2013) program within four special education classes in the province of Québec. The program is composed of 5 workshops, offered once a week by a trained school clinician and address the components of stress, the physical signs of stress, emotion and problem focused strategies and social support.

**Objectives:** The overall objective of this study is to explore the potential of the De-Stress for Success® program to support adolescents with ASD, more specifically to estimate the potential effects of this program on adaptive functioning and emotion recognition which are known constructs related to stress.

**Methods:** Before attending the five workshops, one week after the end of the program and five weeks later, 22 students on the autism spectrum ( $M = 14.03$ ,  $SD = 1.15$ ) completed an emotion recognition task with *The Montreal Set of Facial Displays of Emotion* (Beaupé & Hess, 2005), which

includes 54 photographs illustrating shame, joy, fear, disgust, sadness and anger. Their teachers completed the *Behavior Assessment System for Children* (BASC-3; Reynolds et Kamphaus, 2015) at these three time periods.

**Results:** Multivariate analysis of variance on repeated measures support the potential of the program in improving general adaptation and recognition of emotions. The students identified with greater facility facial expression of joy ( $F(21) = 27.48, p < .001$ ) and sadness ( $F(21) = 13.36, p < .001$ ). The teachers noted less behaviors related to atypicality ( $F(18) = 5.41, p < .05$ ) and withdrawal ( $F(18) = 5.27, p < .05$ ). They also observed improvement in adaptive skills ( $F(18) = 22.99, p < .001$ ), precisely social skills ( $F(18) = 5.73; p < .05$ ), leadership ( $F(18) = 6.9, p < .05$ ), functional communication ( $F(18) = 37.23, p < .001$ ) and adaptability ( $F(18) = 15.48; p < .001$ ).

**Conclusions:** These results provide support in favor of a transdiagnostic approach to intervention, by proposing to focus efforts on reducing stress, a common trigger of a multitude of adaptive challenges related to autism (such as self-isolation, difficulties in social skills, functional communication and emotional regulation) instead of intervening separately on these difficulties. Thus, this intervention has an impact beyond the concept of stress.

#### **503.017 (Virtual Poster)** Effects of a Visualizing Intervention on Reading Comprehension in Autistic Children

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#### **Background:**

Previous research has shown that many autistic children and adolescents struggle with reading comprehension, even in the presence of typical decoding abilities (Nation et al., 2006; Norbury & Nation, 2011). This could be due to difficulties integrating multisensory information, such as verbal knowledge and visual imagery (Paivio, 1991). Interventions designed to strengthen the relationship between visualizing skills and verbal comprehension could improve reading comprehension for autistic children. This has widespread implications as improving reading comprehension can lead to improved educational outcomes and establish a foundation for life-long learning (National Reading Panel, 2000).

#### **Objectives:**

This randomized control trial (RCT) aims to assess the outcomes of an intensive reading comprehension intervention, "Visualizing and Verbalizing® for Language Comprehension and Thinking" (V/V; Bell, 1991), in improving comprehension in autistic children.

#### **Methods:**

An experimental group of autistic children (ASD-EXP; target n=50), ages 7-13 years, completed a battery of neuropsychological assessments (pre-test), followed by 10 weeks of intensive V/V intervention (4 hours/day, 5 days/week, for a total of 200 hours) before returning for a repeated assessment battery (post-test). Another group of autistic children were randomly assigned to the waitlist control group (ASD-WLC; target n=50) and completed the same assessments but received the intervention after both pre- and post-test sessions were completed. We hypothesize that the ASD-EXP group will make significant gains in reading comprehension at post-test, as measured by the Gray Oral Reading Test (GORT-5; Wiederholt & Bryant, 2012) Comprehension Score. We further hypothesize that the ASD-EXP group will show significantly greater gains in reading comprehension at post-test than the ASD-WLC group. Data collection for this study is ongoing. Preliminary data from ASD-EXP (n=3) and ASD-WLC (n=5) participants who presented for both pre- and post-test have been analyzed. Pre- and post-test GORT-5 Comprehension raw scores were compared within and between participants using a repeated-measures ANOVA. Percent change on GORT-5 Comprehension score was compared between groups using a two-sample t-test. Percent change was calculated as ((post-test – pre-test)/pre-test)\*100.

#### **Results:**

There was a trend towards a main effect of time on GORT-5 Comprehension raw score, with scores increasing from pre- to post-test for both groups,  $F(1)=3.971, p=.0937$ . There was no significant interaction of time\*group,  $F(1)=.441, p=.531$ . There was no significant effect of group on GORT-5 score at either time point,  $F(1)=.012, p=.915$ . Although pairwise group differences in percent change on GORT-5 raw score were not statistically significant,  $t(6)=1.021, p=.347$ , the ASD-EXP group ( $M=38.33\%$ ) showed greater percent change than the ASD-WLC group ( $M=15.18\%$ ).

#### **Conclusions:**

Trends in this preliminary dataset support the promising utility of the V/V intervention for improving reading comprehension in autistic children. In addition to supporting the use of the V/V intervention specifically, these results may also point to the positive benefit of visualization strategies for autistic children. We plan to do additional analyses with standard scores and anticipate stronger trends and statistically significant differences as more data are collected.

#### **503.018 (Virtual Poster)** Can We Improve Online Education for Autistic Teens through Data-Driven Curricular Revisions? Insights from Educators Who Led Two Game Design Workshops

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**Background:** Autistic people are often skilled with computers (DuPaul et al., 2011) and drawn to STEM fields (Wei et al., 2013) yet encounter difficulties obtaining employment (Shattuck et al., 2012). Therefore, evidence-based strategies to help neurodivergent youth engage with STEM curricula as empowered learners are sorely needed.

Our research was designed with an informal educational non-profit where neurodivergent youth learn authorial technology skills. Staff facilitated two game design workshops for autistic adolescents. Workshop 1 (July 2021) combined game design principles, workforce readiness, and social justice issues. Workshop 2 (August 2021) focused on the same concepts after curricular revisions based on Workshop 1. We present staff reflections on the successes and challenges of these workshops.

**Objectives:**

1. Assess staff perceptions of whether students in each workshop achieved four learning goals (LGs).
2. Understand how changes after Workshop 1 impacted staff perspectives.
3. Examine the degree to which educator and student engagement ratings aligned.

**Methods:** Seven staff members (one teacher, assistant teacher, social worker, and occupational therapist and three counselors) were surveyed (Table 1) on the final day of two, ten-day virtual game design workshops for two cohorts of autistic adolescents ( $n=20$ ;  $n=19$ ).

Students and staff completed engagement probes following targeted activities (Riccio et al., 2021). After Workshop 1, staff collaboratively implemented changes including increased differentiation, daily “staff spotlights” about different careers, agendas, and more time to share students’ interests. Staff were given “diversity profiles” to help them provide individualized support based on student’s strengths, interests, and challenges.

**Results:** Staff reported that most students achieved each LG across both workshops (Table 2). Staff were more likely to report that students attained LG2 (social justice) following Workshop 2 ( $p=.029$ ) describing increased effectiveness of teaching methods LG2 ( $p=.031$ ).

Staff reported being more prepared to teach game design concepts than social emotional or social justice themes and being more prepared following Workshop 2 than 1. However, differences were not significant ( $ps >.11$ ).

Staff reported that familiarity with the curriculum and additional teaching strategies improved Workshop 2. Staff felt that opportunities for students to playtest each other’s games contributed to their achieving LG1. Staff reported wanting to provide more 1-on-1 support, but found the virtual format and time constraints challenging.

Despite evidence of improvements across workshops from educators’ perspectives, educator ratings of student engagement were often not well-aligned with students’ ratings of their own engagement; it was rare for more than one educator to achieve a moderate positive correlation between their engagement ratings and students’ own engagement ratings for each activity assessed.

**Conclusions:** Results highlight the importance of data-driven iterations when developing supports for autistic learners. Increased focus on individualization and interaction led educators to have more confidence in student learning following Workshop 2. Additional training may have helped staff engage in meaningful social justice discussions during Workshop 2. Despite benefits of online workshops, educators struggle to accurately assess student engagement online. Results suggest that program evaluation and iteration improve staff readiness to facilitate online educational programming but student feedback is essential for understanding (and thus promoting) engagement.

**503.019 (Virtual Poster)** Does Participation in Social Skills Intervention Improve Quality of Life for Teens with ASD? a Preliminary Investigation  
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**Background:** The Program for the Education and Enrichment of Relational Skills (PEERS®) is an intervention shown to improve social skills in autistic (ASD) adolescents (Laugeson, 2011). However, intervention programs are criticized by some autistic self-advocates claiming that these strategies are neuro-typical centric and encourage behavior akin to social “masking” (Roberts, 2021), which refers to consciously and unconsciously mimicking neuro-typical behavior and suppressing ASD traits, and is related to poor mental health (Cage, 2019).

**Objectives:** (1) Examine how participation in PEERS® is related to quality of life measures such as happiness, social anxiety, and loneliness. (2) Examine how quality of life measures are related to caregiver-reported social skills and ASD severity, as these measures are often used to indicate intervention efficacy.

**Methods:** Participants included ASD adolescents ( $n=13$ ,  $M=14.7$ ) and their caregivers. Measures were collected before (Time 1; T1) and after PEERS® (Time 2; T2). Caregivers completed the Social Responsiveness Scale Second Edition (SRS-2; Constantino, 2012) and Social Skills Improvement System (SSIS; Gresham and Elliott, 2008). Adolescents completed the Loneliness and Social Dissatisfaction Scale (LSD; Asher &

Wheeler, 1985), Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1988), and Happiness subscale of the Piers-Harris Self-Concept Scale Second Edition (PH2; Piers & Herzberg, 2002).

Results: Repeated measures ANOVAs did not indicate differences in either social satisfaction/loneliness (LSD) or happiness (PH2) ( $p$ 's > .2) over time. A marginal decrease in social anxiety (SIAS) was observed ( $p=.062$ ). SRS-2 scores decreased ( $p=.002$ ), and SSIS scores increased ( $p=.022$ ). Social satisfaction/loneliness at T1 was negatively correlated with SRS-2 score at T2, ( $p=.022$ ). Social Anxiety at T1 was positively correlated with SRS-2 score at T2 ( $p=.002$ ). SSIS score at T1 was positively correlated with change in SIAS scores between T1 and T2 ( $p=.046$ ). SSIS score at T1 was negatively correlated with change in happiness from T1 to T2 ( $p=.004$ ).

Conclusions: Consistent with previous studies, social skills improved after participation in PEERS®. No significant changes were observed in loneliness/social satisfaction or happiness between the two time points; however, marginal improvements to social anxiety were observed. Teens with higher social satisfaction at the beginning of the program had better caregiver-reported social skills after PEERS®. This suggests that teens who were more satisfied with their social experiences at the beginning of the program were more likely to be perceived as socially skilled by their caregivers at the end of the program. Participants with higher starting social anxiety had lower ending caregiver-reported social skills. It is possible that the participants' social anxiety prevented them from actively participating in the program as much as other participants. Participants who had better initial caregiver-reported social skills had less robust improvements to both social anxiety and happiness. It is possible that less-affected teens had less room to improve in these categories. Overall, results indicate that although significant changes were not observed in happiness or loneliness/social satisfaction after PEERS®, individual characteristics may clarify the relationship between quality of life measures and caregiver-reported social skills. Future research should investigate how participation in intervention affects quality of life in individuals with ASD.

**503.020 (Virtual Poster)** Effectiveness of Improving Joint Attention in Low-Functioning Chinese-Speaking Children with Autism: Comparison of Robot-Based Intervention to Human-Based Intervention

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Background: Children with Autism Spectrum Disorder (ASD), especially those with low cognitive functioning, have response to joint attention (RJA) and initiation of joint attention (IJA) impairments. Existing interventions rely heavily on human therapists, who are greatly involved in the intervention procedures and provision of feedback and reinforcement. However, human-based intervention incurs high costs to families with children with ASD. Besides, individuals with ASD show deficits in orienting themselves toward social stimuli, engaging with humans, and maintaining social relations. The dynamic facial features and expressions of human beings may induce intensive sensory processing in individuals with ASD, possibly resulting in sensory and emotional overstimulation and distraction. As a result, it is necessary to develop effective, affordable, and timely intervention for children with ASD through the application of technology (such as social robots). Previous research found positive learning outcomes of robot dramas but did not include human-based intervention for comparison of learning effectiveness (So et al., 2020; online). In contrast, Zheng et al. (2020) and Srinivasan et al. (2016a, 2016b) did not find significant positive learning outcomes of robot-based intervention, but their results should be interpreted with caution as their designs of their robotic intervention either might not arouse children's motivation or might not be comparable to human-based intervention.

Objectives: The present study aimed to address the limitations of research design of the previous studies and compare the learning effectiveness of robot-based intervention to human-based in RJA and IJA.

Methods: A total of 38 Chinese-speaking speaking children aged 6-9 were randomly assigned to the robot-based intervention and human-based intervention. They were confirmed with having autism (mean ADOS-2=8), severe social impairments (mean SRS>100), and moderate intellectual disabilities (mean IQ=40). Before and immediately and one month after intervention, they were administered with the Early Social-Communication Scales (ESCS; Mundy et al., 1996). Each child received six training sessions, with each session lasting for 30 minutes, over three weeks. He/she watched one or two dramas in each training session depending on his/her attention span. There were totally six dramas. In the robot-based intervention, two robots demonstrated RJA and IJA in the form of dramas. The intervention procedures in the human-based condition were the same except that human acted in the dramas. Caregivers of the participating children completed the social validity questionnaire after the intervention.

Results: See Figure 1. There was significant interaction effect,  $F(2,68)=3.38, p<.04, \eta^2=.12$ . After taking six drama lessons, children in the robot-based intervention produced more RJA behaviors in the delayed post-test than in the pre-test. They were also found to have an increase in IJA behaviors in the immediate post-test than in the pre-test, and more promising, their increase was maintained in the delayed post-test. However, those improvements were not evident in the children taking human-based drama lessons. These findings were in line with parents' ratings of both kinds of intervention. Parents of the children receiving the robot-based intervention rated the program more positively than those of the children taking the human-based intervention.

Conclusions: Robot-based intervention may be more effective than human-based intervention in promoting RJA and IJA.

**503.021 (Virtual Poster)** Effects of Creative Movement Interventions on Rhythmic Praxis and Drumming Performance of Children with Autism Spectrum Disorder

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**Background:** Over 85% children with Autism Spectrum Disorder (ASD) are at risk for motor coordination impairments. Children frequently have impaired balance, bimanual coordination, imitation, interpersonal synchrony, and praxis skills. Praxis is the ability to plan and execute multi-step actions/gestures. For instance, children with ASD have difficulties with spatial and temporal aspects of movement execution when asked to perform skilled hand gestures to imitation and verbal command.

**Objectives:** This study will assess the effects of a creative movement intervention compared to a seated play intervention on the rhythmic praxis and bimanual coordination skills of children with ASD.

**Methods:** 30 children with ASD between 6 and 14 years were recruited. The study lasted for 10 weeks with pretests and posttests conducted in the first and tenth weeks. Children were matched on age, gender, and functioning level and then randomly assigned to one of two groups: Creative Movement (CM) or Seated Play (SP). Each child received 8 weeks of training @ 2 sessions/week. The CM group engaged in rhythmic movements to music while imitating partners during drumming and whole-body movements with a focus on bimanual coordination. The SP group engaged in tabletop activities such as reading, building, and art-craft. Outcome measures included a drumming test that required children to copy incrementally challenging, sequential motor patterns performed by a tester. We coded both spatial (movement precision, modulation, and symmetry/reciprocity) and temporal aspects (movement rhythmicity and pace) of imitation accuracy during the drumming test. The Bilateral Motor Coordination Subtest of the standardized, Sensory Integration and Praxis Tests (SIPT-BMC) was also administered at pretest and posttest.

**Results:** Preliminary data from 9 children in the CM group suggest that 77% of the children showed a reduction in spatial errors during drumming in the posttest (Mean(SE): 10.7(7.11)) vs. pretest (5.3(5.8)). Specifically, 66% children improved their ability to precisely copy multi-step drumming patterns (Pretest:4.7(1.6), Posttest:2.3(0.8)) and 55% of the coded sample improved their ability to appropriately modulate (Pretest:4.6(1.5), Posttest:2.2(0.7)) drumming actions. In terms of temporal errors, 55% of the children improved their ability to replicate the demonstrated rhythms in the posttest (1.7(0.6)) vs pretest (3(0.3)). We did not find any improvements in other temporal error categories during the drumming test. During SIPT-BMC, children in the CM group showed improvements in temporal performance posttest (6.3(1.7)) vs. pretest (11.9(3.4)). We hypothesize that the CM group will show greater improvements in rhythmic praxis and drumming performance compared to the SP groups.

**Conclusions:** Creative movement interventions that provide children opportunities for instrument play and rhythmic movement to music are excellent ways to promote rhythmic praxis, imitation, motor planning, and complex bimanual coordination in children with ASD. Our ongoing work serves as preliminary evidence to advocate for rhythmic movement opportunities within therapy contexts for children with ASD.

**503.022 (Virtual Poster)** Effects of a Rhythm-Based, Creative Movement Intervention on Social Communication, Behavior, and Affect in Children with ASD

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**Background:** Children with Autism Spectrum Disorder (ASD) demonstrate social communication impairments and engage in restricted and repetitive behaviors. Our past work has demonstrated the positive effects of whole-body rhythm- and yoga-based interventions on social communication, affect, and repetitive behaviors in school-age children with ASD.

**Objectives:** Our ongoing clinical trial builds on this work by comparing the effects of a rhythm-based creative Movement (CM) intervention to a standard-of-care, Seated Play (SP) intervention on social communication and behavioral-affective skills in children with ASD. In light of COVID-19, a subset of children in both groups were seen online using video-conferencing platforms allowing comparisons between face-to-face versus telehealth-based intervention delivery.

**Methods:** 30 children with ASD between 6 and 14 years were seen over 10 weeks with pretests and posttests conducted during the first and tenth weeks. Children were matched on age, gender, and level of functioning and then randomly assigned to CM or SP groups. Each child received 8 weeks of training @ 2 sessions/week conducted with an expert trainer and an adult model. The CM group engaged in music, dance, and yoga-based activities promoting interpersonal synchrony, imitation, bilateral coordination, and balance skills. The SP group engaged in tabletop reading, building, and art-craft activities to promote academic and fine motor skills. The standardized Joint Attention Test (JTAT), administered at pretest and posttest was used to assess changes in responsive joint attention. We also coded the % duration of verbalization and positive affect as well as rates of repetitive behaviors across an early, mid, and late training session.

**Results:** Preliminary data from the CM group suggest that 9 out of 13 children showed improved responses to the verbal bids on the JTAT from pretest to posttest. From an early to a late session, 77% reduced self-directed verbalization and instead engaged in socially directed verbalization towards the trainers. Moreover, CM interventions promoted greater spontaneous speech initiations (Mean(SE): 11.3(1.4)) compared to responsive verbalization (Mean(SE): 2.1(0.3)) in all children across sessions. 55% of children showed a reduction in total frequencies of repetitive and maladaptive behaviors from an early to a late session. Specifically, children reduced the frequencies of sensory behaviors with objects (Early: 9.9(1.8), Late: 5.9(1.6)) and negative behaviors (Early: 9.1(3.1), Late: 6(2.4)) following training. Our preliminary data suggest that children seen face-to-face and via telehealth demonstrate similar trends in terms of training-related improvements. We hypothesize that the CM group, irrespective of mode of intervention delivery, will demonstrate greater improvements in measured outcomes compared to the SP group.

**Conclusions:** These findings build on past evidence from this research team on the value of socially-embedded CM therapies in addressing core impairments in ASD. Moreover, our preliminary data suggest that telehealth-based intervention delivery is a viable option to access therapies for at

least some children with ASD. Our work supports the inclusion of whole body, rhythmic movement experiences in the standard-of-care in ASD and emphasizes the role of physical therapists as motor advocates for children with ASD.

**503.023 (Virtual Poster)** Effects of the “Transition to Kobe University Program” on High School Students with High-Functioning Autism Spectrum Disorder

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**Background:**

Many students with high-functioning autism spectrum disorder (HFASD) exhibit high performance in academic skills. However, some university students with HFASD exhibit difficulties in social and advocacy skills, which results in them dropping out of university. Since these students exhibit problems related to their academic, social, daily living, and advocacy skills at a high school age (Adreon & Durocher, 2007), we developed the Transition to Kobe University Program (TKUP) for high school students with HFASD in 2019. In 2020, the COVID-19 pandemic forced individuals to change their lifestyles and maintain physical distancing. Thus, we modified our TKUP method from a face-to-face (FFTKUP) to an online (OLTKUP) one using the Zoom video conferencing platform. In this presentation, we present the effects of both FFTKUP and OLTKUP on high school students with HFASD.

**Objectives:**

To investigate the effects of both FFTKUP and OLTKUP on high school students with HFASD.

**Methods:**

**Participants:** The participants comprised high school students with HFASD. Two boys and one girl participated in the OLTKUP, while five boys and one girl participated in the FFTKUP. One boy was excluded from the FFTKUP as his score in the Social Responsiveness Scale Second Edition (SRS-2) was below 60 (see Table 1).

**Materials:** The TKUP framework consists of academic, social, and advocacy skills, as well as knowledge about life in the university; for the OLTKUP, we also employed the Zoom platform.

**Procedure:** All sessions were conducted on Friday night after school. For the FFTKUP, we had seven sessions, conducted once a month from June to February 2019, except August.. For the OLTKUP, nine bi-monthly sessions were held, from September 2020 to February 2021. Before and after each session, students answered a questionnaire comprising six items rated on a 10-point Likert scale ranging from “I have no idea” (1) to “I understand” (10).

**Results:**

A comparison of the six items before and after the sessions shows that students with HFASD could understand the transition to university regardless of the programs (see Table 2). Scores of the items were as follows: “difference from high school learning” ( $t(6) = -6.30, P < .01$ ); “campus life” ( $t(7) = -3.47, P < .05$ ); “importance of self-determination” ( $t(7) = -3.42, P < .05$ ); “how to make a report” ( $t(7) = -2.89, P < .05$ ); “schedule management” ( $t(7) = -4.12, P < .01$ ); and “protect privacy” ( $t(7) = -2.20, n.s.$ ).

**Conclusions:**

All high school students with HFASD reported the TKUPs (both FFTKUP and OLTKUP) to be beneficial. Our findings also indicated the OLTKUP to be as effective as the FFTKUP. However, due to the small sample size, the study has certain limitations.

**503.024 (Virtual Poster)** Exploring the Acceptability of a Community-Based Cognitive Behaviour Therapy Program for Autistic Children: A Mixed-Methods Approach

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**Background:** Autistic children often experience high levels of socioemotional difficulties and can be supported using cognitive behaviour therapy (CBT; Perihan et al., 2020; Weston et al., 2016). Emerging research has evaluated aspects of the clinical utility of these interventions, such as generalizability and feasibility (Goodheart et al., 2006). Another aspect of clinical utility is multi-faceted acceptability, which includes seven

domains: affective attitude, perception of burden, ethicality, intervention coherence, opportunity costs, perceived effectiveness, and self-efficacy (Sekhon et al., 2017). Research is needed to understand the acceptability of CBT interventions when provided to autistic youth.

**Objectives:** A mixed-methods approach was used to investigate caregiver-reported acceptability of a virtual 10-week, group-based CBT intervention for autistic children, Secret Agent Society (Beaumont, 2015), which focuses on social and emotion regulation skills, as delivered by seven community-based autism service agencies in Canada.

**Methods:** 77 caregivers (94% females;  $M = 42.5$  years,  $SD = 5.7$  years) and their children (79% males;  $M = 9.9$  years,  $SD = 1.3$  years) completed the intervention. All children had a confirmed autism diagnosis from a regulated health care professional. On average, caregivers participated in 90% of the caregiver-related sessions ( $SD = 20\%$ , Range: 0-100%) and children completed 95% ( $SD = 10\%$ , Range: 33-100%) of their sessions. Caregivers completed post-intervention surveys including a novel acceptability measure, based on the Theoretical Framework of Acceptability (Sekhon et al., 2017): The Implementation Acceptability Scale (7 items, 5-point Likert scale from “Strongly Disagree” to “Strongly Agree”). Semi-structured focus groups and interviews were conducted with 64 caregivers.

**Results:** Levels of acceptability across domains were variable. Caregivers reported feeling positively about the program (75%), that it aligned with their values (95%), and that they understood how it worked (87%). Some caregivers felt that the program required an unacceptable amount of effort (39%), felt they had to give up resources or opportunities to participate in the program (23%), felt that it was not effective in achieving its goals (38%), and did not feel confident in the skills they had learned (23%). Qualitative analysis revealed that therapist knowledge and rapport-building skills contributed to overall program acceptability. Many caregivers had positive attitudes towards the program, stating benefits in their children’s sense of connectedness with other children and caregivers due to the group-based format, despite the program being provided online during the pandemic. Some caregivers noted high opportunity costs related to the additional time and effort spent maintaining children’s engagement with the online format. However, the online format reduced other opportunity costs (e.g., travel, scheduling). Many caregivers felt that the program was effective in achieving its goals, but there were limitations to applying strategies outside of sessions. The fast-paced sessions and high volume of content were linked to lower feelings of caregiver self-efficacy.

**Conclusions:** Understanding the acceptability of autism-based interventions may provide insight into the factors that influence adherence and uptake of the clinical benefits of interventions in the community. Future research is needed to examine how contextual factors (e.g., pandemic) influence other aspects of the clinical utility of these interventions.

#### **503.025 (Virtual Poster)** Is It Possible to Foster Social Competence Via Telehealth? Examining Effects of PEERS® for Adolescents Telehealth for Autistic Adolescents

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Background: Emerging evidence indicates that telehealth services may be effective for autistic individuals (Ellison et al., 2021), yet research on telehealth administration of social skills interventions is still limited. It is important to continue examining the effectiveness of specific telehealth services for autistic youth to further expand access to care during and post-pandemic. The PEERS® intervention (Laugeson & Frankel, 2010), delivered in-person, has been found to increase social knowledge, social responsiveness, social skills, and get-togethers (Laugeson et al., 2009, 2012; Schohl et al., 2014). The telehealth administration of PEERS® offers many benefits (e.g., adherence to health guidelines, increased accessibility, etc.), and may also pose challenges (e.g., potentially fewer informal interactions between participants, unknown implications of virtual social activities). Thus, it is essential to determine whether the telehealth version of PEERS® is equivalent to in-person intervention, outside of the site of development.

**Objectives:** This study explores the effects of the PEERS® for Adolescents Telehealth intervention on core social domains including autistic features, get-togethers, and social knowledge.

**Methods:** 12 families with adolescents aged 11-16 ( $M=13.3$ ;  $SD=1.36$ ; 91% male) were enrolled in the current study based on 1) documentation of an autism diagnosis, 2)  $IQ \geq 70$ , and 3) access to reliable Wi-Fi with at least two devices. Families completed pre- and post-adolescent self-report forms (QSQ-A-R; TASSK) and pre- and post-caregiver-report forms (QSQ-P-R; SRS). Participants completed PEERS® in 16 weeks via Zoom and Microsoft Teams. Paired sample t-tests SPSS 27.0 examined change pre- to post- intervention. Due to the small sample, a combination of null-hypothesis significance testing and effects sizes was used to interpret results.

**Results:** Analyses confirmed decreases in core autistic symptoms as measured by the SRS (Total score),  $t(11) = 3.744$ ,  $p = .003$ ,  $M_{pre} = 103.08$ ,  $SD_{pre} = 24.24$ ,  $M_{post} = 84.92$ ,  $SD_{post} = 26.53$  with a large effect size (Cohen’s  $D = 1.08$ ). Significant change was reported by caregivers regarding total invited and hosted get-togethers, as measured by the QSQ-P-R,  $t(10) = -3.148$ ,  $p = .010$ ,  $M_{pre} = 0.64$ ,  $SD_{pre} = 1.29$ ,  $M_{post} = 6.36$ ,  $SD_{post} = 5.26$  with a large effect size (Cohen’s  $D = .95$ ). Adolescents also reported a significant increase in total invited and hosted get-togethers on the QSQ-A-R,  $t(10) = -4.73$ ,  $p = .001$ ,  $M_{pre} = 0.64$ ,  $SD_{pre} = 1.21$ ,  $M_{post} = 4.09$ ,  $SD_{post} = 2.21$  with a large effect size (Cohen’s  $D = 1.43$ ). Adolescents significantly improved in knowledge of PEERS® concepts and friendship skills as measured by the TASSK,  $t(10) = -4.662$ ,  $p = .001$ ,  $M_{pre} = 13.55$ ,  $SD_{pre} = 1.25$ ,  $M_{post} = 21.27$ ,  $SD_{post} = 4.08$ , and demonstrated a large effect size (Cohen’s  $D = 1.41$ ).

**Conclusions:** These findings indicate that telehealth version of PEERS® yielded similar improvements as those observed in the in-person format. Preliminary findings indicate that PEERS® for Adolescents Telehealth significantly decreases core autistic symptoms, increased knowledge of social skills, and increased number of get-togethers in autistic adolescents. Our findings showcase effects of an evidence-based intervention that can be accessed via telehealth by the autistic community.

**Background:** Self-regulation, which includes emotion regulation (ER) and executive functioning (EF), especially inhibition, plays a crucial role on children's development and life outcome (Diamond, 2013; Moffitt et al., 2011). Challenges in self-regulation are common in children with Autism Spectrum Disorder (ASD) (Kenworthy et al., 2009), and have been shown to be predictive of symptom severity, functioning and treatment outcomes (Gardiner & Iarocci, 2018). Programs and interventions aimed at improving ER and EF in children with ASD have been exponentially increasing. With these new programs comes the responsibility of thoroughly examining the empirical evidence supporting them.

**Objectives:** The current systematic review aims to gather and synthesize information regarding existing interventions that target ER and inhibition in children with ASD, and to examine the evidence supporting these programs, while identifying core components.

**Methods:** The study was preregistered with PROSPERO (CRD42021243700) and procedures and reporting were performed following the Preferred Reporting Items for Systematic review and Meta-Analyses (PRISMA) guidelines. Five databases were used to locate articles: Medline, EMBASE, ProQuest, PsycINFO, and ERIC. Searches were conducted in June 2021 and were limited to peer-reviewed articles published in English or French between 1987 and 2021. The search terms used fell under four general categories: a) ASD, b) children (age 0 to 17), c) training target/outcome (inhibition, EF, and ER), and d) intervention/program. Data extraction was performed using Covidence, and the Evaluative Method for Determining Evidence-Based Practice in Autism (Reichow et al., 2008) and OCEBM were utilized to rate the quality and level of evidence of each study.

**Results:** The database search resulted in 4368 studies, of which 30 met the inclusion criteria involving 884 participants (age range: 3-17 years). Approximately half of the studies included were conducted between 2005-2018, while the remaining half were investigated from 2019-2021. 16 studies targeted inhibition, eight targeted ER and six targeted self-regulation more broadly. 16 studies were group interventions and 14 were delivered on an individual basis. 13 of the studies included were randomized controlled trials (RCT), 11 were non-randomized controlled trials and 6 were case studies, demonstrating mixed evidence for different programs. Studies who received the highest quality rating and support, were mostly programs that targeted school aged children, included a caregiver component allowing for high transferability of skills, and which utilized components of CBT and/or mindfulness, aligning with the current research on evidence-based treatments for ASD. Only one intervention met criteria for a well-established intervention: The Secret Agent Society/Junior detective (Beaumont & Sofronoff, 2008), which targets ER.

**Conclusions:** To our knowledge, this is the first systematic review that investigates inhibition and ER programs for children with ASD. The review highlights key components of interventions that can be utilized to develop a successful program that targets inhibition and ER in children on the spectrum. While most interventions showed promising results, many scored low ratings on quality indicators. Further studies are warranted, particularly RCT studies to bring forth more empirical evidence.

**503.027** (Virtual Poster) Picture Memory in Autistic Children Following a Reading Comprehension Intervention

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**Background:** Often, autistic children's reading comprehension lies significantly below their decoding skills (Huebner & Mann, 2010), requiring an intervention that does not merely focus on improving reading ability. Visualizing and Verbalizing<sup>®</sup> for Language Comprehension and Thinking (V/V, Bell, 1991) is a reading intervention which improves reading comprehension by teaching children to use visual imagery during reading. The V/V intervention is based on the Dual-Coding Theory, which posits two subsystems involved in cognition, a non-verbal (imagery) subsystem and a verbal subsystem for non-linguistic and linguistic information respectively (Pavio, 2007). Prior research has linked facets of these two subsystems, including visual (Lynn et al., 2005) and verbal (Cain, 2006) memory, to reading.

**Objectives:** This study aims to investigate the role of visual and verbal memory in facilitating and improving reading comprehension in autistic children.

**Methods:** In this randomized control trial, children between the ages of 7 and 13 years completed the V/V intervention and presented for pre- and post-testing sessions to track response to treatment. While data collection is ongoing, preliminary data from two autistic groups, an experimental group (EXP; n=6) and a waitlist control group (WLC; n=5), were analyzed. The EXP group completed the V/V intervention between pre- and post-testing sessions, while the WLC group received intervention after completion of both testing sessions. Scaled scores from the following WRAML-2 subtests were utilized: Story Memory (SM), Design Memory (DM), Verbal Learning (VL), and Picture Memory (PM). Mann-Whitney nonparametric statistical analyses were used to assess within-group differences in scaled scores between pre- and post-test and between-group differences in percent change in scores from pre- to post-test.

**Results:** WRAML-2 subtest scaled scores did not significantly differ for either group from pre- to post-testing ( $p=n.s.$ ). Between groups, the difference in the percent change for PM from pre- to post-test was significant ( $U=2.5$ ,  $z=-2.287$ ,  $p=0.017$ ). The mean percent change for PM was 124.76% for the EXP group and -13.52% for the WLC group. Percent change was not significantly different between the groups for SM ( $U=6$ ,  $z=-1.686$ ,  $p=.126$ ), DM ( $U=10$ ,  $z=-.934$ ,  $p=.429$ ), or VL ( $U=10.5$ ,  $z=-.823$ ,  $p=.429$ ). However, for all three of these subtests, mean percent change was higher in the EXP group (SM=150%, DM=34.5%, VL=58.09%) than in the WLC group (SM=-13.89%, DM=28.61%, VL=22.22%), suggesting a possible trend toward greater improvement in the EXP group.

**Conclusions:** Greater improvement in Picture Memory performance in the EXP group suggests that the V/V intervention, which focuses on building visual imagery during reading, may have an impact on visual memory, specifically on the ability to learn and recall meaningful visual information.

Since V/V has been shown to improve reading comprehension (Maximo et al., 2017; Murdaugh et al., 2015; 2017), it is possible that contextual visual memory is one of the mechanisms through which improvements in reading comprehension are facilitated. The trend of improvement across the other subtests for the EXP group suggests that the intervention may have a positive impact on other types of memory as well. Additional data obtained through ongoing data collection will help fully elucidate the patterns behind these trends.

**503.028 (Virtual Poster)** Predictors of Treatment Use in Autistic Children

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**Background:** Autism is a heterogeneous condition with characteristics that present in different ways and is often accompanied by co-morbid psychiatric disorders. Many different treatments are available for autistic individuals, some aimed at reducing core autism symptoms while others target co-occurring problems. The diverse nature of autism and its treatment options justify the need to understand which individual characteristics are associated with the use of which treatment.

**Objectives:** This study aimed to predict treatment prevalence, treatment types (interventions and medication), and treatment load (duration and intensity of treatments) from *demographic* factors (age, sex, parental education level, IQ, educational setting and co-occurring diagnosis) and *autism-specific* features (severity of symptoms, social skills, repetitive and/restrictive behaviours and interests, and sensory issues).

**Methods:** This study used parent reported data on autistic children (N=1464, aged 1-17 years) from the Netherlands Autism Register. Based on (inter)national guidelines (including: CDC, 2019 (US), ESCAP; Fuentes et al., 2020 (European) and NICE, 2013 (UK)) three treatment categories were devised: *Guideline* treatments targeted the core characteristics of autism (social communication and repetitive/restricted behaviours and interests), *Mainstream* treatments included interventions or medication not specifically for autism, targeting associated symptoms (e.g., sleep difficulties) and *Other* treatments are interventions or medications that are not included in the treatment guidelines (e.g., alternative therapies) or are actively discouraged in the guidelines.

**Results:** Most children (88%) had received interventions (77% had received *mainstream*, 77% *guideline* and 28% *other* interventions) and about half (52%) had received medication (51% had received *mainstream* medication and 5% *other* medication). The most commonly reported interventions included: physiotherapy, parent training and social skills training. Children in special education received more interventions and children with co-occurring diagnoses had a higher number of total hours of treatment. Older age, higher IQ and being female were related to more *guideline* (specifically for autism) or *mainstream* (associated symptoms) intervention use. Lower parental education was related to more *mainstream* medication use. Autism specific measures (severity of autism symptoms, social skills, repetitive and restrictive behaviours) did not relate to treatment use. However, more severe sensory issues increased the chance of medication use.

**Conclusions:** Treatment use is mostly guided by demographic factors (age, IQ, gender, parental education) rather than autism-specific characteristics (e.g., level of social skills, or repetitive behaviours). Ideally all children should receive the treatment they need based on the severity and profile of characteristics, regardless of demographic factors such as gender, IQ or parental education. Therefore, autism-specific characteristics should be taken into consideration more when selecting interventions for children as described in international treatment guidelines.

**503.029 (Virtual Poster)** Preliminary Outcomes for Mentors in the Autism Mentorship Program (AMP)

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**Background:** Research shows that relationships with caring, non-parental adult mentors are critical to healthy development and can positively influence a range of outcomes, such as peer and parent-child relationships, identity development, academic achievement, self-confidence, the prevention of problem behaviors, and reducing mental health problems (DuBois et al., 2011; Haft et al., 2019; Raposa et al., 2019; Taussig et al., 2019; Wyman et al., 2010). While mentoring is beneficial for youth, there is evidence that mentoring can be mutually beneficial and also provide positive outcomes for mentors. Mentoring in the autism community, particularly with autistic mentors, is relatively new and this experience has yet to be explored in-depth.

**Objectives:** The aim of this study was to examine preliminary outcomes for mentors participating in the Autism Mentorship Program (AMP).

**Methods:** AMP involves one-to-one mentorship of adolescents with ASD (ages 14-18) by adults with ASD. Mentoring sessions consisted of 22 weekly 60-minute virtual sessions conducted via Zoom. Pairs participated in semi-structured activities centered around common interests. Mentors included 14 autistic adults (ages 19-35; 57% male, 79% non-Hispanic) who were recruited from a local suburban community in the Midwest. All participants had a diagnosis of ASD without co-occurring intellectual disability or language impairments. The majority of participants had co-occurring diagnoses of anxiety, depression, or ADHD. Participants completed a variety of standardized questionnaires including the Social Skills Improvement System (SSIS), the Achenbach Rating Scales (ASR), the Rosenberg Self-Esteem Scale, and a study developed survey evaluating self-concept, quality of life, and daily activities. Descriptive and associational statistics were used to meet objectives.

**Results:**

Participants reported improvements in social and emotional functioning during AMP and also reflected on pieces they found rewarding and challenging about mentoring. Mentors reported a strong relationship quality with their mentees (rating 4.1 on a 5-point scale). They also reported enjoying aspects of mentoring such as being able to guide their mentees, building a positive relationship with their mentee, interacting with other

matches, getting to know autistic students, knowing they could make a small impact on someone's life, and playing games. Mentors noted challenges related to mentoring including maintaining conversations and having difficulty determining how their mentee was feeling. Mentors reported improvements in quality of life ( $d=.58$ ), initiating interactions with friends ( $d=.3.6$ ), and receiving communication from friends ( $d=.50$ ). However, they saw decreases in time spent with friends in person ( $d=-.80$ ), which may be related to the pandemic. Small positive changes were reported regarding self-esteem, social competence, externalizing, and internalizing symptoms.

Conclusions: AMP has the potential to positively impact the social and emotional functioning of autistic mentors. Mentor outcomes should continue to be explored with larger samples in future AMP cohorts.

**503.030 (Virtual Poster)** Satisfaction and Preliminary Outcomes of the PEERS Social Skills Program When Delivered Via Telehealth

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**Background:**

Teens and young adults with autism spectrum disorder (ASD) experience increased social challenges as they experience more complex social environments (e.g., Bauminger & Kasari, 2000; Constantino, 2005). Social skills training can support individuals by improving social skills and knowledge, peer relationships, social-emotional well-being (e.g., Laugeson et al., 2012; Hill et al., 2017). The Program for the Evaluation and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2010), a curriculum using a cognitive-behavioral approach to teach age-appropriate social skills, teaches ecologically valid social skills. PEERS has been adapted for telehealth to meet the increasing wide-spread social needs of those with ASD, including increased need during COVID-19.

Objectives: Investigate the initial response to the PEERS program when implemented via telehealth.

**Methods:**

The PEERS program includes 16 90-minute weekly sessions focused on teaching skills needed to make and maintain friendships. We delivered PEERS for telehealth using the officially adapted telehealth materials created and provided by Dr. Elizabeth Laugeson and the UCLA Semel Institute PEERS Clinic for certified PEERS providers (both authors).

Descriptive analyses included weekly online survey responses from 16 families of individuals (ages 14-22, 82% male) enrolled in two telehealth PEERS groups through an outpatient clinical setting. A total of 274 responses were obtained over the course of these two groups. Participants reported on the following aspects of the session: satisfaction with the session, satisfaction with technology used to host the session, helpfulness of the session, and ability to use the information learned.

Participants were administered outcome measures pre- and post-group to evaluate social and emotional outcomes. Eight families completed pre- and post-group measures. Analyses include pre- and post-test comparisons of mean scores on outcome measures, including the Social Responsiveness Scale, 2<sup>nd</sup> Edition (SRS-2), the Test of Adolescent Social Skills Knowledge (TASSK), the Brief Rating Scale of Executive Functioning – 2<sup>nd</sup> Edition (BRIEF-2), the Generalized Anxiety Disorder – 7 (GAD-7), the Patient Health Questionnaire – 9 (PHQ-9), and the Achenbach Rating Scales (Child Behavior Checklist). Additional pairwise comparisons will be conducted with a larger sample when the next phase of data is collected this winter (expecting an additional 16-20 families to complete data collection), including analysis of the Social Skills Improvement System (SSIS).

Results: Results from online surveys indicated high satisfaction with PEERS via telehealth. Eighty-three percent (83%) of respondents rated the session as Excellent or Very Good; 87% rated the technology used as Excellent or Very Good; 76% reported that the session was Completely or Very Helpful to them; 81% reported they were Completely or Very able to use the information learned. Preliminary analysis shows significant improvements related to social skills knowledge (TASSK), autism-related symptoms (SRS-2, including social communication, social motivation, total score, restricted and repetitive behaviors, and social communication and interaction), executive functioning (BRIEF-2, including inhibition, emotional control, planning/organization, task monitoring, cognitive regulation, and global executive composite), challenging behaviors (CBCL), and anxious and depressed symptoms (GAD-7, PHQ-9, CBCL). See Table 1 for a summary of mean scores.

**Conclusions:**

The PEERS program shows promising results when delivered via telehealth.

**503.031 (Virtual Poster)** Sex-Based Differences of Treatment Response to PRT for Emotional and Behavioral Symptoms

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Background: Psychiatric and behavioral comorbidities are prevalent among children with autism spectrum disorder (ASD), with an estimated 70% of children with ASD having at least one comorbid disorder (DeFilippis, 2018). Comorbidities negatively impact the social and adaptive functioning as well as the overall quality of life of children with ASD (Romero et al., 2016). Pivotal Response Treatment (PRT) is an empirically validated intervention that utilizes a naturalistic and play-based environment and targets social and communication skills (Koegel & Koegel, 2012). Few studies have investigated sex differences in comorbid symptoms in response to PRT.

**Objectives:** The present study examines sex differences in emotional/behavioral comorbidities of children with ASD in response to Pivotal Response Treatment (PRT).

**Methods:** The study included thirty children aged 4-11 years old, 10 girls (M = 95.50 months, SD = 29.36) and 20 boys (M = 84.65 months, SD = 31.30). All children had an ASD diagnosis as confirmed by the Autism Diagnostic Observation Schedule (ADOS). Participants received 6 hours of PRT for 16 weeks. Emotional and behavioral symptoms were assessed before and after treatment using the Child Behavior Checklist – Preschool and School Age (CBCL/1.5-5 ( $n = 14$ ) and CBCL/6-18 ( $n = 16$ )).

**Results:** At baseline, there were no significant sex differences in the CBCL scores of the domains considered (Internalizing Problems, Externalizing Problems, Total Problems, and subdomains Anxious/Depressed, Anxiety Problems, ADHD, and ODD). Following PRT, there were no significant differences in improvement between girls and boys: Internalizing Problems (girls M = 6.00, boys M = 4.60), Externalizing Problems (girls M = 3.80, boys M = 5.40), Total Problems (girls M = 5.70, boys M = 5.85) and subdomains Anxious/Depressed, Anxiety Problems, ADHD, and ODD. However, all participants individually improved significantly across the post-treatment CBCL categories of Internalizing Problems,  $t(29) = 3.3$ ,  $p = .002$ ; Externalizing Problems,  $t(29) = 3.5$ ,  $p = .002$ ; Total Problems,  $t(29) = 3.9$ ,  $p < .001$ ; and ODD subdomain,  $t(29) = 3.4$ ,  $p = .002$ . There was no significant individual change post-treatment in CBCL subdomains Anxious/Depressed, Anxiety Problems, and ADHD. No scores in the symptom domains were significantly worse following treatment.

**Conclusions:** These results indicate that there were no sex differences in comorbid behavioral/emotional symptoms at baseline. There was also no sex-based response to treatment. Notably, both girls and boys show improvement in emotional and behavioral problems following PRT, supporting the efficacy of PRT as an effective treatment for comorbidity symptoms in children with ASD across both sexes.

**503.032 (Virtual Poster)** The Effects of an Eight-Week Physical Exercise Intervention, LEGO and Minecraft Activities on Anxiety in Underserved Children with Autism Spectrum Disorder

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**Background:** Anxiety is a frequent comorbidity in children with autism spectrum disorder (ASD). Physical exercise has been shown to have therapeutic benefits for reducing anxiety in adults and adolescents and may be a low-cost and easy to access intervention for reducing anxiety in younger children with ASD.

**Objectives:** To examine the efficacy of an 8-week physical exercise intervention specifically designed for younger children with ASD from underserved populations to reduce anxiety, and to compare to a sedentary activity LEGO/Minecraft intervention.

**Methods:** 148 children (6-12 years old) with ASD were randomized into a clinical trial to evaluate the efficacy of an exercise protocol designed to reduce anxiety specifically in younger children with ASD. Participants were randomized to an exercise intervention group (N=76) or sedentary activity LEGO/Minecraft group (N=72). Both programs were administered 1-3 times weekly for 8 weeks. Anxiety was assessed with the Child Behavior Checklist DSM-5 anxiety (CBCL DSM-5) at weeks 1, 3, 6, and 8 as well as follow up at weeks 12 and 16. Secondary outcome measures included the Screen for Child Anxiety Related Disorders (SCARED), Child's Sleep Habits Questionnaire (CSHQ-ATN), Physical Activity Questionnaire (PAQ-C), and salivary cortisol measured at weeks 1, 3, 6, and 8.

**Results:** CBCL DSM-5 and SCARED anxiety scores showed improvements in both groups at 8-weeks with no significant differences between the physical exercise and sedentary activity LEGO/Minecraft groups. In addition, the CBCL DSM-5 anxiety scores decreased in the physical exercise group at weeks 12 and 16 compared to baseline. Follow up at weeks 12 and 16 were unavailable for most of the LEGO/Minecraft group, which was offered to participate in the physical exercise intervention after week 8. Sleep as measured by the CSHQ also showed improvements in the physical exercise group but not in the LEGO/Minecraft group with no significant differences between the groups. Physical activity levels were significantly increased in the physical exercise group compared to the LEGO/Minecraft group at week 8. Salivary cortisol did not show any significant changes in groups or differences between groups.

**Conclusions:** Anxiety decreased in the 8-week physical exercise as well as the sedentary LEGO/Minecraft interventions in 6–12-year-old underserved children with ASD with no significant difference between the intervention groups.

**503.033 (Virtual Poster)** School-Partnered Development of a Sleep Intervention for Autistic Students: Lessons Learned

**I. Schouwenaars<sup>1</sup>**, M. Magnee<sup>1</sup>, H. M. Geurts<sup>2</sup>, C. van Bennekom<sup>3</sup>, S. Pillen<sup>4</sup> and J. P. Teunisse<sup>1</sup>, (1)HAN University of Applied Sciences, Nijmegen, Netherlands, (2)University of Amsterdam, Amsterdam, Netherlands, (3)R&D, Heliomare, Wijk aan Zee, Netherlands, (4)Kempenhaghe, Heeze, Netherlands

**Background:**

Teachers at schools for special education observe that their autistic students experience sleep problems (Cortesi et al., 2010) that negatively impact their daytime functioning (Schouwenaars et al., 2021). Although we have seen that schools are willing to support their students in reducing sleep problems, the implementation of sleep interventions in schools remains unsuccessful because most are not developed for a school-based setting.

**Objectives:** We used our knowledge about successful sleep interventions and considered the context of special education to co-create a school-based sleep intervention. Our research question was: What were the lessons learned from the school-partnered development of a school-based sleep intervention for autistic students?

**Methods:** We used the first three phases of the Centre for eHealth Research and Disease Management (CeHReS) roadmap: contextual inquiry, value specification, and design (van Gemert-Pijnen et al., 2011). Each phase had specific goals and activities (Table 1) that led to iterative development involving future users (autistic adolescents, their parents, and teachers) and professionals (researchers, teachers, somnologist, software developers).

**Results:** Based on the previously described activities, we developed a school-based sleep intervention that consists of three parts: 1) monitoring the students' sleep and daytime functioning, 2) holding a sleep consultation with a teacher based on the monitoring, and 3) implementing the sleep recommendations. The future users and professionals indicated that it was important to include four factors with corresponding operationalizations in the sleep intervention: limited burden, sense of usefulness, clear guidance and structure, and additional support cues (Figure 1). In the usability questionnaire, the adolescents reported the sleep recommendations to be beneficial and useful, the instructions were easy to understand, and they had enough resources to be able to use the sleep recommendations. Applying and maintaining the sleep recommendations were most challenging. Students and parents mentioned that it was sometimes difficult to change their habits and fit the sleep recommendations into daily routines. This emphasizes the need for optimal guidance of the students in the implementation of the recommendations and motivation for long-term adherence.

**Conclusions:** Due to this roadmap's iterative development approach with an emphasis on stakeholder participation, we already noticed possible barriers to the intervention's application during its development. This approach enabled us to anticipate those barriers and adapt the sleep intervention during its development, which increases the likelihood of successful implementation. Moreover, engaging autistic people in co-creation can be difficult because co-creation involves collaborating with others, creating new ideas, and communicating those ideas, all of which could be challenging for autistic people (Benton et al., 2012). Due to the application of recommendations for a successful co-creation process with autistic students (e.g., of similar structure for each session, conducting the sessions in a familiar environment, and involving adults that are familiar to the students) we experienced that the engagement of autistic students in this study was successful.

#### **503.034 (Virtual Poster) Efficacy of a School-Based Sleep Intervention for Autistic Students**

**I. Schouwenaars<sup>1</sup>, M. Magnee<sup>1</sup>, C. van Bennekom<sup>2</sup>, H. M. Geurts<sup>3</sup>, S. Pillen<sup>4</sup> and J. P. Teunisse<sup>1</sup>,** (1)HAN University of Applied Sciences, Nijmegen, Netherlands, (2)R&D, Heliomare, Wijk aan Zee, Netherlands, (3)University of Amsterdam, Amsterdam, Netherlands, (4)Kempenhaghe, Heeze, Netherlands

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**Background:** The majority of existing sleep interventions for autistic adolescents are delivered in clinical practice (e.g., (Loring et al., 2018), however, school-based sleep interventions could be more easily accessible for school-aged youth and, therefore, have a greater reach and make earlier treatment possible. Early interventions to reduce sleep problems are important to prevent its exacerbation (Morin & Benca, 2012). We co-created a school-based sleep intervention together with autistic adolescents, their parents and teachers to improve sleep and daytime functioning (Loring et al., 2018). In this study we investigate the effectiveness of our co-created school-based sleep intervention for autistic adolescents

**Objectives:** Our research questions are:

- 1) What are the effects of the school-based sleep intervention on sleep quality in adolescents with ASD?
- 2) What are the effects of the school-based sleep intervention on daytime functioning in adolescents with ASD?

**Methods:**

The study included 21 autistic adolescents each together with a parent and teacher. The inclusion criteria for adolescents were: (a) diagnosed with an autism spectrum disorder by a psychiatrist or psychologist, based on DSM-IV or DSM 5 criteria, (b) total score of >7 on the Insomnia Severity Index, and, (c) medication free or at a stable dose during the study. Exclusion criteria are: (a) intellectual disability, (b) diagnosed or suspected depression, anxiety disorder, substance dependence or game addiction, (c) disturbed parent-child relationship that can hinder the intervention, and (d) indications that pupil will have difficulties to perform the requested activities.

We used a multiple baseline design to investigate the effectiveness of the sleep intervention. In this design the intervention the baseline varies across participants. The duration of the baseline was two to three weeks and of the intervention period ten weeks. Follow-up data were collected eight weeks after the intervention. The sleep intervention consists of three repeating parts: 1) monitoring the adolescents' sleep and daytime functioning, 2) holding a sleep consultation with a teacher based on the monitoring, and 3) executing the sleep recommendations.

This study has two primary outcome variables: sleep quality (mean of questions about how well they slept, their feeling of being rested when waking up and difficulties with waking up) and daytime functioning as reported by adolescents (sum of scores on mood, concentration, daytime sleepiness). These variables are measured by daily self-reports and rated from 1 to 10.



Data will be first visually analyzed, conducted in four steps (Kratochwill et al., 2010): 1) determine whether the baseline shows a predictable and stable pattern, 2) compare the data of each phase with the data of the adjacent phase on level, and variability, 3) the previous information is supplemented with immediacy of the effect and overlap, 4) combine information of each of the phases. In addition, the statistical significance of the intervention effect is evaluated by randomization tests.

**Results:** The data collection started in September 2021 and will be finished in February 2022. The results and conclusions will be presented at the conference.

**Conclusions:** Conclusions will be presented at the conference.

**503.035 (Virtual Poster)** Improving Academic Performance through a School-Based Intervention Targeting Executive Functioning and Study Skills  
**L. B. Jones<sup>1</sup>, E. Hamik<sup>1</sup>, J. Patronick<sup>1</sup>, J. Yeung<sup>1</sup>, A. Duncan<sup>2,3</sup>, A. Zoromski<sup>1</sup> and L. Tamm<sup>1</sup>,** (1)Division of Behavioral Medicine and Clinical Psychology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (2)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (3)College of Medicine, University of Cincinnati, Cincinnati, OH

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**Background:** Students with autism spectrum disorders (ASD) often experience academic difficulties (e.g., missing assignments, losing materials, inefficient studying) in part due to their deficits in executive functioning (EF). Middle school is an important time to address EF skills such as organization, planning, prioritizing, and working memory given increasing demands for these skills in the transition from elementary to middle school. However, no evidence-based interventions currently target EF skills for middle schoolers with ASD. An outpatient intervention, Achieving Independence and Mastery in School (AIMS), was developed to target EF skills in middle-school students with ASD. AIMS was recently significantly modified to be delivered in the middle-school setting by school personnel.

**Objectives:** To test the feasibility, acceptability, and initial efficacy of the school-based version of AIMS in an open trial.

**Methods:** Participants were middle-school students with ASD without intellectual disability ( $n=6$ ; 83.3% male; 16.67% racial minority; age:  $12.83 \pm 0.41$ ; IQ:  $84.83 \pm 24.93$ ) attending a school specializing in ASD. AIMS included 34 student sessions targeting EF (i.e., problem-solving, organization systems, planning/prioritizing, and study strategies) delivered twice per week during a class period within one semester. Feasibility was measured using attendance, real-world practice assignment completion, and AIMS teacher fidelity to the manual (i.e., adherence). Acceptability was measured through student report on the Acceptability of Intervention Questionnaire (AIQ) on a Likert scale from 1-5 (5 being best). Due to the small sample size, pre to post effect sizes were computed to assess intervention efficacy for classroom teacher and/or parent ratings on the Children's Organizational Skills Scales (COSS), Adolescent Academic Problems Checklist (AAPC), Homework Problems Checklist (HPC), Classroom Performance Survey (CPS) and Academic Performance Rating Scale (APRS).

**Results:** All six students completed the study, although only five completed the AIQ. On average, 29 of 34 (85%) AIMS sessions were attended, and 23 out of 27 (85%) real-world practice assignments were completed. The AIMS teacher delivered content in compliance with the manual 93% of the time. Improvements with large effect sizes ( $\geq .8$ ) were observed for parent-rated HPC homework behaviors and AAPC academic skills (Table 1). Improvements with medium effect sizes ( $\geq .5$ ) were observed for parent-rated COSS memory and materials management and teacher-rated AAPC academic skills. Students gave high AIQ ratings ( $\geq 4$ ) for how well they understood backpack and locker organization skills, and study skills (e.g., breaking down assignments, summarizing, study cards), and reported that they would use the information learned in AIMS in the future. Students' ratings were acceptable ( $>3$ ) for their understanding of binder and computer organization skills, and lowest for how much they liked the handouts.

**Conclusions:** Results of the open trial suggest that AIMS has high feasibility and acceptability, and initial findings support an impact on academic performance and EF skills. Further intervention adaptation and replication with a larger sample size is warranted. Preliminary data from an ongoing pilot randomized trial in six schools (anticipated  $n=34$ ) will be available at the time of presentation.

**503.036 (Virtual Poster)** A Holistic Evaluation of Social Skills Group Programs for Autistic Adults According to the ICF: A Systematic Review  
**B. Afsharnejad<sup>1</sup>, E. D'Arcy<sup>2</sup>, M. Youell<sup>3</sup>, R. Mordant<sup>4</sup>, L. Rogalasky<sup>5</sup>, J. Berlinger<sup>6</sup>, S. McGarry<sup>4</sup>, S. Bolte<sup>5</sup> and S. J. Girdler<sup>6</sup>,** (1)Autism Research Team, Telethon Kids Institute, Perth, WA, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Curtin University, Bentley, WA, Australia, (4)Curtin Autism Research Group, Curtin University, Perth, WA, Australia, (5)Center of Neurodevelopmental Disorders (KIND), Centre for Psychiatry Research; Department of Women's and Children's Health, Karolinska Institutet, & Stockholm Health Care Services, Region Stockholm, Stockholm, Sweden, (6)School of Allied Health, Curtin University, Bentley, WA, Australia

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**Background:** Although social skills group programs (SSGPs) are among the most frequently employed programs to support autistic adults navigating the neurotypical social world, it is unclear if a holistic view was used to develop these programs. The International Classification of Functioning, Disability and Health (ICF) is a biopsychosocial model of functioning, consisting of an interplay between an individuals' Personal Factors, Health Condition/s, Body Functions and Structures, Activities and Participation, and Environmental Factors.

**Objectives:** To identify and evaluate the quality of randomised controlled trials (RCTs) conducted of SSGP for autistic adults and identify and describe the components of these programs according to the ICF.

**Methods:** A systematic review (registration ID# CRD42021275848) of RCTs exploring the efficacy of SSGPs for autistic adults was conducted. Medline, PubMed, CINAHL, Scopus, and PsychInfo electronic databases were searched from January 2011 until August 2021 for peer-reviewed RCT studies published in English, evaluating the efficacy of an SSGP for autistic adults (Aged >18 years) with average or above-average IQ levels. In

addition to a quality appraisal and extraction according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement, key components of the SSGPs were extracted (including aims, mechanisms, contexts, and outcomes). These were then classified according to the ICF using a standardised linking methodology.

**Results:** A search of title, abstract and keyword in the database searches identified ten studies, meeting the inclusion criteria. Although the studies demonstrated an adequate to strong methodological quality with scores ranging from 58-92% (Mean=81.2%), they were limited by small sample sizes, non-blinded outcome collection, and unclear reporting of estimates of variance, randomisation process, and participant characteristics. The main components (as described in the RCT study) of the included SSGPs were predominantly designed reflecting codes under the Activities and Participation chapter, including “Learning and applying knowledge”, “General tasks and demands”, “Communication”, “Self-care”, “Interpersonal interactions and relationships” and “Major life areas”. “Intellectual functions”, “Products and technology”, and “Support and relationships” were the only other subcodes identified under the Body Function and Environmental Factors.

**Conclusions:** While the literature suggests that SSGPs can support autistic adults navigating the neurotypical social world, there are still limitations to the current evidence. These include a lack of consideration and involvement of autistic adults in developing SSGPs, limitations relating to study design and limited understanding of the generalisability of social capabilities to everyday contexts. In addition, SSGPs appear to focus heavily on Activities and Participation with little consideration of the influence of Body Functions and Environmental Factors. Future research should consider co-producing the components of the SSGPs with autistic adults while taking a more holistic approach, particularly recognising the complex interplay between all components of the ICF which influence functioning.

**503.037 (Virtual Poster)** A Systematic Review of Social Skills Group Programs Delivered to Autistic Youth with a Co-Occurring Intellectual Disability

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**Background:** Although social skills group programs (SSGPs) are among the most frequently employed programs to support autistic youth navigating the neurotypical social world, they are predominantly delivered to autistic participants with average or above-average cognitive abilities, with the efficacy of SSGPs delivered to autistic youth with a co-occurring Intellectual disability (ID) remaining largely unknown.

**Objectives:** To identify and investigate the design and quality of studies evaluating the efficacy of SSGPs delivered to autistic youth with a co-occurring intellectual disability and their outcome framework.

**Methods:** This study conducted a systematic review (CRD42021275841) of RCTs exploring the efficacy of SSGPs for autistic youth with co-occurring ID. CINAHL, Medline, ProQuest, Scopus, and Web of Science electronic databases were searched from January 2011 until July 2021 for peer-reviewed studies published in English, evaluating the efficacy of an SSGP delivered to autistic school-aged youth (5 to 18 years) with a co-occurring ID assessed via an experimental design. A quality appraisal and extraction were then delivered according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement, identifying the components of the SSGPs (including aims, mechanisms, contexts, and outcomes).

**Results:** Overall, eight studies, half randomised controlled trials and half quasi-experimental, meeting the inclusion criteria were identified, searching the databases at a title, abstract, and keyword level. Although the studies demonstrated an adequate methodological quality for the included studies ( $M = 74.5\%$ , ranging from 63-93%), they were restricted by small sample sizes, non-blinded outcome collection, some having quasi-experimental design and reporting of the participants’ characteristics, especially the diagnosis and IQ level. Additionally, the RCT studies were limited by unclear reporting of confounding factors, estimates of variance and randomisation process. The SSGPs used implicit teaching strategies such as horse riding and martial arts or explicit ones such as peer or video modelling and were predominantly delivered within a school context, targeting varied skills. The majority of studies relied on parent proxy and observer reports to evaluate the SSGT, mostly reporting on autistic-like traits and adaptive functioning, with only a few collecting social interaction and communication outcomes.

**Conclusions:** Findings of this review demonstrated a paucity of understanding about how SSGPs improve the social competence of autistic youth with ID. Due to the limited understanding of the effect of cognitive capabilities on the youth’s social outcomes, Clinicians should be cautious in suggesting SSGPs for autistic youth with ID. Future research should consider using a more rigorous and youth-centred approach towards evaluating the efficacy of SSGPs for autistic youth with ID.

**503.038 (Virtual Poster)** A Neurocognitive Therapy Intervention to Develop Inner Speech Infor Autistic Children: Preliminary Results for a Remote, Synchronous Training Program for SLPs

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**Background:** Speech language pathologists (SLPs) play a critical role in supporting children on the autism spectrum. However, SLPs receive minimal autism training in graduate school. Effective autism interventions are essential to improve social and academic outcomes for autistic populations. Therefore, we developed a remote training program to train SLPs in a neurocognitive intervention that helps autistic children independently solve emotional, social or academic problems. The intervention, called *Thinking in Speech®* (TiS), develops inner speech, which is

essential for solving problems and self-regulation. Prior research found that autistic children seen by SLP graduate students trained to use *TiS* outperformed autistic children seen by experienced SLPs not trained in *TiS* (Nathan & Nathan, 2018). *TiS* received a 2019 Pitt Innovation Challenge (PInCh) Award from the University of Pittsburgh Clinical and Translational Science Institute, which funds this research.

**Objectives:** As a result of participation in a remote, synchronous *TiS* training program, and in preparation for using *TiS* therapy with autistic children, SLPs will report having improved knowledge of, and anticipated comfort using *TiS* strategies (e.g., asking for help, developing emotions vocabulary, category development; Hypothesis 1), taking responsibility for a child's dysregulation during therapy (Hypothesis 2) and interacting with the caregiver/parent after each therapy session (Hypothesis 3).

**Methods:** Experienced SLPs ( $n = 9$ ) were trained remotely by the *TiS* developer in two groups. Training consisted of: 1) readings; 2) four two-hour synchronous formal training sessions; 3) two one-hour synchronous feedback sessions; and 4) an individual asynchronous evaluation session of the recorded session. All trainees completed a post-training evaluation questionnaire. Group 2 trainees ( $n=5$ ), completed questionnaires on their knowledge and comfort with key components of the therapy at pre-and post-training on a 5-point Likert scale.

**Results:** Hypothesis 1 was supported; SLPs reported having improved knowledge of, and comfort with *TiS* strategies (e.g., asking for help, developing emotions vocabulary, category development),  $t(4)=-4.975^* p=.004$ ). Hypothesis 2 was supported; SLPs anticipated feeling more comfortable taking responsibility for a child's dysregulation during therapy,  $t(4)=-2.138^* p=.050$ ). supported; Hypothesis 3 was not supported; SLPs did not report anticipating they would have improved interactions with the caregiver/parent after each therapy session ( $t(4)=-.054 p=.480$ ). (Note: While nine SLPs were trained in total, pre-training scores were available only from five SLPs; post therapy scores will be available for all SLPs)

**Conclusions:** Though a small sample, results are encouraging. Even after a relatively short training program, SLPs report increased comfort with, and knowledge of an innovative neurocognitive therapy intervention for working with autistic children and their caregivers. Research is ongoing to examine whether SLPs report greater comfort and knowledge after therapy sessions are concluded compared to both pre- and post-training. More importantly, we will examine whether autistic children have less anxiety, less anger, less emotional dysregulation, higher executive functioning, and improved social responsiveness after eight weeks of *TiS* therapy, and whether these improvements remain an additional 10 weeks after therapy is concluded.

#### **503.039** (Virtual Poster) A Quality Evaluation of Intervention Outcomes for Transition-Age Autistic Youth

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**Background:** In the United States, the Individuals with Disabilities Education Act (IDEA, 2004) mandates the provision of educational supports to prepare transition-age students with disabilities for adulthood. These supports are meant to improve academic and functional skills relevant for success in adulthood. However, autistic students remain disengaged from employment and post-secondary education following high school (Shattuck et al., 2012; Wei et al., 2015). It could be that intervention research for this population has not focused on the outcomes that will have the greatest impact on adulthood. Sandbank and colleagues (2021) encourage researchers to differentiate between *proximal* outcomes; those that index behaviors or constructs directly taught or facilitated in the intervention, and *distal* outcomes; those that are developmentally beyond what was directly taught or facilitated in the intervention. They also encourage a distinction between *context-bound* outcomes; those that were measured in contexts similar to the intervention context, and *generalized* outcomes; that were measured in contexts that differ along several dimensions from the intervention context. While systematic reviews have characterized intervention outcomes in research for young autistic children (e.g., Sandbank et al., 2021), there have been no comprehensive efforts to assess outcome quality in research for transition-age autistic youth.

**Objectives:** In this systematic literature review, we examine outcome variables extracted from 191 studies, and characterize them according to: a) outcome domain, b) whether they indexed proximal or distal outcomes, and c) whether they indexed context-bound or generalized outcomes.

**Methods:** Included studies were: peer-reviewed, published in English, published between 1970 and 2020, and focused on non-pharmacological interventions; and included participants with a diagnosis of autism, PDD-NOS, or Asperger's Syndrome, and were between the ages of 14-22 years. Outcomes were categorized by two independent coders, based on domain (see Table 1 for outcome types and corresponding definitions), distality, and boundedness.

**Results:** At the time of submission, outcomes from 76% of the 191 included studies have been coded for proximity and boundedness, and 26% for outcome domain. Preliminary results reveal that, of 433 total outcomes, 94% were proximal and 72% were context-bound. The majority of outcomes (88%) measured discrete behaviors. In terms of outcome domain, 40% focused on social or verbal behaviors (e.g., initiations to a peer), 39% focused on transition-specific areas (academics, functional/daily living skills, or employment), and no outcomes focused on self-determination.

**Conclusions:** Interventions for transition-age autistic students have primarily focused on outcomes that were directly taught in the intervention, and were measured in contexts that are very similar to the intervention. These types of outcomes limit our confidence that learning gains will be maintained after students leave the intervention context. This is especially problematic for this age-group, as they are not expected to have the intervention supports offered during school upon school exit. Additionally, there is little focus on outcomes that are meant to be the focus of the transition period, such as academics, functional/daily living skills, and employment. A relatively weak evidence base for supporting transition-age autistic youth could explain persistently poor post-school outcomes for this population.

#### **503.040** (Virtual Poster) Evaluation of a Brief Telehealth PRT Training Program for Parents of Autistic Children

**Background:** Due to a variety of resource-related issues, many autistic individuals and their families aren't able to access the support and services that they need. Factors such as long provider waitlists, a lack of trained professionals, limited financial resources/funding issues, and geographical location prohibit large scale dissemination for certain populations. Additionally, immunocompromised status and other health related concerns and natural disasters/emergency situations, such as the COVID-19 pandemic present unique challenges for accessing services. Provision of services via telehealth and the use of parent-mediated interventions have been used by researchers and clinicians to address these issues. Multiple studies on such models of Pivotal Response Treatment (PRT) parent training show promise. However, at the present time, little is known about the effects on parent fidelity of implementation and related child gains of combining these modalities into more condensed, short-term telehealth parent training programs. As such, it is important to explore these shorter telehealth options to determine if professionals can be used more effectively in their dissemination of evidence-based support to autistic individuals and their families.

**Objectives:** The primary objective of this study was to assess the impact of a brief telehealth PRT parent training program on parents' fidelity of implementation (FOI) and changes in child social-communication skills.

**Methods:** Three parent-child dyads participated in a non-concurrent multiple-baseline study looking at the effects of an intensive (10 hour) week-long telehealth PRT parent training program. The children included two males and one female (mean age=2;5; 1 White/1 Hispanic/1 Asian). Though both parents participated, the mother was the primary research participant in all three families. Parents' FOI and child utterances were coded in parent-recorded videos collected during baseline, intervention, post-intervention, and follow-up. One third of the videos were double coded to ensure reliability. Though data presented below is only for two participants, data has been collected for three and will be analyzed and presented. Recruitment is ongoing.

**Results:** Parents' FOI of PRT and the number of child utterances per minute improved for both participants (see Figure 1). Specifically, parents' FOI improved from baseline to intervention and continued to improve post-intervention and at the one month follow-up. For participant 1, there were improvements in the child's rate of verbal utterances from baseline to intervention. Moreover, the child continued to improve his rate of verbal utterances one month after the intervention. For participant 2, though there was a slight decrease in average utterances per minute from baseline to intervention, there were improvements from baseline to post-intervention and follow-up.

**Conclusions:** This data suggests that a more condensed parent training program delivered via telehealth can be effective in teaching parents PRT and improve the social-communication skills of autistic children. This provides an immediate and cost-effective solution to delays and pauses in accessing intervention services. As such, it could be beneficial for this type of program to be widely adopted to support families who are waiting for more comprehensive interventions or who may not be able to access these types of services.

#### **503.041 (Virtual Poster) PEERS Intervention with Adolescents: Are There Broader Effects on the Family?**

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**Background:** Family functioning varies greatly among families with autistic (ASD) youth. ASD youth who present with greater problem behaviors may negatively impact the family unit and influence parent perceptions of their child (Sikora et al., 2013). Following the PEERS social skills intervention, Karst et al. (2015) found improvements in parenting self-efficacy, suggesting that parent involvement in the intervention can improve parents' views of their own confidence and parenting beliefs. Furthering our understanding of the potential change in parent and youth factors following PEERS may explain how individual or combined effects contribute to broader family functioning among families with autistic youth.

**Objectives:** To examine how improvements in ASD youth's social behavior following the PEERS intervention may impact youth's problem behaviors, parent perceptions of their youth, and broader family functioning.

**Methods:** Participants included autistic adolescents ( $n=13$ ,  $M=14.17$ ) and their caregivers who participated in PEERS, and a comparison group of neurotypical adolescents (TD) ( $n=20$ ,  $M=13.66$ ) and their caregivers who received no intervention. Caregivers reported on measures of their youth's problem behaviors and impact of the youth on the family at pre- and post- intervention. Standard scores of parent-reported problem behaviors were used from the Social Skills Improvement System (SSIS; Gresham and Elliott, 2008). Subscales of positive parent perceptions and negative family impact (a composite score of negative parent perception and negative impact of the adolescent on family social life) were assessed through parent completion of the Family Impact Questionnaire (FIQ; Donenberg and Baker, 1993). Parent involvement was measured using parent homework completion during the intervention.

**Results:** For the SSIS problem behaviors subscale, a significant group by time interaction effect was observed,  $F(1,29)=4.14$ ,  $p=.05$ . Post-hoc tests revealed significant improvements in problem behaviors for ASD adolescents across time ( $p=.05$ ), whereas TD adolescents showed no difference across time ( $p>.05$ ). For FIQ negative impact scale, a significant main effect of group was observed,  $F(1,30)=7.25$ ,  $p=.01$  such that FIQ negative family impact was higher as reported by parents of ASD versus TD adolescents. In a regression analysis predicting negative family impact post-intervention, problem behaviors at pre-intervention explained a significant proportion of the variance of negative family impact at post-intervention,  $R^2=.62$ ,  $F(2,10)=8.26$ ,  $p<.01$ , but parent involvement during intervention did not.

**Conclusions:** Findings suggest there were no significant second-hand effects found on broader family life following the PEERS intervention. Nevertheless, it was evident that ASD youth had a greater negative impact on their family compared to TD youth. Moreover, problem behaviors exhibited by ASD youth were a significant factor in predicting total negative impact on the family following intervention. These results suggest that PEERS did not have an effect on parents' views of broader family life, despite the fact that the intervention did decrease problem behaviors exhibited by ASD youth. Potentially, one way to improve parent perceptions of their autistic youth may be to incorporate youth self-regulation strategies and parent mindful coping strategies within the current social skills intervention.

**503.042 (Virtual Poster)** Effects of a Community-Based Social Skills Intervention for Children with Autism: Parent-Rated Skills Outside of the Treatment Setting

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**Background:** Social skill challenges are well documented in children with autism spectrum disorder (ASD). These difficulties can interfere with academic achievement, post-school outcomes, and mental health (Hall et al., 2018). Though social skills intervention (SSI) is an evidence-based practice to improve the social skills of individuals with ASD, more studies are needed on how skills learned through SSI are used and maintained in settings outside of the treatment setting (Gates et al., 2018).

**Objectives:** This study examined participant baseline (T1), intermediate (T2) and end-intervention (T3) data from a 30-week novel, community-based SSI to evaluate whether the improvement in social skills, and emotional and behavioral problems in the treatment setting was observed by parents, beyond the intervention setting, and whether outcomes differed depending on where treatment was received (i.e., in a hospital clinic vs. community-based clinic).

**Methods:** Data from implementation of the aforementioned SSI were analyzed (total n = 114). One group of participants received the SSI within a hospital setting (HG), and the other group in a community-based agency setting (CG). For both groups, parents rated their child's severity of social problems on the *Social Responsiveness Scale – Second Edition (SRS-2)*, and their child's emotional and behavioral difficulties on the *Behavior Assessment System for Children Parent Rating Scales - Third Edition (BASC-3)*. Data were gathered at three time points across 30 weeks. A mixed ANOVA was conducted to determine whether participants' social skills, and emotional and behavioral problems improvement were observed across time outside of the treatment setting, and whether these observations differed depending on receiving treatment HG vs. CG.

**Results:** For social abilities, significant improvement over time was found for parent ratings of behavior outside the treatment setting for the following: *SRS-2* - Social Awareness, Social Communication, Social Motivation, Social and Communication Interaction, Total Score; *BASC-3 PRS* – Adaptability, Social Skills, and Functional Communication. For emotional and behavioral difficulties, significant improvement over time was found for the following parent-rated *BASC-3* subscales: Anxiety, Depression, and Withdrawal. Participants in HG showed better outcomes compared to CG.

**Conclusions:** Results suggested that participation in the SSI was associated with parent observations of increased social abilities, and decreased emotional and behavioral difficulties. This study contributes to limited research on the SSI outcomes observed and maintained outside of the treatment setting, and how SSI may improve not only the social but also emotional and behavioral functioning of individuals with ASD. Limitations include lack of a control group, missing data due to non-returns, and COVID-19 pandemic as a threat to internal validity. Future directions include determining the moderating factors that impact upon the effectiveness of SSIs, and examination of generalization of skills outside of the treatment setting into the school setting.

**503.043 (Virtual Poster)** Secondary Outcomes of a Parent-Mediated Intervention for Children with Autism & Disruptive Behaviors

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**Background:** The Research Unit in Behavioral Intervention (RUBI) protocol is a manualized, parent-mediated intervention designed for young children with autism and disruptive behavior (DB). Several studies in the US have shown that RUBI reduces DB in these children in a one-on-one, lab-based setting (e.g. Bearss et al., 2015). Initial work from our lab indicates its efficacy when delivered in the community in a group format both in-person and virtually (Graucher et al., under review).

Disruptive behaviors in autism have been linked with elevated parenting stress, and reduced adaptive functioning, as well as with RRB severity (e.g. Koller et al., 2021). Beyond the explicitly targeted outcomes of RUBI, we hypothesized that participation in the intervention would associate with reduced parenting stress, improved adaptive functioning, and decreased RRB severity.

**Objectives:** The aim of the current study was to complement previous findings regarding improvement in primary outcomes (i.e. disruptive behavior) by investigating the secondary effects of the RUBI protocol delivered in community settings via a group format with Israeli and Palestinian parents in Israel. Given the onset of the Covid-19 pandemic during the initial phase of this study, no control group was recruited.

**Methods:** Fifty-five parents of children aged 3-10 years participated in the current study (26 Palestinians, 29 Jewish Israeli). These families participated in the 12-week RUBI intervention. Secondary outcome measures included the Repetitive Behavior Scale-Revised (RBS-R), Adaptive Behavior Assessment System, 2<sup>nd</sup> edition (ABAS-II), and the Parental Stress Index (PSI), and were administered pre- and post- intervention.

Results: Following participation in RUBI groups, paired sample t-tests indicate that parents reported a reduction in PSI total scores ( $t = -3.67$ ,  $p < .01$ ), a significant decrease in their children's compulsive behaviors as measured by the RBS-R ( $t = -2.11$ ,  $p < .05$ ), and a significant increase in their children's overall adaptive behavior scores as measured by the ABAS ( $t = 2.10$ ,  $p < .05$ ).

Conclusions: Findings from the current study indicate that, in addition to a reduction in child disruptive behaviors, children and families who participated in RUBI groups experienced secondary gains as well. Specifically, parents reported a reduction in their own parenting stress, improvement in their child's adaptive functioning, and a reduction in their RRB severity. Future studies should employ randomized -controlled designs in order to draw stronger conclusions regarding primary and secondary effects of the protocol, in the context of child and family outcomes.

**503.044 (Virtual Poster)** The Emotional Support Plan: Preliminary Results from a Brief Telehealth, Mobile Intervention to Support Autistic Adults **V. H. Bal<sup>1</sup>**, **N. Jadav<sup>2</sup>**, **J. Shinal<sup>3</sup>**, **G. B. Gunin<sup>4</sup>**, **E. Istvan<sup>5</sup>**, **E. Brennan<sup>1</sup>**, **E. Wilkinson<sup>2</sup>** and **E. Kleiman<sup>2</sup>**, (1)Graduate School of Applied and Professional Psychology, Rutgers University - New Brunswick, Piscataway, NJ, (2)Graduate School of Applied and Professional Psychology, Rutgers University-New Brunswick, Piscataway, NJ, (3)Columbia University Medical Center, New York, NY, (4)Rutgers University, Piscataway, NJ, (5)Psychology, Rutgers University, Piscataway, NJ

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**Background:** Autistic adults are at high risk for co-occurring depression and anxiety (Hollocks et al., 2019), possibly due to difficulty regulating negative emotions. Autistic adults may be particularly vulnerable during stressful periods, such as the transition to postsecondary education or the COVID-19 pandemic (Mazefsky et al., 2015). There is a general lack of evidence-based interventions to support the mental health of autistic adults (Brugha et al., 2014). However, reports highlighting the impact of the pandemic on mental health and well-being of autistic adults (Adams et al., 2021; Bal et al., 2021; Hedley et al., 2021) underscores the dire need for brief, problem-focused interventions to support autistic adults through these periods.

**Objectives:** To evaluate the feasibility and preliminary efficacy of a brief telehealth and mobile intervention called the Emotional Safety Plan (ESP), modeled after similar suicide risk reduction interventions, designed to support autistic adults during stressful periods.

**Methods:** Participants are 35 autistic adults participating in studies evaluating the ESP to cope with emotional distress during the COVID-19 pandemic ( $N=20$ ) and postsecondary education ( $N=15$ ). Participants complete a 2-2.5 hour telehealth intervention followed by 8-15 brief (10-20 minutes) weekly monitoring visits to gather information about ESP use and mental health symptoms (PHQ-9, GAD-7). Participants were paid \$40 to complete the intervention, \$10 for each weekly monitoring visit and \$20 for each outcome and follow-up visit. Feasibility was assessed by completion of assessments; acceptability was evaluated by online survey and follow-up interview conducted at the end of the monitoring period and four weeks later.

**Results:** Preliminary data for the first 16 participants in the study ( $M_{age}=25.33$ ,  $SD=7.43$  years; 38% identifying as woman or other gender) who have already completed outcome visits demonstrate feasibility (97.6% completion rate across 8 monitoring and 2 outcome assessments). Overall, the ESP was well-received by participants. On a 5-point scale (1-strongly disagree to 5-strongly agree), participants rated the format as acceptable (4.3) and indicated the intervention was helpful (3.9), relevant (4.1) and that they would recommend to others (4.0). Reductions in depressive symptoms were also observed during the eight-week post-intervention monitoring period ( $F(9,146)=4.06$ ,  $p<.001$ ,  $d=.94$  to 1.39 in weeks 2-8;  $d=.52$  at week 12; Fig 1.). Anxiety symptoms followed a similar trend ( $F(9,146)=1.72$ ,  $p=.090$ ); though anxiety seemed to decline in weeks 2-6 ( $d=.37-.74$ ), there was a noticeable increase in anxiety after week 6, ending in a return to near-baseline levels by week 12 ( $d=.10$ ). Data examining use of the ESP by postsecondary students is currently being collected and suggests similarly high compliance (96.8% in the first 6 weeks of participation).

**Conclusions:** These results provide preliminary support for the ESP to support autistic adults in coping with distress. Although reduction in clinical symptoms suggest a potential therapeutic effect, the rise of anxiety symptoms in week 6 suggest a potential need for a "booster" session. Data from use of the ESP to cope with different types of distress will inform future modifications to this brief intervention and design of RCTs to evaluate its efficacy with autistic adults.

**503.045 (Virtual Poster)** The I-Socialise Study: A Cluster Randomised Controlled Trial Investigating the Social Competence and Isolation of Children with Autism Taking Part in LEGO® Based Therapy ('play brick therapy') Groups in Mainstream School Environments **E. N. Kingsley<sup>1</sup>**, **C. Cooper<sup>2</sup>**, **K. Biggs<sup>2</sup>**, **M. Bursnall<sup>3</sup>**, **H. I. Wang<sup>3</sup>**, **T. Chater<sup>4</sup>**, **E. Coates<sup>5</sup>**, **M. D. Teare<sup>6</sup>**, **K. McKendrick<sup>2</sup>**, **G. Gomez de la Cuesta<sup>7</sup>**, **A. Barr<sup>2</sup>**, **K. Solaiman<sup>2</sup>**, **A. Packham<sup>2</sup>**, **D. Marshall<sup>8</sup>**, **D. Varley<sup>9</sup>**, **R. Nekooi<sup>10</sup>**, **S. Parrott<sup>2</sup>**, **S. Ali<sup>2</sup>**, **S. Gilbody<sup>3</sup>** and **A. LeCouteur<sup>11</sup>**, (1)Research & Development, COMIC Research/LYPFT NHS, York, United Kingdom, (2)Clinical Trials Research Unit, University of Sheffield, Sheffield, United Kingdom, (3)Department of Health Sciences, University of York, York, United Kingdom, (4)University of Liverpool, Liverpool, United Kingdom, (5)Science Policy and Research Programme, National Institute for Health and Care Excellence, Sheffield, United Kingdom, (6)Population Health Science Institute, Newcastle University, Newcastle upon Tyne, United Kingdom, (7)Play Included CIC, Duxford, United Kingdom, (8)Centre for Reviews and Dissemination, University of York, York, United Kingdom, (9)University of York, York, United Kingdom, (10)Sheffield Children's NHS Foundation Trust, Sheffield, United Kingdom, (11)Population Health Sciences Institute, Newcastle University, Newcastle upon Tyne, United Kingdom

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Background:

Children and young people (CYP) with autism spectrum disorder (ASD) often struggle with social skills which can affect friendships crucial to their development. Social skills interventions are commonly recommended to help CYP with ASD develop these skills, though engagement is often low. LEGO® based therapy (now Play Brick Therapy) is a child-led group social skills intervention which aims to make learning social skills interesting to CYP with ASD.

## Objectives:

To evaluate the clinical effectiveness of LEGO® based therapy on the social and emotional skills of CYP with ASD in a mainstream school setting as compared with usual support. Secondary objectives included assessing the intervention's cost effectiveness, acceptability, and treatment fidelity.

## Methods:

The study used a cluster randomised controlled trial (RCT) design with remote random allocation of each school to either LEGO® based therapy or usual support. Participants were CYP between seven and 15 in mainstream schools in the North of England with a diagnosis of ASD. For each CYP recruited, a parent/guardian, an associated teacher or teaching assistant (TA), and an interventionist teacher/TA (intervention schools only) were also recruited.

The intervention consisted of 12 weekly sessions of LEGO® based therapy delivered in school by a trained staff member. Usual support from school, GPs, and other professionals was also received. The control arm received usual support only.

The primary outcome measure was the social skills scale of the Social Skills Improvement System (SSIS) completed by the CYP's associated teacher or TA at 20 weeks post-randomisation. Other outcome measures were also completed by participants to answer additional objectives.

## Results:

A total of 250 CYP were recruited to the study. One hundred and twenty-seven CYP were allocated to the intervention arm and 123 to the control arm. A minimal clinically important difference (MCID) was pre-specified at between 9-10 points change on the primary outcome measure. Analysis of this primary outcome was carried out using intention to treat (ITT) analysis. This found a modest positive effect of 3.74 points ( $p=0.06$ , 95% CI: -0.16, 7.63) for the intervention arm. Per protocol analysis was also carried out which showed slightly increased statistical significance ( $p=0.036$ ). Cost-effectiveness of the intervention was found in reduced service use costs and a small but significant increase in quality adjusted life years. Fidelity and acceptability of the intervention were both assessed with positive results. No adverse events or effects related to the intervention were reported.

## Conclusions:

Analysis of the primary outcome showed a change score in social skills which did not reach the MCID. However, it did show a modest positive clinical effect for the intervention arm as compared with the control arm. Health economics and qualitative results were also positive. As such, consideration should be given to the contribution of LEGO® based therapy to the social skills of CYP with ASD in a mainstream school setting.

The study team recommend that future research continues to investigate LEGO® based therapy in school environments and the other possible avenues such as the intervention's effectiveness for CYP with less severe ASD symptomatology.

## 503.046 (Virtual Poster) Using Observed Child Affect & Parent-Report to Assess the Social Validity of a Brief, Intensive PRT Parent Training Program

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**Background:** An intervention's social validity—the degree to which stakeholders find the program goals, procedures, and outcomes acceptable—is an integral part of any intervention. Prior studies on Pivotal Response Treatment (PRT) that have assessed social validity suggest that it is an acceptable intervention. However, assessment of PRT social validity has often solely relied on parent- or clinician-report measures, and do not attempt directly ascertain evidence of the child's acceptance of the delivered intervention. While asking autistic individuals about their perspectives on treatment acceptability is a reasonable method assessing social validity, this is not always possible with young children with communication challenges who often receive early intervention. One promising approach for gauging an intervention's social validity is to examine nonverbal indicators of child affect. By observing a child's baseline affect and systematically assessing visible changes to their emotional state over the course of intervention exposure, we can reasonably obtain a proxy of a child's acceptance of intervention procedures.

**Objectives:** This study aimed to obtain indicators of PRT social validity using (a) observations of child emotional states during parent-child interactions and (b) parent-report measures.

**Methods:** Three parent-child dyads took part in a multiple baseline study examining the effects of a 10-hour, week-long PRT telehealth parent training program. Child participants were a 2y11m Hispanic female (Participant 1), a 2y2m White male (Participant 2), and a 2y0m Asian male (Participant 3). Child affect in videos of parent-child interactions obtained before, during, and after the intervention were coded for positive and negative affect. Graphs were visually inspected for decreases in positive affect and increases in negative affect between baseline and implementation of PRT. At the end of the intervention, parents filled out the Scale of Treatment Perceptions (STP; Berger et al., 2016), a 20-item 7-point Likert-scale measure designed for assessing social validity of autism interventions.

**Results:** Positive affect remained stable or increased for all participants across timepoints. Negative affect also remained stable across timepoints. Parents' average ratings on the STP indicated they found the intervention acceptable (Participant 1: 6.15/7; Participant 2: 6.35/7; Participant 3: 5.85/7). While all scored high on the STP safety subscale, Participant 1's and Participant 2's parents' average ratings were 7/7, whereas Participant 3's

parent rating was slightly lower (6/7). Of note, Participant 3's mother only slightly disagreed with the statement, "My child has experienced discomfort during the course of this treatment," as opposed to the others' strong disagreement.

**Conclusions:** Child affect observation and parent-report converged across participants, suggesting that this brief, intensive online PRT program was socially valid for these parent-child dyads. However, Participant 3's mother's answer to the the question regarding her child's discomfort potentially warrants further investigation. This preliminary analysis highlights the importance of frequent, detailed assessment of social validity from multiple stakeholder perspectives—including the autistic child's—as well as the need to individualize interventions based on client response.

**503.047 (Virtual Poster)** Using the Theory of Planned Behavior to Predict French-Speaking Practitioner' Intention and Behavior of Using Robot for ASD

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**Background:** Society is facing several challenges in ASD care and education in terms of cost, accessibility, and turnover. One promising tool receiving research's attention is the use of robots in the care of children with ASD . While robots offer numerous possibilities in terms of therapeutic and educational applications, knowledge transfer, and care's accessibility (e.g. Diehl et al., 2012; Huijen et al., 2016), little is known regarding how practitioners perceive such robots use into their work. The Theory of Planned Behavior (TPB; Fishbein & Ajzen, 2010) is a popular models to predict health-related behaviours and it was successfully used to predict the use of research-recommended practices for ASD (e.g. Ingersoll et al., 2018). It posits that processes underlying human behaviour can be described by a small set of constructs that are intentions, attitudes towards behaviour, subjective norms, perceived behavioural control, and beliefs. The TPB framework could allow a better understanding of professionals's position concerning the use of robots in the ASD field.

**Objectives:** Our study investigated for the first time the extent to which TPB helps to predict the French-speaking practitioners' intent to use robots in the educational and therapeutic care of children with ASD.

**Methods:** Our questionnaire included demographic variables (gender, age, education, years of ASD experience, job title, and age of clients) as well as constructs from TPB and additional constructs (professional self-efficacy, perceived morality, and positive and negative emotions). In total, 326 professionals working in ASD were included in this online study. Intention to use a robot was assessed twice. Once in a general way and once by specifying a context (contextual intention) in which they may benefit a facility for doing the behavior (e.g., loan). The behaviour measured was that of signing up for participating in a field study involving actual use of this type of robot.

**Results:** A repeated measures t-test showed that the mean intention in general ( $M=3.42$ ,  $SE=1.02$ ) was statistically lower than the mean intention in a in a facilitated context ( $M=3.68$ ,  $SE=1.07$ )  $t(326) = -8.54$ ,  $p = .000$ . There was no difference in practitioner contextual intention depending on whether they were referring to the use of a robot with a child or an adult ( $F(1,325) = 1.10$ ,  $p = .29$ ). There was also no difference based on their country of origin ( $F(8,315) = 1.28$ ,  $p = .26$ ). Finally, to test TPB model while considering control variables (age and experience), we conducted two multiple hierarchical regressions, one on the behavior (table 1) and one on the contextual intention (table 2).

**Conclusions:** To our knowledge, this is the first time that a study highlights strong interest of professionals in using a robot for their adult patients with ASD. The reason of their interest will remain to be explore. Results from the hierarchical regressions also demonstrated the applicability of TPB to professionals' intentions to use a robot in the coming year. Those results bring deeper knowledge about intention's determinants but also suggest an important gap between intention and behavior that remains to be studied.

## Interventions - Pharmacologic

### POSTER SESSION — INTERVENTIONS - PHARMACOLOGIC

#### 413 - Interventions - Pharmacologic

**413.157 (Poster)** A Pilot Treatment Study of Low-Dose Ketamine Shows Improvement of Social Attention in Children with Adnp Syndrome  
**B. Lerman<sup>1</sup>, S. Barkley<sup>2</sup>, T. Levy<sup>3</sup>, H. Walker<sup>4</sup>, K. Keller<sup>5</sup>, D. Halpern<sup>6</sup>, J. Zweifach<sup>7</sup>, P. M. Siper<sup>8</sup>, M. P. Trelles<sup>9</sup>, J. D. Buxbaum<sup>10</sup>, A. Kolevzon<sup>11</sup> and J. H. Foss-Feig<sup>12</sup>,** (1)Seaver Autism Center for Research and Treatment, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)Teachers College, Columbia University, New York, NY, (3)Rosalind Franklin University of Medicine and Science, North Chicago, IL, (4)Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY

**Background:** Activity dependent neuroprotective protein (ADNP) syndrome is a genetic neurodevelopmental disorder characterized by sensory reactivity, cognitive delays, and social communication deficits. Moreover, ADNP syndrome is a leading genetic cause of autism spectrum disorder (ASD) and is associated with abnormalities in joint attention, demonstrated in previous eye-tracking studies. Ketamine, an NMDA receptor antagonist, has been shown to upregulate expression of the ADNP gene, suggesting that it might compensate for ADNP haploinsufficiency and mitigate symptoms associated with the disorder.

**Objectives:** To investigate whether a single low-dose of intravenous (IV) ketamine would improve joint attention in children with ADNP syndrome.



**Methods:** Ten children (7 male), ages 6 to 12 years ( $9.49 \pm 2.29$ ), received a single low-dose (0.5mg/kg) of ketamine infused IV over 40 minutes. A Joint Attention eye-tracking paradigm was conducted at baseline—one day before ketamine administration—and again one week after. A series of 16 pseudo-randomized trials were presented during which a video displays a woman seated at the center of the frame, first looking down for 5s, and then looking up and turning her head to direct attention using eye gaze at either an object on the lower right or lower left of the screen for 10s. Average latency to saccade to the target object, proportion of trials where the target item is looked at before the distractor, and average proportion of time spent dwelling on the target (versus distractor) were calculated. Data were successfully collected from nine participants, but only four participants (3 male,  $M_{age} = 9.38 \pm 2.32$ ) had >25% valid trials at both time points. In addition, a clinician-administered Visual Analogue Scale (VAS) was used to measure attention (N=10), and caregivers completed the Anxiety, Depression and Mood Scales (ADAMS) to examine social avoidance (N=10). Data were analyzed using Wilcoxon signed ranks tests.

**Results:** The proportion of trials in which participants made saccades to the target before the distractor increased from Baseline ( $0.53 \pm 0.14$ ) to Week 1 ( $0.70 \pm 0.14$ ) ( $r = 0.80$ ;  $p = 0.109$ ). Moreover, participants spent a greater proportion of time looking at the target at Week 1 ( $0.66 \pm 0.11$ ) versus Baseline ( $0.51 \pm 0.19$ ) ( $r = 0.913$ ;  $p = 0.068$ ). However, there was no significant change in saccade latency to target from Baseline ( $2319.38 \text{ms} \pm 1202.34$ ) to Week 1 ( $1674.18 \text{ms} \pm 301.93$ ) ( $r = 0.37$ ,  $p = 0.47$ ). These results mirrored clinical findings, wherein attention significantly improved ( $p = 0.028$ ) and social avoidance significantly decreased ( $p = 0.018$ ) over this one-week interval.

**Conclusions:** We found a trend toward improved joint attention after ketamine treatment in children with ADNP syndrome, demonstrated by both an increase in joint attention accuracy and in time spent looking at the target. Saccade latency to the target did not change, suggesting that accuracy and attention, but not speed, were sensitive to treatment. Eye-tracking results parallel clinical changes, providing promising evidence that social attention in ADNP syndrome is improved with ketamine and suggesting that eye-tracking may be a useful biomarker to index this change. This work provides important insights into potential therapeutic approaches for treating ADNP syndrome and offers preliminary data to support a placebo-controlled clinical trial to include these potential endpoints.

#### **413.158 (Poster)** A Randomized Double-Blind Clinical Trial with *L. Reuteri* in Autism Spectrum Disorder: Improvement of Social Behaviour and Gastrointestinal Symptoms, with Modulation of Immune Response

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#### **Background:**

Children with Autism Spectrum Disorder (ASD) are 3.5 times more likely to suffer from gastrointestinal (GI) issues than neurotypical individuals. Recent studies reported microbiota dysbiosis and immune dysregulation in ASD individuals. These evidence indicate that gut microbiota-brain axis is involved in ASD, and that the immune system may play a crucial role in this crosstalk. In such a scenario, probiotic supplementation is an emerging area of research in ASD, by modulating microbiota and immune system. It has been reported that a specific strain of *Lactobacillus Reuteri* (PTA6475) improves social behaviour in ASD mouse models. To our knowledge no prior study investigated the efficacy of *L. Reuteri* in ASD children.

#### **Objectives:**

The aim of the study was to assess the effect of 6 months *L. Reuteri* (DSM17938 and ATCC PTA6475) supplementation on behavioural profile, with a specific focus on social deficits, on GI symptomatology and on immune response, in ASD children.

#### **Methods:**

Forty-three ASD children (35 males 8 females; age range 3-8 years) were enrolled. At baseline participants were blindly randomized to *L. Reuteri* or placebo supplementation. A standardized clinical assessment of cognitive skills, socio-communicative behaviors and GI symptoms (Fig. 1) was performed for each patient at baseline (T0), after three months (T1) and after six months (T2) of supplementation. Blood samples were collected from all participants at T0, T1 and T2 and immune response was analysed in peripheral blood mononuclear cells by flow cytometry.

#### **Results:**

Behavioral results based on intelligence quotient (IQ) stratification reveals *L. Reuteri* efficacy on social and GI domains in ASD with normal range IQ (Leiter-R range score: 85-120). In particular *L. Reuteri*, and not placebo supplementation significantly increased scores of ABAS-II social subdomain ABAS-II\_SAD (mean T0=68.5±13.4; T2=74.5±13.5;  $p = 0.04$ ) and decreased total score of SRS (mean T0=85.1± 17.2; T2=76.7±17.4;  $p = 0.001$ ) and GSRS (mean T0=6.5± 5.0; T2=4.3± 3.4;  $p = 0.03$ ), at 6 months. No significant effects of probiotic supplementation on autistic core symptoms were observed on ADOS-2.

Analysis of immune frequencies reveals that *L. Reuteri*, and not placebo, decreases the frequency of inflammatory mucosal associated invariant T (MAIT) cells (mean T0=1.0±0.6; T2=0.7± 0.4;  $p = 0.001$ ) and natural killer cells (mean T0=8.7± 4.9; T2=7.3±4.3;  $p = 0.04$ ), within the total population of leukocytes, after 6 months of supplementation, while frequency of other immune cells were not modulated. Interestingly, GSRS and frequency of NK cells were significantly correlated ( $r = 0.31$ ;  $p = 0.005$ ), indicating that decrease of NK cells mediated by *L. Reuteri* could be associated to improvement of GI symptoms.

## Conclusions:

This study shows that *L.Reuteri* improves social deficits, GI symptoms and modulates inflammatory response in children with ASD. From a scientific point of view, modulation of immune response associated with improvement of GI symptoms and social behaviors reflects a strong link between gut, brain and immune system. From a clinical point of view, *L.Reuteri* supplementation represents a promising therapeutic area for ASD children with or without GI symptoms.

### **413.159 (Poster)** Changes in Parent- and Self-Reported Anxiety Symptoms in Children with and without ASD Receiving SSRI Medication: A Retrospective Chart Review

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**Background:** Clinically significant anxiety symptoms are common in autistic children with prevalence estimates as high as 79%, significantly higher than typically-developing children (Kent & Simonoff, 2017). Selective serotonin reuptake inhibitors (SSRIs) are first-line pharmacological treatments for anxiety in the general pediatric population; however, their effectiveness in children with autism is unclear. A chart-review study of 29 children and adolescents diagnosed with ASD receiving SSRIs for anxiety showed a significant reduction in clinical global impression scores over a period of 12 months (Thorkelson et al., 2019). However, more research is needed to inform the use of SSRIs to treat anxiety in autistic children and youth.

**Objectives:** Our objective was to compare changes in parent- and self-reported anxiety symptoms in youth with and without a diagnosis of ASD using a retrospective chart review of clinical data. A secondary objective was to identify potential moderating factors of treatment response such as age, biological sex, and type of SSRI medication.

**Methods:** Data consisted of 2,026 patients seen for medication management within the psychiatry department of a large children's hospital in the Midwest region of the United States between 2015 and 2019. Inclusion criteria for the study included an ICD-10 anxiety disorder diagnosis and the prescription of an SSRI. 86 children had a clinical diagnosis of ASD. Among the 1,940 non-ASD participants, the mean age was 13.81 years ( $SD = 2.91$ ). Among the 86 ASD participants, the mean age was 12.97 years ( $SD = 2.92$ ). The majority of the non-ASD group was female (63.71%) while the majority of the ASD group was male (73.26%). Participants were predominantly white (non-ASD: 81.19%; ASD: 76.74%). Anxiety symptoms were measured using the Screen for Child Anxiety Related Disorders (SCARED). Changes in parent- and self-reported SCARED scores were tested using linear mixed effects models using the *lme4* package in R.

**Results:** The ASD group was 10 months younger ( $p = .01$ ) and started with a baseline SSRI dose of 8.56mg greater ( $p = .03$ ) than the non-ASD group; differences in dosage remained consistent over time. There were no group differences in baseline SCARED-Parent scores. A time $\times$ group interaction effect approached statistical significance ( $p = .08$ ) with a trend toward relatively slower reduction of anxiety scores in the ASD vs. non-ASD group (see figure 1A). For the SCARED-Child scores, children with ASD reported lower baseline SCARED scores, with similar rates of change between groups (see Figure 1B). Post-hoc analysis indicated a significant time $\times$ group $\times$ sex interaction showing that females with ASD reported significantly lower SCARED scores at Baseline (see Figure 2). Age and type of SSRI medication were not significant moderators.

**Conclusions:** Autistic youth may show similar reductions in anxiety with SSRI medication compared to typically-developing peers, although they may require higher doses. Females with ASD presenting for psychiatric consultation for anxiety reported overall lower levels of anxiety compared to their peers. Future research could elucidate whether this difference is due to differences in perception/awareness of anxiety symptoms. Replication in larger samples and controlled designs are needed to confirm these findings.

### **413.160 (Poster)** Children and Adolescents Treated with Cbd-Rich Cannabis Exhibit Significant Improvements in Social Symptoms of ASD in an Open Label Study

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**Background:** There is considerable interest in the potential benefits of CBD enriched cannabis for treatment of individuals with ASD. However, there is little evidence regarding the efficacy of such treatment. While previous open label studies have reported that children with ASD respond well to treatments with CBD-rich cannabis, these studies did not utilize standardized assessments of core ASD symptoms and did not assess the specific impact of treatment on social communication and restricted and repetitive behaviors (RRB) symptoms.

**Objectives:** The current open label study examined the impact of treatment with CBD-rich cannabis over a period of 6 months on core ASD symptoms as assessed using clinical observations and parent reports.

**Methods:** Initially, 100 participants (5-25 years old) were recruited to this prospective open label study. The treatment protocol was preformed using a personalized medicine approach. Participants received medical cannabis extract with a CBD:THC ratio of 20:1 (Nitzan Spectrum®, Seach Medical Group) for six months. All participants started with one drop daily (each drop contains: 0.3mg THC and 5.7mg CBD), the dose was increased gradually until improvement was reported by parents. The final dose did not exceed 10mg/kg/day of CBD and 0.5mg/kg/day of THC. Efficacy of treatment was assessed using the Autism Diagnostic Observation Schedule 2<sup>nd</sup> edition (ADOS-2), the Vineland adaptive behaviors scale 3<sup>rd</sup> edition,

the Social Responsiveness Scale 2<sup>nd</sup> edition (SRS-2) and the Repetitive Behaviors Scale – Revised (RBS-R). The final analyses were conducted with 76 participants who completed at least one of the assessments described above both before and after 6 months of treatment.

**Results:**Results from the 76 participants who completed the 6 month treatment program revealed significant improvements in all measures of social communication (Figure 1) including the ADOS-2 Social Affect (SA) Calibrated Severity Score (CSS,  $M=-0.46$ ,  $SD=1.59$ ,  $t(62)=-2.29$ ,  $p=0.02$ ), the SRS-2 standardized social sub-scale ( $M=-4.2$ ,  $SD=9.2$ ,  $t(54)=-3.39$ ,  $p=0.001$ ), Vineland Socialization scale ( $M=6.76$ ,  $SD=13.06$ ,  $t(66)=4.2$ ,  $p<0.001$ ), and Vineland Communication scale ( $M=4.36$ ,  $SD=14.72$ ,  $t(66)=2.41$ ,  $p=0.02$ ).

In contrast, most measures of RRB symptoms did not exhibit significant improvement following treatment (Figure 2). These included the ADOS RRB CSS ( $M=-0.46$ ,  $SD=2.23$ ,  $t(62)=-1.64$ ,  $p=0.11$ ) and parent reported RBS-R sub-scales regarding Stereotyped Behavior ( $M=-0.62$ ,  $SD=3.94$ ,  $t(63)=-1.27$ ,  $p=0.21$ ), Self-injurious Behavior ( $M=0.06$ ,  $SD=2.12$ ,  $t(63)=0.22$ ,  $p=0.83$ ), Compulsive Behavior ( $M=-0.19$ ,  $SD=2.2$ ,  $t(63)=-0.68$ ,  $p=0.5$ ) and Restricted Behavior ( $M=-0.22$ ,  $SD=1.93$ ,  $t(63)=-0.91$ ,  $p=0.37$ ). Nevertheless, parents did report significant improvement in the SRS-2 standardized RRB sub-scale ( $M=-3.24$ ,  $SD=9.04$ ,  $t(54)=-2.65$ ,  $p=0.01$ ) and the RBS-R ritualistic/sameness behavior sub-scale ( $M=-2.12$ ,  $SD=6.25$ ,  $t(63)=-2.67$ ,  $p=0.009$ ).

**Conclusions:**Taken together, these results suggest that treatment with CBD-rich cannabis may yield significant improvement in the severity of core ASD symptoms, and particularly in social communication symptoms as reported by both parents and clinicians who performed the ADOS assessments. While open label studies are prone to large uncontrolled placebo effects, the dissociation between social and RRB symptoms suggests that improvement was specific to one symptom domain and not apparent in both as may be expected from a general placebo effect. Further double-blind placebo-controlled studies are highly warranted for determining the efficacy of this treatment.

#### **413.161 (Poster)** Effects of Propranolol on Gastrointestinal Problems in Children and Adults with Autism Spectrum Disorder

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**Background:** Many individuals with autism spectrum disorder (ASD) experience severe gastrointestinal (GI) problems, which can impact social interactions and exacerbate social communication deficits. Past treatments of GI problems in ASD mainly include medications targeted at individual symptoms (e.g., Miralax for constipation). It is vital that novel treatments be explored for GI disorders in ASD to improve their specific symptoms, but also the underlying root of the problem, to improve quality of life. Previous research shows that individuals with ASD experience an increased physiological stress response which is associated with GI problems. Drugs that target the gut-brain axis may provide GI relief for some individuals with ASD. The gut-brain axis is a bidirectional path that allows communication between the brain and GI tract via the vagus nerve that modulates digestion, GI motility, and the stress response. Propranolol, a central and peripheral beta-adrenergic antagonist that increases vagal tone, may lead to GI improvements in ASD.

**Objectives:** This study examined the effectiveness of propranolol in decreasing GI problems in children and young adults with ASD.

**Methods:** A sample of 37 individuals with ASD aged 7-24 participated in a 12-week open label trial of propranolol. The Gastrointestinal Severity Index (GSI) was administered at baseline and at the end of the trial period. The GSI is an 8-item questionnaire about GI functioning over the past week including constipation, diarrhea, stool consistency, stool smell, flatulence, abdominal pain, unexplained daytime irritability, and nighttime awakening. Total severity scores range from 0-16, wherein higher scores reflect greater or more severe GI symptoms. A paired sample *t*-test was used to compare baseline and follow-up severity scores. Descriptive statistics were used to determine the extent of improvement in GI symptoms, and an independent samples *t*-test and chi square analysis were used to assess the influence of age group (7-14 versus 15-24) on level and type of change.

**Results:** GI symptoms significantly improved at follow-up ( $M=2.03$ ,  $S=1.82$ ) compared to baseline levels ( $M=2.76$ ,  $S=1.52$ ),  $t_{paired}(33)=2.506$ ,  $p=.017$ . Nine individuals (26.5%) displayed more GI problems, eight individuals (23.5%) maintained the same level of GI problems, and seventeen individuals (50%) experienced fewer GI problems after the trial, with 8 people experiencing no (zero) GI symptoms at follow-up. Age group did not influence total amount of change over time,  $t(32)=-.193$ ,  $p=.848$ , or type of change (improvement, worsening, or stability),  $\chi^2(2)=1.581$ ,  $p=.454$ .

**Conclusions:** The results from this open label trial suggest that propranolol may reduce GI symptoms in some individuals with ASD. Propranolol increases parasympathetic tone both centrally and peripherally, which might explain the reduction in GI symptoms. However, it is unclear why some individuals reported increases in GI symptoms after the trial. Future studies should examine data from more sensitive GI questionnaires and identify biomarkers that may predict the response to treatment with propranolol. For example, individuals with high baseline stress levels or co-occurring anxiety disorders may receive the greatest benefit from propranolol due to dampening of sympathetic tone. These data should be interpreted with caution until randomized, double-blinded, placebo-controlled trials of propranolol are completed.

#### **413.162 (Poster)** Examining the Effects of Low Dose Ketamine on Neural Responses of Children with Adnp Syndrome

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**Background:** ADNP syndrome is caused by pathogenic variants in the activity dependent neuroprotective protein (*ADNP*) gene and is characterized by intellectual disability, autism spectrum disorder (ASD), speech and motor delays, and medical comorbidities. Ketamine is an NMDA antagonist which has been suggested to upregulate expression of *ADNP* and affects excitatory and inhibitory neural systems by blocking glutamatergic binding and inhibiting GABA release. The auditory steady-state response (ASSR) measured by electroencephalography (EEG) assesses neural synchrony and has been shown to index the balance of excitatory and inhibitory neural pathways, modulated by GABAergic and glutamatergic systems.

**Objectives:** This study investigated if administration of low dose ketamine in children with ADNP syndrome would alter ASSR as measured by EEG. Based on research implicating glutamatergic functioning in neural oscillations across several frequency bands, we hypothesized that ketamine administration would alter 20Hz and 40Hz ASSR in this population.

**Methods:** EEG was recorded from 10 children ages 5-12 with ADNP syndrome (M age = 9; 3 Female). In separate runs, participants heard 150 trials of 500ms click trains with a stimulation rate of 20Hz or 40Hz. Inter-trial interval was 50ms. Data were cleaned before conducting time-frequency analysis to extract intertrial phase coherence (ITC) at 20 and 40Hz. ITC is a value between 0 and 1, where 0 reflects a random distribution of phase angles and 1 reflects absolute neural synchrony. Data were collected from all participants at Baseline and Day 1, Week 1, Week 2, and Week 4 following a single ketamine intravenous infusion at 0.5 mg/kg over 40 minutes. After excluding participants with unusable data at any time point, we included 7 participants in 40Hz analyses and 8 participants in 20Hz analyses. Average ITC at each time point was calculated from the Cz central electrode. Wilcoxon Signed Ranks Tests were used to compare average ITC values at Baseline against each subsequent time point.

**Results:** 40Hz (gamma) ITC significantly increased from Baseline to Week 1 ( $p = 0.05$ ). No significant differences were found between Baseline and Day 1, Week 2, or Week 4 ( $ps > 0.1$ ). 20Hz (beta) ITC significantly decreased from Baseline to Week 1 ( $p = 0.05$ ). No significant differences were found between Baseline and Day 1, Week 2, or Week 4 ( $p > 0.1$ ). These results align with findings from clinical measures (presented elsewhere) showing greatest improvement in behavior at one week following ketamine infusion.

**Conclusions:** The increase in evoked gamma band oscillations at Week 1 suggests an effect of ketamine related to enhancing glutamatergic functioning in ADNP syndrome, likely caused by NMDA receptor modulation. Conversely, the decrease in beta ITC at Week 1 may be indicative of an inhibitory effect of ketamine causing decreased GABA concentrations. These findings may be important in the treatment of ADNP syndrome, as gamma and beta neural oscillations are implicated in several important cognitive processes and may relate to clinical symptoms. This study suggests the potential of ASSR as a biomarker of ketamine treatment response in ADNP syndrome.

#### **413.163 (Poster)** Intranasal Esketamine in a Young Woman with Autism Spectrum Disorder and Resistant Depression

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**Background:** Autism spectrum disorders are often associated with other psychiatric conditions, among which depression is one of the most frequent. It could be hard for the clinician to formulate an exact diagnosis of depression in the context of ASD as many symptoms can overlap. Additionally, women with ASD are often difficult to identify as they may have learnt several camouflaging techniques during the years. Pharmacological strategies for major depression are still ineffective in approximately one third of the patients and short acting treatments for suicidality are still lacking. This is particularly true in the context of ASD, as many subjects may experience adverse side effects and low efficacy compared to typically developing depressed individuals.

**Objectives:** to evaluate the efficacy of intranasal esketamine in a young woman with ASD and resistant depression

**Methods:** From week 1 to 4 she was administered esketamine 84 mg twice weekly; from week 5 to 8 she received esketamine 84 mg once a week. Esketamine was self-administered via an atomized nasal spray device under medical supervision. Vital parameters were collected during every session prior to the first administration and repeated after one hour of continuous observation of the patient. The following evaluation scales were administered before the first drug administration (T0) and repeated after one week (T1), four weeks (T2) and eight weeks (T3) of treatment: Montgomery Asberg Depression Rating Scale (MADRS), Columbia-Suicide Severity Rating Scale (C-SSRS), Dissociative Experiences Scale (DES-II), Psychache Scale (PSA), Reflective Functioning Questionnaire (RFQ-8).

**Results:** esketamine was well tolerated and no side effects were noticed; vital parameters were always within normal ranges. MADRS total scores decreased progressively, as well as PSA and DES-II scores. Mentalizing skills, assessed by means of RFQ-8, also showed meaningful improvement. This is particularly relevant in the context of autism spectrum disorders. Moreover, these positive effects were maintained over time, as assessed during the further follow-up of 2 months

**Conclusions:** The initial results of our experience of intranasal esketamine in the treatment of depression comorbid to autism demonstrated that it was well tolerated and efficacious in treating depressive symptoms and improving psychic pain.

#### **413.164 (Poster)** Pharmacotherapy of Adolescents with Autism Spectrum Disorder: Findings from Population Based Surveillance in a US Metropolitan Area

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**Background:** There are no pharmacological treatments for the core symptoms of Autism Spectrum Disorder (ASD); however, psychoactive therapy is used to target associated symptoms or comorbid conditions commonly seen in ASD patients. Two antipsychotic drugs, risperidone and aripiprazole, are FDA-approved for treatment of maladaptive behaviors such as irritability and aggression associated with ASD. Additional psychoactive drugs are used to treat associated symptoms and comorbid psychiatric conditions. Previous findings on psychoactive medication use by adolescents with ASD have been based on convenience samples and administrative datasets and may be biased or non-representative.

**Objectives:** The goal of this study is to estimate the proportion of adolescents with ASD receiving psychoactive drugs and polypharmacy and to determine if utilization of psychoactive drugs varies by sex, race/ethnicity, and/or socioeconomic status in a large, diverse population.

**Methods:** Data were collected as part of a population-based study monitoring ASD prevalence in New Jersey. The Autism and Developmental Disabilities Monitoring (ADDMM) method was utilized for active ascertainment. This approach is a population based, (2-phase) process involving comprehensive retrospective review, scoring and analysis of information contained in professional evaluations from multiple health and education sources. Demographic variables and case-specific data, including information on the prescription of psychoactive medicines was collected from records and analysed. The findings represent adolescents (age 16-years) born in 1998 and surveyed in 2014. Chi-square tests were used to test associations.

**Results:** We identified 557 adolescents with ASD. Prevalence was estimated at 17.6 per 1,000 (95% CI:16.2-19.2). Among individuals identified with ASD, 254 (46%) had indication of receipt of psychoactive drugs and 169 (30%) had indication of multiple psychoactive drugs (polypharmacy). Stimulants (28%) and anti-psychotics (19%) were the most frequently utilized drug categories, and medications targeting ADHD symptoms (stimulants and non-stimulants) were most frequently used, overall (34%). Differences in the receipt of psychoactive drugs were observed by sex, race/ethnicity and socioeconomic status (SES). Females were more likely to receive psychoactive drugs overall (55%) and antidepressants (31%), compared to males. Non-Hispanic White (54%) adolescents were more likely to be prescribed psychoactive drugs compared to their Non-Hispanic Black (34%) and Hispanic (39%) peers. Adolescents from high SES areas were more likely to receive psychoactive drugs (53%) compared to peers from mid SES areas (42%) and low SES areas (37%). Polypharmacy was prevalent among adolescents and use ranged from 1 to 18 psychoactive drugs. We identified 13 adolescents that were prescribed ten or more psychoactive drugs at any point by age 16-years old.

**Conclusions:** Approximately 1 in 2 adolescents with ASD residing in metropolitan New Jersey are prescribed psychoactive drugs. Among those, 2 in 3 are prescribed two or more psychoactive medications. Our findings are consistent with other studies describing the increasing prescription of psychoactive medications to adolescents with ASD. The high proportion of adolescents receiving pharmacotherapy and polypharmacy may reflect the high proportions of co-morbidity among adolescents with ASD. In our population, the utilization of pharmacotherapy varied by sex, race/ethnicity and SES. Research into the long-term effects of psychoactive medications on individuals with ASD is needed.

#### **413.165 (Poster) Psychophysiological Predictors of the Treatment Response to Propranolol on Core ASD Symptoms Using the Autism Impact Measure**

**C. Applig<sup>1</sup>, N. Nuraini<sup>2</sup>, D. Q. Beversdorf<sup>3</sup>, A. Kalathil<sup>4</sup> and B. J. Ferguson<sup>4</sup>,** (1)Interdisciplinary Neuroscience Program, University of Missouri, Columbia, MO, (2)University of Missouri Columbia, Columbia, MO, (3)Department of Radiology, Neurology, and Psychological Sciences, University of Missouri, Columbia, Columbia, MO, (4)Health Psychology, Radiology, & Thompson Center for Autism & Neurodevelopmental Disorders, University of Missouri, Columbia, MO

#### **Background:**

Autism spectrum disorder (ASD) is a condition characterized by the presence of social and communication impairments, with the presence of restrictive repetitive behaviors originating in early development. Pharmacotherapeutic interventions for ASD have primarily targeted psychiatric co-occurring conditions, such as atypical neuroleptics for aggressive behavior. However, at this time, no agent has yet proven beneficial for the core features of ASD. Propranolol is a relatively inexpensive, generic, nonselective beta-adrenergic antagonist that was originally FDA approved to treat hypertension. Previous studies have implicated propranolol in improving performance on language tasks, verbal problem solving, and facial scanning which are all important social behaviors (Zamzow, 2014; 2016; 2017). It is critical to better understand if propranolol can serve as a pharmacological intervention for core ASD symptoms, and if we can predict these changes using psychophysiological biomarkers.

#### **Objectives:**

This pilot study investigated the efficacy of using an adrenergic biomarker to predict the treatment response to propranolol. We hypothesized that baseline resting heart rate variability (HRV) would predict the score change on the Autism Impact Measure (AIM) from baseline to 12-weeks in children with ASD treated with propranolol.

#### **Methods:**

Children with ASD ages 7-14 (n=23) were invited to participate in this open label, double-blind clinical trial. Resting electrocardiogram (ECG) was collected, and HRV variables were calculated to represent autonomic nervous system functioning. HRV and AIM scores were obtained at baseline and again after 12-weeks of propranolol administration. The AIM assesses the symptoms of ASD in the domains of repetitive, atypical behavior, communication, social reciprocity, and peer interaction. The differences between baseline and 12-week AIM scores were calculated and linear regression was used to examine their relationship with baseline resting HRV variables.

#### **Results:**

A significant relationship was found between the peer interaction subdomain frequency change score and triangular interpolation of rhythm-to-rhythm interval (TINN) HRV measure. Furthermore, there were significant relationships between the Very Low Frequency (VLF) power log HRV measure and the atypical behavior subdomain change score for frequency and overall score (i.e., frequency plus impact score).

## Conclusions:

Baseline HRV may predict the change in core ASD symptoms, as measured by the AIM, in response to treatment with propranolol. HRV is a non-invasive measure of autonomic nervous system activity that could be used to predict outcomes prior to starting treatment. Future studies need to confirm whether baseline HRV assessment can help clinicians determine who may best benefit from propranolol in order to optimize targeted treatment. In general, the high degree of heterogeneity of ASD has created a challenge in clinical trials targeting core symptoms, making precision medicine approaches essential. The results presented herein are promising, but more research is needed to see if these effects are sustained in a larger population.

### **413.166 (Poster)** Randomized, Double-Blind, Controlled Trial of Probiotic Supplementation in Children with Autism Spectrum Disorder: Improvement of Gastro Intestinal Symptoms and Gut Microbiota Modulation.

*D. Adduce<sup>1</sup>, M. Siracusano<sup>2,3</sup>, R. Abate<sup>4</sup>, F. Cristofori<sup>1</sup>, L. Arturi<sup>3</sup>, A. Riccioni<sup>3,4</sup>, R. Francavilla<sup>5</sup> and L. Mazzone<sup>2,4</sup>, (1)University of Bari, Bari, Italy, (2)Biomedicine and Prevention, POLICLINICO TOR VERGATA, University of Rome Tor Vergata, Rome, Italy, (3)Child and Adolescence Psychiatry Unit, Policlinico Tor Vergata Hospital, Rome, Italy, (4)Systems Medicine, Division of Child Psychiatry, University of Rome Tor Vergata, Rome, Italy, (5)Children's Hospital "Giovanni XXIII", University of Bari, Bari, Italy*

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## Background:

Recent data supports the hypothesis that the alteration of the microbiota plays a pivotal role in the pathogenesis of autism spectrum disorder (ASD). Several studies show that the gut microbiota of ASD individuals may be in part responsible for a deregulation of the gut-brain axis with particular relation to the onset of internalizing and externalizing symptoms. Besides, children with ASD are frequently characterized by gastrointestinal (GI) symptoms which may be linked to gut dysbiosis. Noteworthy, animal studies suggest that *Lactobacillus* (L.) *reuteri* PTA-6475 selectively rescues social deficits in genetic and idiopathic ASD models.

## Objectives:

Aim of this study is to assess the effect of a 6 month *L.Reuteri* (DSM17938 and ATCC PTA6475) supplementation on GI symptoms and gut microbiota in a sample of ASD children

## Methods:

We performed a randomized double-blind placebo-controlled trial on forty-three children with ASD (35 males 8 females; age range 3-8 years). Participants were randomized to L. Reuteri (DSM17938 and ATCC PTA6475) supplementation or placebo for a total of 180 days. At baseline (T0), after three months (T1) and at six months (T2), all participants underwent a standardized clinical assessment of GI problems (Gastrointestinal Symptoms Rating Scale), autism core symptoms and social behavior (Autism Diagnostic Observation Schedule-2<sup>nd</sup>; Social Responsiveness Scale; Adaptive Behavior Assessment 2<sup>nd</sup>). Gut microbiota analysis was performed at all timepoints by DNA extraction and then sequenced with MGI DNBT7.

## Results:

Preliminary results on gut microbiota analysis show that, at baseline, ASD children are characterized by a significant increase of Bacteroidetes ( $p<0.05$ ) and a decrease of Actinobacteria ( $p<0.034$ ) and Lactobacillus abundance ( $p<0.01$ ). After probiotic supplementation, we found that children receiving probiotic supplementation – in comparison to the placebo group - have a significant increase of: a) abundance of Bacteroidetes ( $p<0.006$ ), b) abundance of Intestinomonas butyriproducens family ( $p=0.02$ ). L. Reuteri was shown to change the microbiota composition of children treated with probiotic, leading to an increase in biodiversity as assessed by the Shannon Index.

## Conclusions:

The present clinical trial provides new insights into the gut-brain connection in ASD and shows that the supplementation with L. Reuteri (DSM17938 and ATCC PTA6475) fosters the abundance of anti-inflammatory species able to produce short chain fatty acids, increases microbiota diversity and improves GI symptoms. Further gut microbiota analysis that considers the social behavioral outcome after probiotic supplementation with L.Reuteri, may give a better understanding of the role played by microbiota in ASD.

### **413.167 (Poster)** Resting Heart Rate Variability As a Predictor of Anxiety Response to Propranolol in Autism Spectrum Disorder

*N. Nuraini<sup>1</sup>, C. Appling<sup>2</sup>, D. Q. Beversdorf<sup>3</sup>, K. Kovarik<sup>4</sup>, M. Prendergast<sup>4</sup> and B. J. Ferguson<sup>5</sup>, (1)Interdisciplinary Neuroscience Program, Thompson Center at the University of Missouri, Columbia, MO, (2)Interdisciplinary Neuroscience Program, University of Missouri, Columbia, MO, (3)Department of Radiology, Neurology, and Psychological Sciences, University of Missouri, Columbia, MO, (4)University of Missouri, Columbia, MO, (5)Health Psychology, Radiology, & Thompson Center for Autism & Neurodevelopmental Disorders, University of Missouri, Columbia, MO*

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## Background:

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social communication and interaction as well as restricted and repetitive behaviors that occur early in development. Many individuals with ASD have been shown to have co-occurring anxiety disorders which have been shown to be associated with dysautonomia, including increased sympathetic and decreased parasympathetic tone. In general, there is a large amount of heterogeneity in ASD, resulting in where some individuals responding to particular pharmacological interventions while others do not. For the treatment of anxiety, it is plausible that those individuals with greater adrenergic tone at rest may receive the most benefit from propranolol, which is a nonselective, beta-adrenergic antagonist. Identifying predictive biomarkers for treatment response for those with ASD and co-occurring anxiety may lead to optimization of individualized treatment

## Objectives:

The present pilot study explored the ability of baseline resting heart rate variability (HRV), a measure of autonomic nervous system functioning, on the change in clinician-rated anxiety after taking propranolol for 12 weeks. We hypothesized that baseline resting HRV variables would predict the anxiety response to propranolol in ASD.

## Methods:

Patients diagnosed with ASD age 7-24 (n=31) took propranolol for 12 weeks in an open label manner. Baseline heart rate variability (HRV) was obtained through 5-minute electrocardiogram recordings. Before and after 12 weeks, anxiety outcomes were clinician-rated using the Clinical Global Impression of Severity (GCI-S).

## Results:

Among the HRV variables, Very Low Frequency Power (VLF), Low Frequency Power (LF power), and High Frequency Power (HF Power) in frequency domain were found to predict treatment response for anxiety in response to propranolol as assessed by the clinician rated change in CGI-S after 12 weeks of open label treatment.

## Conclusions:

Frequency domain aspects of baseline HRV predicted anxiety outcomes after 12 weeks of treatment with propranolol, as measured by GCI-S. HRV measurement is beneficial in investigating the pathophysiology of various psychiatric disorders. HF reflects vagal (i.e., parasympathetic) activity while LF indicates baroreceptor activity during resting conditions. Lower HF and LF may be associated with anxiety. VLF rhythm activity is generated by heart intrinsically due to physical activity and anxiety that modulates its frequency and amplitude. These findings begin to suggest a psychophysiological assessment that may be integrated to facilitate the prediction of treatment outcomes for anxiety treatments targeting the adrenergic system. Further exploration is needed with larger trials targeting anxiety in patients with ASD while monitoring HRV to establish the clinical utility of predictive markers for response to propranolol and potentially other agents.

## 413.168 (Poster) The Effect of Low-Dose Ketamine on Aberrant Behaviors in Children with ADNP Syndrome

**L. Massa<sup>1</sup>, T. Levy<sup>2</sup>, D. Halpern<sup>2</sup>, H. Walker<sup>3</sup>, B. Lerman<sup>2</sup>, S. Barkley<sup>2</sup>, C. F. Layton<sup>1</sup>, P. M. Siper<sup>2</sup>, J. H. Foss-Feig<sup>2</sup>, J. D. Buxbaum<sup>4</sup>, A. Kolevzon<sup>2</sup> and K. Friedman<sup>5</sup>,** (1)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)Seaver Autism Center for Research and Treatment, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Teachers College, Columbia University, New York, NY, (4)Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (5)Vanderbilt University, Nashville, TN

## Background:

Activity-dependent neuroprotective protein (ADNP) syndrome is caused by pathogenic variants in the *ADNP* gene that lead to haploinsufficiency of the activity-dependent neuroprotective protein. Over 400 genes are regulated by ADNP and haploinsufficiency negatively impacts brain development, manifesting clinically as aberrant behavior, cognitive and language delays, attention deficits and hyperactivity, sensory seeking behaviors, anxiety, and sleep disturbance. Ketamine is an NMDA receptor antagonist that, in low doses, induces overexpression of ADNP at low doses in animal models (Brown et al., 2015). We hypothesized that treatment with low-dose ketamine would have a beneficial effect in individuals with ADNP syndrome by compensating for ADNP haploinsufficiency. To assess clinical outcomes, we used a variety of measures, including the Aberrant Behavior Checklist (ABC), which is a caregiver rating instrument developed for use in individuals with intellectual disability to assess the severity of aberrant behaviors across five subscales (Aman et al., 1985).

## Objectives:

To evaluate the safety of low-dose ketamine treatment in children with ADNP syndrome, as well as its efficacy for improving aberrant behaviors.

## Methods:

Ten individuals (7 male) with ADNP syndrome, ages 6 to 12 years ( $9.49 \pm 2.29$ ) participated in this single-dose, open-label clinical trial with low dose ketamine (0.5 mg/kg) infused intravenously over 40 minutes. Safety, tolerability, and efficacy measures were collected at (D0) Baseline before ketamine was administered, as well as post-infusion Day 1 (D1), Week 1 (W1), Week 2 (W2), and Week 4 (W4). To examine treatment effects, the Wilcoxon signed-rank test was calculated for the differences in data distributions (change over time) from D0 to D1, W1, W2, and to W4. All tests of statistical hypotheses were done on the two-sided 5% level of significance. Since this was an initial proof-of-concept study, no adjustments were made for multiple testing in the reported p-values. The Systematic Longitudinal Adverse Events Scale (SLAES) was administered by the study physician and the ABC was completed by the same parent at each time point. Adverse events were tabulated at each post-infusion visit.

#### Results:

No serious adverse events were reported; common adverse events included fatigue (n=5), aggression (n=5), elated/silly (n=4), decreased appetite (n=3), and anxiety (n=3) (Table 1). The Irritability, Social Withdrawal, Stereotypy, and Hyperactivity aberrant behavior subscales showed significantly decreased scores at W1, W2, and W4 in comparison to D0 (Table 2). No subscale scores significantly decreased from D0 to D1. The Inappropriate Speech subscale did not significantly decrease after drug administration (D0 to W1:  $p=0.606$ ).

#### Conclusions:

Ketamine was well tolerated and four of the five ABC subscales decreased significantly after ketamine was administered, suggesting overall improved aberrant behavior. The Inappropriate Speech subscale scores did not reflect improvement, likely because of the low verbal abilities of participants at baseline. Our results suggest that low dose ketamine is both safe for this cohort and potentially effective in reducing aberrant behaviors in children with ADNP syndrome. Future studies of ketamine in ADNP syndrome using placebo-controlled design in larger samples are warranted.

## VIRTUAL POSTER SESSION — INTERVENTIONS - PHARMACOLOGIC

### 513 - Interventions - Pharmacologic --- (V)

**513.111** (Virtual Poster) A Randomized Controlled Trial of Everolimus for Neurocognitive Symptoms in PTEN Hamartoma Tumor Syndrome  
S. Srivastava<sup>1</sup>, B. Jo<sup>2</sup>, B. Zhang<sup>1</sup>, T. W. Frazier<sup>3</sup>, A. S. Gallagher<sup>4</sup>, F. Peck<sup>4</sup>, A. R. Levin<sup>5</sup>, S. Mondal<sup>6</sup>, Z. Li<sup>6</sup>, R. Filip-Dhima<sup>7</sup>, G. Geisel<sup>1</sup>, K. Dies<sup>1</sup>, A. Diplock<sup>1</sup>, C. Eng<sup>8</sup>, R. Hanna<sup>9</sup>, M. Sahin<sup>1</sup> and A. Y. Hardan<sup>10</sup>, (1)Boston Children's Hospital, Boston, MA, (2)Department of Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, Stanford, CA, (3)Psychology, John Carrol University, Cleveland, OH, (4)Neurology, Boston Children's Hospital, Boston, MA, (5)Neurology, Boston Children's Hospital, Brookline, MA, (6)Stanford, Stanford, CA, (7)Boston Children's Hospital, Boston, MA, (8)Genomic Medicine, Cleveland Clinic Lerner Research Institute, Cleveland, OH, (9)Cleveland Clinic, Cleveland, OH, (10)Psychiatry & Behavioral Sciences, Stanford University, Stanford, CA

#### Background:

PTEN hamartoma tumor syndrome (PHTS) is a complex neurodevelopmental disorder associated with a high prevalence of autism spectrum disorder (ASD) and characterized by mTOR (mechanistic target of rapamycin) overactivity. Limited data suggest that mTOR inhibitors may be therapeutic. No placebo-controlled studies have examined mTOR inhibition on cognition and behavior in humans with PHTS with/without ASD.

#### Objectives:

We conducted a 6-month phase II, randomized, double-blinded, placebo-controlled trial to examine the safety profile and efficacy of everolimus (4.5mg/m<sup>2</sup>) in individuals (5-45 years) with PHTS.

#### Methods:

We measured several cognitive and behavioral outcomes, and electroencephalography (EEG) biomarkers. The primary endpoint was a neurocognitive composite derived from Stanford Binet-5 (SB-5) nonverbal working memory score, SB-5 verbal working memory, Conners' Continuous Performance Test hit reaction time, and Purdue Pegboard Test score.

#### Results:

Forty-six participants underwent 1:1 randomization: n=24 (everolimus) and n=22 (placebo). Gastrointestinal adverse events were more common in the everolimus group ( $p<0.001$ ). Changes in the primary endpoint between groups from baseline to month 6 were not apparent (Cohen's  $d=-0.10$ ,  $p=0.518$ ). However, several measures were associated with modest effect sizes ( $\geq 0.2$ ) in the direction of improvement, including measures of nonverbal IQ, verbal learning, autism symptoms, motor skills, adaptive behavior, and global improvement. There was a significant difference in EEG central alpha power ( $p=0.049$ ) and central beta power ( $p=0.039$ ) six months after everolimus treatment.

#### Conclusions:



Everolimus is well tolerated in PHTS; adverse events were similar to previous reports. The primary efficacy endpoint did not reveal improvement. Several secondary efficacy endpoints moved in the direction of improvement. EEG measurements indicate target engagement following 6 months of daily oral everolimus.

**513.112 (Virtual Poster)** Treatment of Missed ADHD with Significant Improvement in Three Adult Females with Mild Autism Spectrum Disorder and Recurrent Suicidality

**S. C. Singh<sup>1</sup>, I. Casubhoy<sup>2</sup> and J. A. Hellings<sup>3</sup>,** (1)University of Missouri-Kansas City, Kansas City, MO, (2)University of Missouri-Kansas City School of Medicine, Kansas City, MO, (3)Psychiatry, University of Missouri Kansas City and Truman Behavioral Health, Kansas City, MO

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**Background:** Attention deficit hyperactivity disorder (ADHD) is often missed in adults, especially in females, including those with autism spectrum disorder (ASD). Antidepressants including selective serotonin reuptake inhibitors (SSRIs) may be activating in ASD and may worsen psychiatric problems including suicidality.

**Objectives:** To discuss overlooked ADHD comorbid with ASD, which may present as recurrent suicidality associated with adversity, including in adult females. Treatment with antidepressants, mood stabilizers and antipsychotics may then produce minimal if any improvement, or even worsening if the antidepressants cause activation. Three cases are described that demonstrated significant improvements after ADHD medications were added and antidepressants later cautiously tapered in small doses, and in two cases, tapered off completely with continued improvements in behavior and functioning.

**Methods:** We describe 3 adult females with mild ASD presenting on antidepressants, antipsychotics and mood stabilizers who tested positive for ADHD on the Adult ADHD-RS and met DSM-5 criteria for ADHD, however untreated. Each had significant environmental stressors, impulsivity and recurrent suicidality. We extracted their demographic data, diagnoses, medications at start and end, and outcomes on the Clinical Global Impressions-Improvement (CGI-I) subscale. ADHD medications are a focus of each case, together with very cautious, gradual antidepressant taper.

**Results:** All cases met DSM-5 criteria for mild ASD, ADHD-RS ratings for ADHD, and presented with mood disorder diagnoses. Final CGI-I on all 3 cases was Much Improved. **Case 1:** 18yr WF presented with failure in education, work and independent living accompanied by hopelessness and intermittent suicidal ideation (SI). Atomoxetine (ATX) was added and bupropion XL tapered gradually, with improvement. Aripiprazole was also tapered gradually. Later, mixed amphetamine salts were added, with more improvement. Further environmental stressors resulted in an ED visit for SI and bupropion XL was increased, resulting in manic-like symptoms, which responded to dose reduction, and individual therapy. **Case 2:** 33yr WF with stressors of residential living and interpersonal problems presented with recurrent outbursts, police calls and ED visits for hopelessness, SI and homicidal threats. Medications at presentation included antidepressants (bupropion XL), aripiprazole and lithium. ATX was added and gradually increased, and bupropion and lithium were tapered off, producing improvement. However she worsened again with more stressors, was admitted and ATX was tapered off. Following discharge, ATX was restarted and increased to 40mg qam, 25mg qhs with much improvement and better ability to ignore others, and holds a job. **Case 3:** 24yr WF presented with life stressors of residential living and family stressors, poor frustration tolerance, on antidepressants (sertraline 200mg daily, doxepin 10 mg daily), antipsychotics, and mood stabilizers. She had recurrent ED visits and hospitalizations for SI, until she was started on ATX followed by cautious, taper off antidepressants, producing significant improvement. Final ATX dose was 40mg qam, 25mg qhs.

**Conclusions:** Suicidality can be due to causes other than mood disorders, including environmental stressors, and impaired frustration tolerance associated with ADHD. Diagnostic assessment for ADHD, use of the Adult ADHD-RS, and treatment with ADHD medications as well as cautious antidepressant taper under surveillance may be important in improving outcomes.

**513.113 (Virtual Poster)** Medical Cannabis for Treatment of Comorbid Symptoms in Children with Autistic Spectrum Disorder: An Interim Analysis of Biochemical Safety

**O. E. Stolar,** Autism Center, Assaf Harofeh Medical Center, zerifin, Israel

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**Background:** Autistic Spectrum Disorder (ASD) is a common neurodevelopmental disorder and no effective treatment for the core symptoms is currently available. The present study is part of a larger clinical trial assessing the effects of cannabis oil on autism co-morbidities.

**Objectives:** The aim of the present study was to assess the safety of a CBD-rich oil treatment in children and adolescents with ASD.

**Methods:** Data from 59 children and young adults (ages 5-25 years) from a single-arm, ongoing, prospective, open-label, one center, phase III study was analyzed. Participants received medical cannabis extract infused in MCT oil with a CBD:THC ratio of 20:1 for six months. Blood analysis was performed before treatment initiation, and after 3 months. Complete blood count, glucose, urea, creatinine, electrolytes, liver enzymes (AST, ALT, GGT), bilirubin, lipid profile, TSH, FT4, thyroid antibodies, prolactin, and testosterone measurements were performed at baseline, prior to starting treatment and at study midpoint, after three months of treatment.

**Results:** 59 children (85% male and 15% female) were followed for 18± 8 weeks (mean ±SD). The mean total daily dose was 7.88±4.24 mg/kg body weight. No clinical or statistically significant differences were found in any of the analytes between baseline and 3 month follow up. A comparison of patients who received additional medications (n=14), to those who solely received medical cannabis (n=45) showed no differences in biochemical tests.

**Conclusions:** CBD-rich cannabis oil (CBD: THC 20:1), appears to have a good safety profile. Long-term monitoring with a larger number of participants is warranted.

**513.114 (Virtual Poster)** Medical Cannabis for the Treatment of Comorbid Symptoms in Children with Autistic Spectrum Disorder: An Interim Analysis of Biochemical Safety

**O. E. Stolar**, Autism Center, Assaf Harofeh Medical Center, Zerifin, Israel

**Background:** Autistic Spectrum Disorder (ASD) is a common neurodevelopmental disorder and no effective treatment for the core symptoms is currently available. The present study is part of a larger clinical trial assessing the effects of cannabis oil on autism co-morbidities.

**Objectives:** The aim of the present study was to assess the safety of a CBD-rich oil treatment in children and adolescents with ASD.

**Methods:** Data from 59 children and young adults (ages 5-25 years) from a single-arm, ongoing, prospective, open-label, one center, phase III study was analyzed. Participants received medical cannabis extract infused in MCT oil with a CBD:THC ratio of 20:1 for six months. Blood analysis was performed before treatment initiation, and after 3 months. Complete blood count, glucose, urea, creatinine, electrolytes, liver enzymes (AST, ALT, GGT), bilirubin, lipid profile, TSH, FT4, thyroid antibodies, prolactin, and testosterone measurements were performed at baseline, prior to starting treatment and at study midpoint, after three months of treatment.

**Results:** 59 children (85% male and 15% female) were followed for  $18 \pm 8$  weeks (mean  $\pm$ SD). The mean total daily dose was  $7.88 \pm 4.24$  mg/kg body weight. No clinical or statistically significant differences were found in any of the analytes between baseline and 3 month follow up. A comparison of patients who received additional medications (n=14), to those who solely received medical cannabis (n=45) showed no differences in biochemical tests.

**Conclusions:** CBD-rich cannabis oil (CBD: THC 20:1), appears to have a good safety profile. Long-term monitoring with a larger number of participants is warranted.

**513.115 (Virtual Poster)** Psychotropic Medication Use in Autistic Children Enrolled in Medicaid

**J. Rast<sup>1</sup>, S. Tao<sup>2</sup>, L. Shea<sup>3</sup> and B. K. Lee<sup>4</sup>**, (1)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (2)Drexel University, Philadelphia, PA, (3)A.J. Drexel Autism Institute, Philadelphia, PA, (4)Epidemiology and Biostatistics, Drexel University, Philadelphia, PA

**Background:** Autistic children frequently present with complex mental health conditions. As many as 78% of autistic children have  $\geq 1$  co-occurring mental health condition, and half having  $\geq 2$  mental health conditions. The most common conditions are behavior/conduct problems (61%); anxiety (40%); ADHD (48%); and depression (16%). The use of psychotropic medication is an important consideration in the management of these conditions. The high rates of co-occurring mental health conditions in autistic children drive the use of polypharmacy, with 35% of children taking drugs from  $\geq 2$  psychotropic classes, and 15% taking drugs from  $\geq 3$  classes. In autistic children, the presentation of complex symptom profiles makes prescription and symptom management a difficult task that is often approached on a case-by-case and trial-and-error basis. The safety and efficacy of psychotropic medications in autistic populations is largely unknown.

**Objectives:** This study seeks to provide current estimates of use of psychotropic medications, and predictors thereof, in autistic children across the US enrolled in Medicaid. These medications often carry with them significant neurological, behavioral, or somatic side effects. Although there is emerging evidence regarding the effectiveness (or lack thereof) of several such off-label pharmacological treatments of autism, there is a general lack of understanding about off-label medications to treat autism. There is also little understanding of the distinction between medication for autism symptoms versus maintenance of co-occurring mental health conditions. Thus, it is important to characterize the extent to which these medications are used in the care of autism.

**Methods:** Using Medicaid Analytic eXtract (MAX) data from 2008-2016, we will examine trends and correlates of psychotropic medication use in autistic children and youth ages 6-21. Medications will be classified using the Multum Lexicon database using the following classes of psychotropics: antidepressants, neuroleptics (aka antipsychotics), anxiolytics (aka anti-anxiety), mood stabilizers, sedatives/hypnotics, stimulants, and anticonvulsants. We will examine 1) prevalence of overall medication use by age and year, 2) patterns of medication use including monotherapy, inter- and intra-class polypharmacy, and inconsistent medication use or switching, 3) most common medication combinations for polypharmacy and average length of time engaged, and 4) demographic and patient characteristic factors associated with any psychotropic medication and with polypharmacy using multivariable logistic regression.

**Results:** More than half (58%) of autistic children enrolled in Medicaid took a psychotropic medication in a given year. The most common were mood stabilizers (44%), stimulants (31%), and antidepressants (28%). Further analysis will explore polypharmacy and usage by key strata, including age, sex, and race; and logistic regression results.

**Conclusions:** Use of psychotropic medication is common in autistic children, but with a lack of clinical guidance and safety and efficacy information, it is important to understand use patterns so we can begin to examine how usage impacts health. More work is needed to understand the negative outcomes associated with psychotropic medication use, and polypharmacy in particular.

## Medical and Psychiatric Comorbidity

**Panel Chair:** Jessica Schwartzman, *Psychiatry and Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN*

**Discussant:** Katherine Gotham, *Department of Psychology, Rowan University, Glassboro, NJ*

**205.001 (Panel)** Is Camouflaging Autistic Traits Associated with Thwarted Belongingness, Perceived Burdensomeness, and Suicidality in Autistic Adults?

S. A. Cassidy<sup>1</sup>, H. Cogger-Ward<sup>1</sup>, L. Manning<sup>1</sup>, M. K. Pelton<sup>2</sup> and J. Rodgers<sup>3</sup>, (1)School of Psychology, University of Nottingham, Nottingham, United Kingdom, (2)Coventry University, Coventry, United Kingdom, (3)Population Health Sciences Institute, Newcastle University, Newcastle upon Tyne, United Kingdom

Background:

Autistic adults are at significantly higher risk of suicidality compared to non-autistic people, but there is little research exploring why. The Interpersonal Theory of Suicide posits that a lack of meaningful social connections (thwarted belongingness) and perceiving oneself to be a burden to others (perceived burdensomeness) increases risk of experiencing suicidal thoughts. A previous study found that in a community sample of young adults, those who reported camouflaging high autistic traits to 'fit in' in social situations were more likely to experience thwarted belongingness, which was in turn associated with suicidality. However, this model has not yet been tested in autistic people.

Objectives:

1. To test whether camouflaging significantly predicts: a) thwarted belongingness; and b) perceived burdensomeness.
2. To test whether the association between camouflaging with suicidality is mediated by: a) thwarted belongingness; and b) perceived burdensomeness.

Methods:

385 autistic adults (103 self-identifying autistic, 27.5% male gender, mean age=39.4 *SD*=13.3), completed measures of autistic traits (AQ), camouflaging autistic traits (CAT-Q), thwarted belongingness and perceived burdensomeness (INQ-15), current anxiety (ASA-A) and depressive symptoms (PHQ-9), and lifetime suicidality (SBQ-ASC), online. Multiple hierarchical regressions explored whether camouflaging significantly predicted thwarted belongingness or perceived burdensomeness, after controlling for age, gender, current depression and anxiety symptoms and autistic traits. Serial mediation analyses explored: a) whether the association between autistic traits and lifetime suicidality was significantly mediated by camouflaging and thwarted belongingness; and b) whether the association between autistic traits and lifetime suicidality was significantly mediated by camouflaging and perceived burdensomeness.

Results:

After controlling for age, gender, current depression and anxiety symptoms, and autistic traits, camouflaging did not account for significantly more variance in either thwarted belongingness ( $F(1,375)=1.03, p=.31$ ) or perceived burdensomeness ( $F(1,375)=.045, p=.83$ ). In the first serial mediation model, camouflaging was not significantly associated with thwarted belongingness, and therefore the full serial mediation path was not significant. However, there was evidence for two simple mediation effects, where the association between autistic traits and lifetime suicidality was significantly mediated separately by: a) camouflaging; and b) thwarted belongingness. In the second serial mediation model, the association between autistic traits with lifetime suicidality was significantly mediated by camouflaging and perceived burdensomeness.

Conclusions:

Consistent with previous research, camouflaging was significantly associated with lifetime suicidality in a sample of autistic adults. However, contrary to our hypotheses, camouflaging was more strongly associated with perceiving oneself to be a burden on others, rather than feelings of being socially disconnected from others. This pattern of results is different to that previously found in non-autistic people with high autistic traits, suggesting that the impact of camouflaging on suicidality could be different in autistic compared to non-autistic people. Specifically, non-autistic people who camouflage autistic traits tend to report feeling socially disconnected from others. In contrast, autistic people who camouflage tend to report feeling a burden on others. This suggests that reducing pressure to camouflage is an important transdiagnostic suicide prevention target, but programmes should take into account the potentially different impact of camouflaging on suicidality in autistic people and those with high autistic traits.

**205.002 (Panel)** Modeling Social Predictors of Depressive Symptoms across the First Semester in Autistic and Non-Autistic College Students

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**Background:** Meta-analytic review has suggested autistic individuals are approximately four times more likely than non-autistic individuals to experience lifetime depression (Hudson et al., 2019). Autistic adults are more likely to endorse social rejection, lack of social support, and loneliness, which may contribute to depressive symptoms (Ee et al., 2019; Han et al., 2019; Mazurek, 2014). These concerns may be particularly salient during the first semester of college, as students enter a new, less structured social environment (Bailey et al., 2020; White et al., 2016). Autistic college students who do not feel as socially connected tend to report lower subjective well-being and greater difficulty balancing the demands of school (Bailey et al., 2020), which may in turn affect academic success and retention.

**Objectives:** The current study examines satisfaction with social connectedness as a prospective predictor of depression symptoms in a longitudinal sample of first-semester college students. We hypothesize that students who report lower social satisfaction in biweekly reports will experience greater depressive symptoms over the semester, and that this effect will be stronger for those who reported greater baseline capacity for social reward. While we predict no difference in this model between groups, we hypothesize that a higher proportion of autistic students will exhibit this lack of social fulfillment compared to non-autistic peers.

**Methods:** We recruited incoming college students from four universities in New York and New Jersey who reported either no history of autism ( $n=60$ ; 48% women; SRS-2  $M=53.83$ ;  $SD=8.31$ ) or suspected or previously diagnosed autism ( $n=36$ ; 41% women; SRS-2  $M=63.50$ ;  $SD=10.24$ ). Participants first completed a baseline survey of demographic, diagnostic, and behavioral health information, including the Beck Depression Inventory, 2nd edition (BDI-II; Beck et al., 1996), and Anticipatory and Consummatory Interpersonal Pleasure Scale (ACIPS; Gooding & Pflum, 2014). Participants then completed an 11-question survey twice per week for 12 weeks; this indexed social engagement and satisfaction, depressive and anxiety symptoms, and current stressors. Participants will complete a semester-end battery in mid-December 2021. We anticipate using latent difference score models to analyze the final longitudinal dataset.

**Results:** Across both groups, lower feelings of social connectedness were associated with greater sadness across biweekly surveys ( $F(1, 497) = 67.07$ ,  $p < 0.001$ ), and this relationship was strongest for those with highest baseline social motivation per ACIPS ( $F(1, 497)=10.24$ ,  $p=0.001$ ; see Figure 1). Autistic students reported lower average biweekly social satisfaction ( $M=54.02$ ,  $SD=20.02$ ) than non-autistic students ( $M=58.99$ ,  $SD=22.37$ ;  $F(1, 497)=7.04$ ,  $p<0.01$ ), though both groups showed increasing satisfaction over time (Figure 2).

**Conclusions:** Preliminary results indicate that, across diagnostic cohorts, lower social connectedness is associated with greater reported sadness within frequent, granular self-report, and that this relationship was strongest for those with the greatest baseline capacity for social reward. Autistic students tended to feel less satisfied with their social connection compared to non-autistic peers. At this point, the trajectory appears encouraging insofar as both autistic and non-autistic students tend to report increasing social satisfaction as the semester progresses.

### **205.003 (Panel) Depression and Quality of Life Directly and Sequentially Mediate the Association between Loneliness and Suicidal Ideation in Autistic Adults**

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**Background:** Autistic adults endorse suicidal ideation more frequently than neurotypical adults, prompting investigations into risk and resilience factors. Loneliness and social dissatisfaction may be salient risk factors in autism as one study reported an indirect pathway from loneliness through depression to suicidal ideation (PHQ-9 item #9) in 71 autistic adults (Hedley et al., 2018). However, it remains unknown whether these relationships reflect residual confounding by other risk factors such as social difficulties or trait neuroticism. In addition, despite the importance of quality of life (QoL) as a treatment target and goal for many autistic adults, its role in this pathway to suicidal ideation has not been investigated.

**Objectives:** The objective of this study was to expand upon the early work by Hedley and colleagues (2018) on the loneliness-depression-suicidal ideation pathway by investigating the mediating role of quality of life within this pathway, additionally controlling for relevant demographic and clinical variables that may confound these relationships.

**Methods:** The sample included 762 autistic adults (271 males, 414 females, 77 non-binary; 39.3% with current suicidal ideation) who completed self-report questionnaires at one timepoint as part of a larger SPARK dataset focused on repetitive thinking in depression (RM0030Gotham). Participants self-reported suicidal thoughts/wishes (BDI-II Item #9), depressive symptoms (BDI-II without item #9), loneliness (LiCQ), social anxiety (BFNE-S), neuroticism (IPIP-N10), autistic traits (SRS-2), quality of life (WHOQoL-4), and demographic factors (age, gender, education level). To examine the loneliness-depression-QoL-suicidality pathway, we fit a sequential Bayesian mediation model that additionally controlled for demographics, autistic traits, neuroticism, and social anxiety. Direct and indirect effects of loneliness were quantified using fully standardized path coefficients.

**Results:** The zero-order correlation between loneliness and suicidal ideation demonstrated a moderate-to-large association between the two variables ( $r_{\text{poly}}=0.400$ ,  $CrI_{95\%} [0.326, 0.466]$ ). Within the sequential mediation model (Figure 1), the combined direct and indirect effect of loneliness on suicidal thoughts/wishes was moderate in magnitude ( $\beta_{\text{Sid}}=0.362$ ,  $CrI_{95\%} [0.232, 0.495]$ ) and completely mediated by depressive symptoms and QoL (direct effect:  $\beta_{\text{Sid}}=0.080 [-0.038, 0.202]$ ; total indirect effect:  $\beta_{\text{Sid}}=0.281 [0.207, 0.357]$ ; 77.9% [52.4%, 109.8%] mediated). The indirect path through depression was larger than both the indirect path through quality of life and the sequential path through both depression and quality of life, though all three paths were statistically significant. In addition to the direct effects of depressive symptoms and quality of life, younger age, non-binary gender, and higher education level were all independently associated with greater suicidal ideation. Direct effects of female gender, autistic traits, social anxiety, and neuroticism did not reach statistical significance.

**Conclusions:** These findings confirm that loneliness is a robust predictor of suicidal ideation in autistic adults, even after controlling for demographic variables, neuroticism, and social difficulties. This relationship is fully mediated by a combination of increased depressive symptoms and reduced quality of life, with loneliness influencing suicidal ideation via multiple indirect paths. Future experimental studies that explicitly intervene on loneliness are necessary to further interrogate these causal relationships and investigate the utility of increasing social connectedness as a method of reducing suicidality in the autistic population.

**205.004 (Panel) A Mixed Methods Study of Suicidal and Non-Suicidal Self-Injurious Behavior in Younger and Older Autistic People**

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**Background:** There is now substantial evidence of an increased prevalence of suicidal thoughts and behavior in autistic people when compared to the general population (Kölves et al., 2021). However, given research in this area is relatively recent, the reasons underlying suicidal thoughts and behavior within these individuals are relatively unexplored. In these two studies we used the Columbia-Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011) to collect information on intensity and severity of suicidal ideation, history of suicidal behavior, and lethality of actual attempts in two samples of autistic people. Study 1 was conducted in Canada, and data were collected from caregivers of younger autistic people 8–26 years of age. Study 2 was conducted in Australia where the C-SSRS was administered via interview to older participants (18 years and older). In Study 2 a sub-sample of participants with a history of a suicidal attempt were invited to complete qualitative interviews concerning their experiences managing their mental health and suicidal behavior.

**Objectives:** To characterize suicidal thoughts and behavior in younger and older autistic people from Canada and Australia.

**Methods:** A mixed methods interview design was adopted. Both studies were approved by the relevant ethics review boards and all participants provided written informed consent. Participants in Study 1 were caregivers (91% female,  $M_{AGE}=41.25$ ,  $SD=6.7$ ) of 33 autistic children, youth, and young adults (male=78.8%), 8 to 26 years of age ( $M_{AGE}=13.28$ ,  $SD=4.42$  years) who completed a modified caregiver-report version of the C-SSRS. Participants in Study 2 were 98 autistic adults (women=58.2%, men=34.7%, non-binary=7.1%) 20 to 70 years of age ( $M_{AGE}=41.65$ ,  $SD=2.96$  years). A sub-sample of participants ( $n=19$ ; 58% women,  $M_{AGE}=43.11$ ,  $SD=11.38$ ) with a history of at least one suicide attempt completed semi-structured qualitative interviews. The C-SSRS was used to assess the presence and severity of suicidal behavior and was administered by interviewers who had completed the online training. Suicidal behavior was coded according to C-SSRS guidelines.

**Results:** For Study 1, 24.2% ( $n=8$ ) of caregivers reported their child had a suicide attempt and 60.6% ( $n=20$ ) reported engaging in non-suicidal self-injurious behavior. The mean age of first attempt was early adolescence ( $M_{AGE}=13.54$ ,  $SD=4.93$ , Range:7–24 years). Methods included cutting, running into traffic and overdose. For Study 2, 41.8% ( $n=41$ ) of participants reported a suicide attempt and 63.3% reported engaging in non-suicidal self-injurious behavior. The age of first suicide attempt ranged from 7 to 45 years ( $M=19.39$ ,  $SD=9.28$  years). The most frequent method was overdose (38%), followed by cutting (23.5%) and suffocation (14.7%). The qualitative interviews identified financial cost, the lack of services catering for autistic people, and a perceived lack of autism knowledge amongst mental health professionals as barriers to receiving appropriate mental health. Participants also identified a need for individualised treatment approaches.

**Conclusions:** The findings from these studies highlight that suicidal behavior is present and relatively high among autistic people and across age groups, with adolescence identified as a particularly vulnerable period. Qualitative results identified both shortcomings in existing services as well as new directions for developing appropriate prevention strategies.

## ORAL SESSION - 10A — MEDICAL AND PSYCHIATRIC COMORBIDITY

### 316 - Intersectional Comorbidities

**316.001 (Oral) Sex Differences in Mental Health in Young Autistic Adults: A Population Based Cohort Study**

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**Background:**

Autistic individuals are at increased risk for mental health (MH) problems compared to the general population, with a majority receiving at least one psychiatric diagnosis. Young adulthood – the onset period for many psychiatric disorders – is a challenging transitional period, particularly for autistic individuals. Autistic females show a disproportionally increased risk for psychiatric disorders and might be particularly vulnerable in young adulthood.

**Objectives:**

We examined sex differences in the incidence of co-occurring psychiatric diagnoses in autistic young adults aged 16 to 24 years compared to the general population. We assessed severity of MH problems as indicated by hospitalizations.

## Methods:

Using a population-based cohort design, we identified all individuals born in Sweden between 1985 and 1997 from nationwide registers. A total of 1,335,753 individuals, including 20,841 autistic individuals (7,129 females, 34.21%), were followed up from age 16 to 24 years (end of follow up, 31<sup>st</sup> December 2013). We compared the incidence of 13 psychiatric disorders (see Figure 1) between autistic and non-autistic individuals, assessed through inpatient or outpatient diagnoses in the National Patient Register. To estimate relative risk for co-occurring disorders we calculated hazards ratios (HR) using stratified Cox proportional hazards regression and compared HR between sexes using a ratio of HR ( $HR_{females}/HR_{males}$ ). We computed absolute risk as cumulative incidence at age 25, with additional estimation of standardized survival probability and risk difference using standardization with Cox regressions comparing autistic males and females. Analyses were repeated for inpatient diagnoses to assess psychiatric hospitalization.

## Results:

Autism was associated with increased absolute (cumulative incidence, 0.67; 95%CI, 0.66 -0.68) and relative risk (HR, 6.85; 95%CI, 6.71-7.00) for any psychiatric diagnosis. Sex stratified analyses indicated elevated risk for all MH problems in autistic males and females compared to individuals without autism of the same sex (HR-range males, 2.99-18.67, HR-range females, 3.18-20.78, see Figure2). Comparing autistic females to non-autistic females yielded a higher HR than for males for psychotic disorders, alcohol and substance use disorders, and self-harm. Absolute risk was highest in autistic females for any disorder and 9 out of 13 individual disorders. We observed higher HR for males than females for depressive disorders, OCD, anorexia nervosa and other eating disorders.

Autistic individuals were more likely than non-autistic individuals to be hospitalized due to any psychiatric disorder (HR, 6.67; 95%CI, 6.43-6.92). Ratios of HR pointed toward increased relative risk in females to be hospitalized due to any psychiatric disorder, anxiety disorders, psychotic disorders, alcohol and substance use disorders, and self-harm. Absolute risk was higher in autistic females for any disorder and 6 out of 13 individual disorders.

## Conclusions:

Autistic females, who until now have been underrepresented in research and clinical practice, have similar or even higher MH needs than autistic males. Our findings, especially on self-harm in autistic females, highlight the importance of identifying underlying mechanisms – potentially grounded in delayed diagnosis due to differential autism presentation, masking of symptoms and biases in diagnosing autism in females – that contribute to MH problems in this population.

### 316.002 (Oral) Comorbidities of Autism Spectrum Disorder and Their Etiologies

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**Background:** Autism spectrum disorder (ASD) is a neurodevelopmental disorder manifested by social communication deficits and restricted and repetitive behaviors. In addition to the core features of ASD, affected individuals also experience a higher burden of co-occurring medical conditions.

**Objectives:** This study sought to examine the pattern of comorbidities in individuals with ASD and systematically evaluate the possibility that peri- and postnatal exposures (e.g., preterm birth, hypoxia at birth, traumatic brain injury, and fetal alcohol syndrome) associated with ASD may also be linked with distinct comorbidities.

**Methods:** We used the SPARK study database, launched by the Simons Foundation Autism Research Initiative (SFARI). Pregnancy and birth-related conditions served as the main exposure variables, including preterm birth (gestational age of <37 weeks), serious prenatal infection, fetal alcohol syndrome, hypoxia at birth, and bleeding into the brain during delivery. Postnatal exposures were lead poisoning, brain infections such as bacterial meningitis, and encephalitis, and traumatic brain injury requiring hospitalization. Outcomes were based on parent reported comorbidities, including neurological, cognitive, psychiatric, and physical conditions.

**Results:** The study sample consisted of 42,569 individuals with ASD and their 11,389 non-ASD siblings. Children with ASD had a substantially higher standardized (standardized for age, sex, and year of evaluation) prevalence of all comorbidities analyzed in this study compared to their siblings without an ASD diagnosis (all p-values <0.05). ADHD was the most common comorbidity, affecting 1 in every 3 children with ASD (35.3%), much higher than 1 in 6 (16.8%) among non-ASD siblings. Learning disability (23.5%) and intellectual disability (21.7%) were the next most-common comorbid conditions among children with ASD. Individuals with ASD also had a higher standardized prevalence of all the pre- and postnatal exposures, including preterm birth, hypoxia at birth, traumatic brain injury, and fetal alcohol syndrome. In logistic regression models adjusted for covariates (annual household income, and father's and mother's highest education levels, paternal age and maternal age, year of birth, age of the child at evaluation, survey version, race, and ethnicity), different exposures were associated with distinct patterns of comorbidities in ASD cases, including associations between preterm birth and anxiety disorder (OR = 1.30; 95%CI = 1.20-1.42), preterm birth and hoarding (OR=1.59; 95%CI=1.27-1.98), bleeding into brain and strabismus (OR = 2.74; 95%CI = 1.96-3.82), and traumatic brain injury and difficulty gaining weight (OR

= 2.36; 95%CI = 1.54-3.61). Figure 1 presents an overview of the associations between peri- and postnatal exposures and comorbidity in ASD. A similar pattern of associations was also observed in non-ASD siblings.

**Conclusions:** This study followed a systematic approach, evaluating pre- and postnatal exposure and comorbidity associations in ASD. The high burden of comorbidity in individuals with ASD highlights the importance of timely diagnosis and management of comorbidity in ASD. Study findings, if replicated in other samples, can inform the etiology of comorbidity in ASD, and help with stratification of individuals with ASD for targeted prevention and screening strategies.

### **316.003 (Oral) Network Analysis to Evaluate Relations Among Approach-Withdrawal Behavior and Co-Occurring Conditions in ASD**

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**Background:** Approximately 70% of children with autism spectrum disorder (ASD) present with at least one co-occurring psychiatric condition, with anxiety and mood disorders, obsessive compulsive disorder (OCD), oppositional defiant disorder (ODD), and attention-deficit hyperactivity disorder (ADHD) among the most common. Atypical patterns of behavioral approach and withdrawal may explain relationships among ASD and prevalence of these conditions. For example, ASD-specific social tendencies may reflect increased approach to non-social stimuli and/or decreased approach or increased withdrawal from social stimuli. Similarly, depression and anxiety have been associated with decreased approach toward emotional stimuli and increased withdrawal from feared stimuli.

**Objectives:** Characterize patterns of approach and withdrawal behaviors relevant to ASD in relation to co-occurring symptoms.

**Methods:** Participants included 276 children with ASD aged 7-11 years [ $M_{age}=8.56$  years, 23.6% female, 31.9% non-White] from the Autism Biomarkers Consortium for Clinical Trials. Parents/caregivers completed the Child and Adolescent Symptom Inventory (CASI-5) to evaluate co-occurring symptomatology and the Pervasive Developmental Disorder Behavior Inventory (PDDBI), an ASD rating scale that includes approach-withdrawal behavior. 35.5% exceeded the clinical cutoff for dysthymia, 40.2% for generalized anxiety, 14.1% for separation anxiety, 29.3% for social anxiety, 44.2% for hyperactive impulsivity, 60.1% for inattention, 17.8% for major depressive episode (MDE), and 24.6% for ODD. Interrelations among approach-withdrawal behaviors and clinical symptoms were probed using a regularized partial correlation network containing 35 nodes: 27 PDDBI facets of approach-withdrawal behavior and 8 CASI-5 clinical conditions. Community structure was determined using the walktrap algorithm, node centrality was computed using one-step expected influence, and stability was quantified using case-dropping bootstrap procedures.

**Results:** PDDBI approach-withdrawal behaviors were organized into five communities (Figure 1), which we interpreted as (1) Sensory Features, (2), Temperamental Characteristics, (3) Social Pragmatics, and (4) Preference for Predictability. ODD was situated in Temperamental Characteristics, social and separation anxiety in Preference for Predictability, and ADHD hyperactive impulsivity and inattention in Social Pragmatics. Generalized anxiety, dysthymia, and MDE clustered into their own independent community(5). The network was determined to be stable ( $CS=.44$ ). Examination of edges (i.e., significant partial correlations) connecting CASI to PDDBI nodes revealed that social anxiety was most strongly linked to ASD-related *social withdrawal*, and separation anxiety was associated with *anxious when caregiver is away*; both conditions were strongly associated with *fears and anxieties*. ODD was associated with *aggressive towards others* and *overall temperament problems*. ADHD hyperactivity/impulsivity was associated with *problems with social approach* and ADHD inattentiveness was related to *kinesthetic problems*.

**Conclusions:** Findings offer specificity in linking ASD-related approach-withdrawal behaviors to common co-occurring conditions. Specifically, social anxiety, separation anxiety, ODD, and ADHD were strongly associated with core ASD features, supporting symptom overlap in ASD and these clinical conditions. A notable proportion of the sample (18-40%) endorsed generalized anxiety, dysthymia, and MDE, which comprised a distinct cluster, suggesting that these conditions may emerge *in addition* to core ASD features. Sleep regulation was among the strongest bridge nodes; given that it is integral for daily functioning, sleep may represent an effective intervention target to reduce the development of undesired co-occurring symptoms.

### **316.004 (Oral) Elevated COVID-19 Risk: Children with Autism, Intellectual Disability, and Mental Health Diagnoses**

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**Background:**

Adults and children with some developmental and mental health conditions are at risk of severe disease from COVID-19 (Schott et al. 2021, CDC 2021). With most children returning to in-person schooling in Fall 2021, it is important to assess COVID-19 risk among vulnerable children, such as children with autism and/or intellectual disability (ID).

**Objectives:**

We quantify risk factors related to service needs, health vulnerability, and co-occurring conditions among autistic children, children with ID, and children with mental health conditions, compared to children without these conditions.

#### Methods:

Using Medicaid Analytic eXtract (MAX) data from 2008-2012, we examine the full population of autistic children ages 0-18 (n=469,053) and of children with a diagnosis of ID but not autism (n=292,380), as well as a random sample of children with any mental health condition (n=372,403) and a random sample of children with no mental health or developmental conditions (n=1,301,727). We first quantify risk factors for each of these groups due to service needs (living in a residential facility, needing in-home services), health vulnerability (living in a primary care shortage area, having been hospitalized for a preventable condition), and underlying conditions (those identified by the Centers for Disease Control as putting individuals at risk of severe illness from COVID-19). Next, we conduct logistic regression to examine the odds of these risk factors among autistic children, children with ID, and children with mental health conditions, compared to children without autism, ID, or other mental health diagnoses, controlling for age group, sex, eligibility group, Medicare dual status, insurance type, and state.

#### Results:

Vulnerability to infection is higher among autistic children and children with ID. Living in a residential facility is more common for these children (7% of autistic children, 12% of children with ID, compared to less than 1% of children without any mental health or developmental conditions), as are avoidable hospitalizations (53%, 57%, and 32%, respectively). Autistic children and children with ID are also at greater risk of severe infection from COVID-19: the percent of autistic children and children with ID that have high-risk underlying conditions is more than twice as high as children without mental health or developmental conditions in Medicaid.

Controlling for demographic and insurance characteristics, the odds of living in a residential facility are six times greater for autistic children and 16 times higher for children with ID, compared to children in Medicaid without mental health or developmental conditions. The odds of autistic children having a high-risk underlying condition are twice as high and the odds of children with ID are three times as high as for children in Medicaid without mental health or developmental conditions.

#### Conclusions:

Children with autism, ID, and mental health conditions are at greater risk of COVID-19. It is important to ensure multi-faceted risk mitigation is followed for families with these vulnerable children. First, vaccination among all eligible individuals must be ensured, including children when eligible. Second, attention must be paid to mask-wearing while indoors and proper ventilation and filtration of indoor environments, especially residential facilities.

## ORAL SESSION - 10B — MEDICAL AND PSYCHIATRIC COMORBIDITY

### 322 - The Developmental Complexity Between Autism and Mental Health

**322.001** (Oral) ASD and Trauma: The Impact of Adverse Childhood Experiences on Posttraumatic Stress and Psychiatric Comorbidities Among a Nationwide Sample of Children with Autism Spectrum Disorder

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**Background:** Research shows that children with autism spectrum disorder (ASD) are at significantly increased risk for adverse childhood experiences (ACEs) and trauma. Children and families impacted by ASD possess several identifiable risk factors which further amplify their risk for ACEs. However, identifying posttraumatic stress symptoms in this population has been difficult due to the broad overlap between posttraumatic stress and ASD-related symptoms that may lead to diagnostic overshadowing and poor identification of victims.

**Objectives:** The current study assessed for comorbid mental health diagnoses, symptoms of posttraumatic stress, and symptoms of social impairment in 131 children with ASD and 84 typically developing children across the United States.

**Methods:** A diverse group of participants were recruited via Amazon Mechanical Turk Prime nationwide. Guardians completed measures of trauma exposure (CYW ACEs Questionnaire), posttraumatic stress (Trauma Symptom Checklist for Young Children; TSCYC), and ASD-related social impairment (Social Responsiveness Scale, Second Edition; SRS-2). A one-way MANOVA assessed for differences in prevalence rates of mental health diagnoses between groups and follow-up univariate ANOVAS and Tukey posthoc tests assessed for differences in specific diagnoses between groups. One-way MANCOVAs were conducted to assess for differences in posttraumatic stress symptoms and social impairment symptoms between participant groups while controlling for language ability. A standardized regression model was run to predict posttraumatic stress symptoms from ACEs count and level of social cognition impairments among children with ASD.

**Results:** Results found that children with ASD who experienced ACEs demonstrated significantly greater rates of comorbid mental health diagnoses ( $p<.001$ ), including ADHD ( $p=.001$ ), depression ( $p=.01$ ), and anxiety ( $p=.03$ ) compared to children with ASD who did not experience ACEs. Children with ASD and ACEs demonstrated significantly higher rates of posttraumatic stress ( $p=.003$ ), specifically in the areas of avoidance



( $p<.001$ ), depression ( $p=.001$ ), and anger/aggression ( $p=.004$ ) compared to their ASD peers without ACEs. Children with ASD were also shown to demonstrate a higher baseline measure of posttraumatic stress compared to their typically developing peers with ACEs (ASD  $SS=61.51$  vs TD  $SS=53.38$ ), providing evidence for the diagnostic overlap of ASD and post traumatic stress in children. Lastly, a standard multiple regression model revealed a positive association between ACEs count and total posttraumatic stress among children with ASD, with PTS Total t-scores increasing 2.81 points for every accumulated ACE. The model revealed a positive association between social cognition symptoms and posttraumatic stress symptoms, with PTS Total t-scores increasing 0.56 points for every 1.00 point increase in SRS-2 Social Cognition t-scores.

**Conclusions:** The results of this study provide new evidence for the relationship between adverse childhood experiences and comorbid mental health diagnoses in children with ASD. This study also details how posttraumatic stress symptoms present in children with ASD. Results provide evidence that reduced social cognition associated with ASD does not serve as a protective factor against the psychological consequences of interpersonal trauma. It is hoped that these results will highlight the importance of assessing for adverse and traumatic childhood experiences within diagnostic evaluations for individuals with ASD.

### **322.002 (Oral) Perceived Stress and Emotion Dysregulation As Mediators of Mental Health in Camouflaging Among Autistic Adults**

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**Background:** Prior studies suggest that camouflaging (e.g., behaviors that mask social “challenges”) is associated with anxiety and depression in autistic adults<sup>1</sup>; however, it is unclear what drives this link. Two prime candidates are 1) perceived stress, based on reports of autistic adults who report stress and exhaustion related to camouflaging<sup>2</sup> and 2) emotion dysregulation based on its prevalence<sup>3</sup> in autism spectrum disorder (ASD) and its links to depression and anxiety.

**Objectives:** Examine, for the first time, whether perceived stress and emotion dysregulation drive links between camouflaging and elevated depression and anxiety in autistic adults.

**Methods:** 787 autistic adults (471 [59.8%] assigned female at birth) aged 18-78 years ( $M=40.2$ ,  $SD=13.7$ ) were recruited via Simons Powering Autism Research and Knowledge (SPARK) Research Match to complete a battery of online questionnaires. These included the Camouflaging Autistic Traits Questionnaire (CAT-Q), and measures of depression (Patient Health Questionnaire-9, PHQ-9), anxiety (Generalized Anxiety Disorder-7, GAD-7), perceived stress (Perceived Stress Scale, PSS), and emotion dysregulation (Self-Regulation of Emotions subscale of the Barkley Deficits in Executive Functioning Scale, BDEFS-SRE).

Using PROCESS in R, four moderated mediation models were tested (Figure 1). In all models, CAT-Q total score was the independent variable, and the moderator variable was birth-sex, with age and AQ-28 score serving as covariates. The dependent variable was PHQ-9 or GAD-7 total score, and the mediator variable was the PSS or BDEFS-SRE score. Modeling implemented bootstrap confidence intervals using 10,000 bootstrap samples. Confidence intervals that did not include zero were considered significant.

**Results:** Table 1 presents all model coefficients. *Perceived stress as mediator:* Camouflaging showed significant conditional direct (.05-.18; .02-.12) and indirect effects (.08-.18; .02-.11) on depressive symptoms through an effect on perceived stress (Table 1). Camouflaging also showed a significant conditional direct effect on anxious symptoms (.03-.17; .05-.16) and an indirect effect via perceived stress (.10-.22; .03-.12); additionally, the only significant moderated mediation effect was revealed here (-.16 to -.006), where male sex negatively moderated the indirect effect of camouflaging on anxiety through perceived stress.

*Emotion dysregulation as mediator:* Camouflaging showed a significant conditional direct (.12-.27; .04-.16) and indirect (.003-.10; .01-.07) effect on depressive symptoms through its effect on emotion dysregulation. Camouflaging also showed a significant conditional direct effect (.12-.28; .07-.20) on anxious symptoms and through its effect on emotion dysregulation (.004-.13; .01-.09).

**Conclusions:** For the first time, we present evidence for two potential drivers (perceived stress and emotion dysregulation) in the association between camouflaging and elevated anxious and depressive symptomatology in ASD. Importantly, birth-sex (a known factor associated with camouflaging) was included as a moderator, and both age and autistic features were controlled for. Heightened perceived stress and emotion dysregulation feature prominently in longstanding models of factors impacting the development of depression and anxiety in the general population<sup>4</sup>. These models, taken together with literatures reporting the autistic lived-experience of stress in the context of camouflaging, and associations of emotion dysregulation with poorer mental health in ASD, provide theoretical and empirical grounding for the findings reported here.

### **322.003 (Oral) Understanding the Heterogeneity of Anxiety in Autism Spectrum Disorder: A Subtyping Approach**

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**Background:** The high prevalence and significant clinical impact of anxiety in autistic people has been well documented. Although the prevalence of anxiety is high, there is high heterogeneity in the experiences, presentation and severity of anxiety. Importantly, individual differences in anxiety among autistic individuals has been increasingly recognized as a potential contributor to the lack of consistent findings regarding how anxiety relates to core autism characteristics and other key developmental and clinically relevant factors in this population. Subtyping approaches have shown significant promise for understanding both core and co-occurring characteristics in autism, however, no study to date has utilized a person-centred subtyping approach to better characterize anxiety heterogeneity in the autistic population.

**Objectives:** The present study aimed to examine anxiety profiles among autistic children and adolescents. It further aimed to characterize the association between the identified anxiety profiles and key clinical and developmental variables.

**Methods:** Latent profile analysis (LPA) was conducted on Spence Children's Anxiety Scale-Parent Version (SCAS-P) data from a large international pooled sample of 870 caregivers of autistic children and adolescents (*Age* = 11.6 years, *SD* = 2.77; 107 females). Identified profiles were then compared on anxiety subscale scores, age, sex distribution, cognitive functioning, restricted and repetitive behaviours (RRB), social communication difficulties, and total autism related characteristics.

**Results:** LPA identified a three-anxiety profile solution exhibiting high entropy (.80) and high latent profile probabilities (Profile 1=.97, Profile 2=.91, Profile 3=.94), with good classification accuracy. Identified profiles fell along the anxiety severity spectrum and were labelled as the mild (*n* = 498), moderate (*n* = 272) and severe (*n* = 100) anxiety profiles. There were no statistically significant differences between the three anxiety profiles in terms of sex distribution. Participants in the mild anxiety profile were significantly younger than those in the severe anxiety profile (*d* = 0.42), had significantly fewer social communication difficulties than youth in the moderate anxiety profile group (*d* = 0.31), significantly fewer RRBs and lower cognitive functioning scores compared to both moderate (*d* = 0.69 and *d* = 0.22, respectively) and severe anxiety profile participants (*d* = 1.18; *d* = 0.57). In addition, significantly more participants in the mild anxiety profile had fewer difficulties in responding to others' feelings (*V* = .13), less adherence to routine/insistence on sameness (*V* = .13), circumscribed interests (*V* = .12), and fewer unusual sensory interests than participants in the moderate and severe anxiety profiles (*V* = .24).

**Conclusions:** Current findings further emphasise the high prevalence and diversity of restricted and unusual interests. Interestingly, RI were even more frequent in the current sample than has been reported in previous studies. Importantly, RI and UI showed distinct pattern of relationships with key demographic, cognitive and clinical variables. This may suggest distinct processes underlying the RI and UI subdomains and demonstrates the need for further research characterising the full range of RI behaviours and their mechanisms.

**322.004 (Oral)** Developmental Cascades between Insistence on Sameness Behavior and Anxiety Symptoms in Autism Spectrum Disorder  
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**Background:** Children with Autism Spectrum Disorder (ASD) experience high rates of anxiety. Insistence on sameness behavior (IS) is a core symptom of ASD that appears correlated with anxiety severity.

**Objectives:** The objective of this study was to examine the longitudinal relations between anxiety and IS in ASD using a developmental cascade model.

**Methods:** A longitudinal cohort of 421 children with ASD was followed between 4 and 11 years of age. Anxiety was quantified using items from the Anxiety Problems subscale of the Child Behavior Checklist; sameness behaviors were measured using the Repetitive Behavior Scale- Revised, Ritualistic/ sameness subscale (both parent report measures). Structural equation modelling was used to examine the longitudinal and directional associations between anxiety and IS at four timepoints, through cross-lagged panel models (CLPM) with and without a random-intercepts component (RI-CLPM).

**Results:** Both the CLPM and the RI-CLPM had good fit. Significant directional associations were detected whereby a rise in IS preceded a rise in future anxiety symptoms 1-2 years later. Stable baseline tendencies toward anxiety and IS behavior as between-person traits (intercepts) were strongly associated (standardized estimate = 0.69, *p* < 0.001). The magnitude of the cross-sectional associations between anxiety and IS appeared to lessen with age.

**Conclusions:** IS and anxiety symptoms in ASD are closely related. They appear to be shared traits that mirror each other particularly in younger children. Increasing IS may be a sign of emerging future anxiety. Interventions that target IS to reduce/ prevent anxiety amongst school aged children with ASD merit further study.

**419.117 (Poster)** Anxiety in Adolescents and Young Adults with Autism Spectrum Disorder: Links to Symptom Severity, Aberrant Behaviors, Sensory Issues, and Medical Conditions

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**Background:** Anxiety is highly prevalent in individuals with autism spectrum disorder (ASD) (White et al., 2009). Previous studies predominantly relied on younger populations with ASD to examine associated factors with anxiety. Several studies, which included adults with ASD, mainly focused on social anxiety. Research is needed to investigate how anxiety manifests in adolescents and young adults with ASD beyond social contexts and how it is related to other autistic features and developmental factors. Moreover, previous research often used anxiety measures that were standardized to typically developing samples, which may not reliably reveal how anxiety manifests in ASD. Therefore, there is a critical need to adopt a measure that is standardized in ASD to examine anxiety in this population.

**Objectives:** This study examined the concurrent relations among anxiety and a set of empirically selected variables in adolescents and young adults with ASD, including autism symptom severity, aberrant behaviors, atypical sensory issues, and medical conditions. This study used an anxiety measure standardized in individuals with ASD, the Parent Rated Anxiety Scale for ASD (PRAS-ASD; Scahill et al., 2019).

**Methods:** A total of 66 adolescents and young adults with ASD ( $M_{age}=19.41$  years,  $SD=2.53$ , range from 16.03-25.47) participated in this study. They were recruited remotely and represented a sample from 21 states and regions in the United States. All participants had a clinical diagnosis of autism that was verified by a score of 60 or higher on the Social Responsiveness Scale (SRS-2). Participants' anxiety was reported by the PRAS-ASD. Autism symptom severity was measured on the SRS-2. The Adolescent and Adult Sensory Profile assessed atypical sensory issues. Aberrant behaviors and medical conditions were reported on the Aberrant Behavior Checklist. Adaptive Behaviors were obtained using the Vineland-3 interview form.

**Results:** Adolescents and young adults with more severe ASD symptoms reported higher levels of anxiety, especially those with more social cognition deficits ( $r=.44, p<.001$ ) and restricted and repetitive behaviors (RRBs) ( $r=.43, p<.001$ ). Participants with more aberrant behaviors, including irritability, social withdrawal, hyperreactivity, and inappropriate speech, had elevated levels of anxiety. Moreover, those who tended to be unable to detect sensory stimuli (low registration) and those who exhibited heightened responses to sensory stimuli (sensory sensitivity) demonstrated more severe anxiety. Last, participants with more severe chronic sleep problems and gastrointestinal (GI) issues also reported higher levels of anxiety. See Table 1. Further regression analyses showed that aberrant behaviors no longer predicted anxiety in the participants when controlling for low registration and sensory sensitivity. Sensory sensitivity, chronic sleep problems, social cognition deficits, and RRBs emerged as salient predictors of the participants' overall anxiety level. See Table 2.

**Conclusions:** Results suggest that sensory sensitivities, chronic sleep problems, social cognition deficits, and RRBs, were significant predictors of overall anxiety levels in adolescents and young adults with ASD. Given the current paucity of research regarding anxiety in adolescents and young adults with ASD, understanding how anxiety is associated with these features has important implications for the future provisions of targeted services and treatment for this population.

**419.118 (Poster)** Autistic Severity and Psychiatric Comorbidity Among Children with Autism Spectrum Disorder

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**Background:** Autism Spectrum Disorder is a neurodevelopmental disorder with unclearly identified psychopathology.

**Objectives:** The aim of the current study was to evaluate the severity of autism in relation to demographic characteristics and children's developmental condition, clinical condition of mothers during pregnancy and labor, and psychiatric comorbidity among children with autism.

**Methods:** A descriptive study was utilized with a sample of (84) preschool children diagnosed with autism. Data collected using three tools; I- Demographic and developmental characteristics of children, and clinical condition of mothers during pregnancy, II- Gilliam Autism Rating Scale, and III- Mini International Neuropsychiatric Interview for children.

**Results:** revealed that 72% of studied children with moderate autism severity. Siblings number, age of the mothers during pregnancy, mother comorbid physical complaint during pregnancy, and child age of walking, related significantly to autism severity. More than two thirds (68%) of children with autism comorbid with psychiatric disorders. Anxiety is the most common (35.7%) followed by attention deficit hyperactivity disorder (32.1%). Numbers of comorbid disorders related significantly to autism severity.

**Conclusions:** Numbers of comorbid disorders related significantly to autism severity. Moreover, the severity of autism related significantly to socio-demographic, developmental characteristics and psychiatric co-morbidity.

**419.119 (Poster)** Clinical and Molecular Stratification of Autism-Associated Comorbidities

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#### Background:

The social difficulties and precarious conditions experienced by autistic adults have traditionally been attributed to the core symptoms of autism. However, the mental and physical health problems associated with ASDs (comorbidities) have a significant impact on many areas of these adults' lives. The comorbidities found in ASD are the same as those found in the general population but with varying prevalence, chronicity, and severity, and they affect most body systems, including the cardiometabolic, immune, gastrointestinal, and neurological systems, interacting in a complex and highly interdependent manner.

Interestingly, several studies have highlighted that, despite their genetic heterogeneity, ASDs may be less functionally diverse. In many cases, the large number of genes involved in neurological disorders converge on a smaller number of biological pathways.

#### Objectives:

The participatory research CONTiNuity of care and sErviCes for Adults Living with AuTistic Spectrum Disorder (CONNECT) sought to address the needs and concerns of the Maritime autism community by focusing on their priorities. One component of the CONNECT project was to identify comorbidities in adults with ASD and assess whether some comorbidities tend to cluster, with the end goal of identifying profile-dependent unique biological pathways. It has to be noted that this study is exploratory given its limited sample size.

Methods: This study included 104 respondents from the CONNECT project cohort who completed the needs assessment survey: 41 self-reporting adults with ASD (aged 19-55 years) and 63 adults with ASD (aged 18-63 years) whose information was provided by their caregivers. Frequency distribution were calculated to examine comorbidities prevalence, by age and by sex or gender. We then modeled comorbidity assemblages and stratified the sample into comorbidity profiles.

#### Results:

Latent class analyses discriminated 6 distinct comorbidity profiles. The most discriminating comorbidities were depression, intellectual deficit, gastrointestinal disorders, attention deficit and hyperactivity disorder (ADHD) associated with musculoskeletal disorders, and ADHD associated with other neurodevelopmental disorders. Multivariate regressions are underway to identify socio-demographic correlates associated with each latent class. For each profile identified, the molecular pathways specific to each comorbidity of the profile will be extracted from the KEGG, Human Metabolome Database (HMDB) and GWAS platforms and modeled by a network analysis of their molecular protein-protein, gene and metabolite interactions (interactome). This analysis will allow the identification of convergent molecular pathways and their candidate genes. An analysis by functional annotation of the Gene Ontology (GO) terms of the candidate genes will finally allow the identification in silico of diagnostic biomarkers specific to each profile.

Conclusions: More and more researchers tend to target their attempts at therapeutic interventions towards the associated comorbidities rather than the autistic symptoms themselves, with the hope that by reducing these comorbidities, one could improve overall functioning, decrease the severity of ASD symptoms, and thus improve their overall well-being and quality of life. Examining those comorbidity profiles with a molecular lens might open new research perspectives on the etiology of autism-associated comorbidities and thus new therapeutic avenues to decrease the burden of medical conditions that impeded autistic individuals in their quest to a deserved fulfilling life.

**419.120** (Poster) Critical Review of Measuring Method for Assessing Prevalence of Gender Dysphoria Among Individuals with Autism Spectrum Disorder. - Based on the Results of Interview Survey about Gender Dysphoria Experience of ASD Individuals in Japan.-

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#### Background:

Recently, there has been increased attention to putative relationship between Autism Spectrum Disorder(ASD) and Gender Dysphoria(GD). GD refers to distress caused by a discrepancy between a person's gender identity and that person's sex assigned at birth (Fisk, 1974). On occasion, the distress meets criteria for a formal diagnosis in classification systems such as DSM-5.

There is no consensus on a putative link between ASD and GD because the previous studies suggesting high comorbidity of ASD and GD have several methodological problems(e.g. Turban & Schalkwyk, 2018).

One of the problems is unreliable method of measuring the prevalence of GD among ASD individuals. Particularly, intersectionality of ASD and GD has not been considered sufficiently in current methods. As some case studies have indicated that GD exhibited by ASD individuals have specificity under the influence of ASD characteristics(e.g., Goto, 2005), it is required to consider intersectionality of ASD and GD when assessing GD among ASD individuals.

#### Objectives:

In search for finding the appropriate measuring methods to assess GD among individuals with ASD, this study conducted interview survey to understand the intersectionality of ASD and GD in Japan.

#### Methods:

11 ASD individuals who were aware of GD and three caregivers completed semi-structured interviews. Questions were about experiences of having both GD and ASD from the past to the present. Also, 11 ASD individuals completed the "Japanese version of the Utrecht Gender Dysphoria Scale (UGDS-J)" (Ishimaru and Harima, 2011). Interview data were analyzed using Grounded Theory (Charmaz, 2020).

#### Results:

##### 1. Two types of GD experience among ASD individuals

The result indicated that participants experienced "(1) GD that meets diagnostic criteria" or/and "(2) ASD-specific discomfort with social gender norms." (2) ASD-specific discomfort with social gender norms appears to be similar to (1)GD, but it does not meet the diagnostic criteria and must be distinguished. ASD individuals have difficulty with conforming to the social gender norms due to the ASD characteristics such as difficulties with understanding social relationships or interactions. Also, even if they understand, they feel distress to conform to gender norms in addition to non-ASD norms.

##### 1. UGDS-J may not be able to identify categorical diagnoses of GD in ASD individuals.

It is suggested that ASD individuals found the existential questions (e.g. My life would be meaningless if I would have to live as a boy/man) difficult to answer because they have strength in concrete thinking ("I think I am not good at thinking the meaning of life. I can think of a day or a week, but when you say life, it's too abstract. ").

#### Conclusions:

For assessing prevalence of GD among ASD to clarify a putative link between ASD and the categorical diagnoses of GD, it is required to distinguish (1) GD that meets the diagnostic criteria, and (2) ASD-specific discomfort with social gender norms. However, at present, there is no screening tools for (2) ASD-specific discomfort with social gender norms, and should be developed. Also, when using UGDS-J for ASD individuals to assess categorical diagnoses of GD, modification for existential questions might be required.

#### **419.121 (Poster)** Differences in Predictive Relationships between Parent Reported Social Skills, Child Reported Social Skills, and Mental Health Outcomes

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Background: Poor social skills put autistic youth at risk for low self-esteem and depressive symptomatology. Due to concerns that autistic youth may overreport abilities, studies don't often obtain youth report of social skills, potentially missing robust information (Stratis & Lecavalier, 2015). Understanding how both parent and child-reported social skills relate to mental health outcomes will yield insight about youth's perception of their social skills and provide potential targets for prevention/intervention efforts.

Objectives: The current study sought to compare predictive relationships between: 1. parent and youth-reported social skills and self-esteem, and 2. parent and youth-reported social skills and depressive symptoms in a community sample.

Methods: Participants were 68 youth (6-18, IQ > 70) who received an autism diagnosis following a comprehensive autism evaluation at a community clinic. Youth were administered the *Autism Diagnostic Observation Schedule, 2<sup>nd</sup> Edition* (Lord et al., 2012) to assess autism symptoms and the *Stanford-Binet Intelligence Scales, 5<sup>th</sup> Edition* (Roid, 2003) to assess cognitive ability. Parents and youth completed the *Social Skills Improvement System Rating Scales (SSIS)* (Gresham & Elliot, 2008) to assess social abilities. Youth completed the *Beck Youth Inventories, 2<sup>nd</sup> Edition (BYI-2)* (Beck et al., 2005) to assess symptoms in various mental health domains. Only the self-concept and depression scales from the *BYI-2* were used in the current study. All youth met DSM-5 criteria for ASD.

Results: To assess whether social skills predict self-esteem after controlling for age and IQ, hierarchical multiple regressions were conducted separately for parent and youth report. Parent-reported social skills were not a significant predictor,  $p > .05$ . Youth-reported social skills were a significant predictor,  $b = .29$ ,  $t(49) = 2.33$ ,  $p < .05$ , and the overall model was significant accounting for 25% of the variance in self-esteem,  $F(3, 49) = 5.42$ ,  $p < .05$ . Separate hierarchical regressions for parent and youth-report were run to assess whether social skills predict depressive symptoms. Parent-reported social skills were a significant predictor,  $b = -.37$ ,  $t(64) = -3.23$ ,  $p < .01$ , and the overall model was significant accounting for 17% of the variance in depressive symptoms,  $F(3, 64) = 4.35$ ,  $p < .01$ . Youth-reported social skills were not significant,  $p > .05$ .

Conclusions: Autistic youth's perception, but not parent's, of social abilities is related to how positively or negatively they see themselves. This suggests youth may internalize social failures, negatively impacting their self-esteem. Alternatively, youth who have low self-esteem may be more negative about their social abilities. By contrast, only parent-reported social difficulties predicted greater depressive symptoms. Possibly, parents notice social difficulties that are impacting their child's mood, perhaps due to loneliness or peer rejection, but youth are not attuned to these challenges. Parents may also be picking up on social consequences related to underlying depressive symptomatology. Overall, results demonstrate

that both parent and youth report of social abilities provide important information about current functioning and potential mental health concerns. Obtaining youth's perceptions of their social abilities is valuable in assessment and intervention. Furthermore, results suggest that social skills interventions could positively impact mental health.

**419.122 (Poster)** Familial Metagenomic Profiling Reveals Dysbiosis-Related Commonalities in Children with Autism Spectrum Disorder  
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**Background:** Gut dysbiosis is reportedly a common finding in children with autism spectrum disorder (ASD), however the exact nature and source of the apparent microbial imbalance is not yet clear. One persistent confound in studies that evaluate the microbiome, specifically in children with ASD, is the extreme study sample (cohort) heterogeneity that arises from variability in factors such as genetic background, diet, medication history, medical status, geographic location, and ethnicity – to name a few. One way to mitigate some of this heterogeneity is by using familial metagenomic profiling, wherein the microbiome of the affected child is compared to the microbiome of healthy first-degree relatives.

**Objectives:** The primary objective of this study was to evaluate the microbiome in GI-symptomatic children with ASD, from three unrelated families, compared to their healthy parent and/or siblings, to determine: (1) if dysbiosis was apparent in the children with ASD, and (2) if there were common microbial features unique to the affected children.

**Methods:** Metagenomic sequence analysis was used to compare microbial abundance and diversity in stool samples from three children with ASD (each from a different family), and from one or more of their immediate family members. Family 1, of Indian/Asian descent, consisted of the mother and affected child. Family 2, of Assyrian/Armenian descent consisted of the affected child, the mother, and one unaffected sibling. Family 3, of Indian/Asian descent, consisted of an affected child, her mother, and her two healthy triplet siblings. Briefly, microbial DNA was extracted from individual stool samples, quantified, and prepared for metagenomic shotgun sequencing on the Illumina NextSeq 550 System. Read depth ranged from 13.1M to 15.4M total reads in the nine samples. Raw sequence reads were trimmed and analyzed to assess alpha diversity (Shannon Index) and relative microbial abundances.

**Results:** Overall, children with ASD displayed: (1) a higher Bacteroidetes/Firmicutes ratio and a lower relative abundance of Actinobacteria phyla, (2) a significant reduction in *Bifidobacteriaceae* and an increase in *Bacteroidaceae* families, and (3) a unique finding of *Bacteroides plebeius* species, compared to immediate family members (Figure 1). The ASD samples also displayed a statistically significant lower alpha (Figure 1) and beta microbial diversity.

**Conclusions:** At the outset of this study, we reasoned that using the microbiome profiles from close family members as the comparator samples would eliminate much of the environmental and genetic variability that can complicate interpretation of microbiome profiling results, and would provide some meaningful baseline characteristics of the ASD gut microbiome. The findings demonstrate that within a family, dysbiosis can occur in the child with ASD, and yet not in their siblings or parent who share the same environment and genetic background, suggesting a more complex (bidirectional?) relationship between ASD and gut dysbiosis.

**419.123 (Poster)** Identifying Disparities in Mental Health Services Among Racial/Ethnic Minority Children with Intellectual and Developmental Disabilities  
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**Background:**

The study of racial/ethnic minority children and of children with intellectual and developmental disabilities (IDD) has found consistent health disparities in terms of access and quality of care (Magaña et al., 2013; Magaña & Vanegas, 2021). Much remains to be known for racial/ethnic minority children with IDD as they may experience higher levels of health disparities due to their intersectional identities. Studying mental health among children with IDD is important as mental health can be viewed in distinct ways across racially/ethnically diverse communities and across disabilities (Green et al., 2015). Furthermore, racial/ethnic minority communities may also experience additional stressors that can be associated with greater risk of mental health issues and/or health disparities (e.g., immigration, language acculturation, discrimination; U.S. Department of Health and Human Services Office of Minority Health, 2016; Coker et al., 2009; Ramirez et al., 2017). A better understanding of mental health disparities among racial/ethnic minority children with IDD is needed to develop more equitable services and supports.

**Objectives:**

This study focuses on identifying disparities related to mental health services among racial/ethnic minority children with IDD using a nationally representative sample.

**Methods:**

This study focused on the National Survey of Children's Health (NSCH: 2016-2017) to identify health disparities related to mental health among racial/ethnic minority children with IDD. The NSCH: 2016-2017 is a nationally representative survey of parents of children between 0 and 17 years of age in the United States. For this study, we focused on children with IDD, which included autism, Down syndrome, developmental disability, or intellectual disability. The overall sample of children with IDD was 5,308. See Table 1 for more details on the sample. We examined the prevalence of mental health conditions (e.g., anxiety, depression), coverage of mental health services through the child's insurance, and whether there were

unmet mental health care needs. We also explored the potential impact of sociodemographic factors on the prevalence mental health conditions, access to and receipt of mental health services.

#### Results:

Our initial analyses examined the prevalence of anxiety, depression, and behavioral problems among children with IDD across racial/ethnic groups. Chi-square analyses found significant differences across racial/ethnic groups on parent-report of anxiety,  $\chi^2(n = 5,290) = 101.8, p = .002$ , depression,  $\chi^2(n = 5,290) = 64.6, p < .001$ . No racial/ethnic differences were found for parent-reported behavioral problems,  $\chi^2(n = 5,290) = 34.7, p = .196$ . Percentages of parent-reported conditions are shown in Figure 1. We will present further analyses describing associations between sociodemographic factors (e.g., parent education, household income) on access to and receipt of mental health services.

#### Conclusions:

This study focuses on identifying health disparities that impact children with IDD from racial/ethnic minority backgrounds. The results thus far show that the prevalence of anxiety and depression varies significantly across racial/ethnic groups. These differences may be associated with access to diagnostic services or other sociodemographic factors. These findings are important as it can help identify key areas for advocacy and change to improve access and quality of services for racial/ethnic minority children with IDD.

#### **419.124 (Poster)** Identifying the Structure of Co-Occurring Neurodevelopmental/ Psychiatric Symptoms in Autism across Three Large-Scale Cohort Studies.

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**Background:** ~70% of autistic people experience one or more significant co-occurring neurodevelopmental/ psychiatric symptoms. These co-occurring symptoms contribute substantially to reduced quality of life and represent a priority area for autism clinical research/ practice. Nevertheless, access to effective evidence-based strategies for managing co-occurring symptoms remains limited for autistic people. In part, this is due to a limited understanding of the profile(s) and structure of co-occurring symptoms in autism, where differential symptom presentation and symptom overlap/ overshadowing pose a challenge for assessment and provision of support.

**Objectives:** Thus, the aim of this study was to identify autism subgroups characterised by the structure of co-occurring symptoms - providing a basis for elucidating the underpinning mechanisms for these symptoms, which may represent key target areas for intervention.

**Methods:** Data from 3,291 autistic people (2,770 male; 521 female) aged 12-months-to-30-years was included in this study, from three large-scale cross-sectional cohorts - the Longitudinal European Autism Project (LEAP), Province of Ontario Neurodevelopmental Network (POND), and Simons Simplex Collection (SSC). Two of the most common psychiatric measurement systems in clinical research were used to assess co-occurring symptomatology – the Strengths and Difficulties Questionnaire (SDQ; LEAP) and Child Behaviour Checklist (CBCL; POND and SSC). To identify the structure of co-occurring symptoms within the sample, hierarchical clustering analysis was performed (Ward's linkage, Euclidean distance). Finally, we performed clinical validation by investigating relationships between co-occurring symptom clusters with demographic factors (e.g., age, sex) and core autism features.

**Results:** Analysis of SDQ data (LEAP) revealed a 2-cluster solution (Cluster One  $N=195$ ; Cluster Two  $N=128$ ), with Cluster One characterised by elevated co-occurring symptom severity across the board (particularly hyperactivity;  $p<0.001$ ;  $r$  effect size=0.21-0.63). Autistic people classified within Cluster One also scored higher than those in Cluster Two for core autism features, though there were few differences between clusters on age, IQ and sex. A 2-cluster solution was also revealed in analysis of CBCL data (POND/ SSC; 2-5-years Cluster One  $N=280$ ; Cluster Two  $N=545$  ; 6-18-years Cluster One  $N=1145$ ; Cluster Two=741). In both age ranges, Cluster One was characterised by elevated co-occurring symptom severity across all features (particularly aggression;  $p<0.001$ ;  $r=0.31$ -0.78). Once again, the Cluster scoring highest for co-occurring features also had elevated scores for core autism features, in the absence of significant effects of age and sex.

**Conclusions:** One-to-two-thirds of autistic people in this study were classified within a subgroup characterised by elevated co-occurring symptom severity across all features captured by the SDQ and CBCL. This subgroup was also characterised by higher autistic traits, in the absence of age, IQ and sex effects. In other words, the subgroups identified here were characterised by differences in overall *severity* of co-occurring symptoms, across the board, rather than qualitative differences in the *structure* of co-occurrence of these symptoms. These findings imply that shared underpinning mechanisms may give rise to diverse co-occurring symptoms in autism (including 'internalising' and 'externalising' features), and emphasise the importance of routinely and comprehensively screening autistic people for co-occurring mental health in clinical practice to facilitate access to appropriate support.

#### **419.125 (Poster)** Impact of the COVID-19 Pandemic on Challenging and Adaptive Behaviors in Children Diagnosed with Autism with and without Co-Occurring ADHD

#### Background:

The COVID-19 pandemic is a stressor rife with uncertainty and widespread consequences. Early examinations from China found that the COVID-19 pandemic is impacting child psychological health in the general population (Liu, 2020), and caregivers of children with developmental disabilities reported increased anxiety symptoms and behavioral changes in their children (Ashbury et al., 2020). The pandemic caused numerous changes in the daily lives of autistic children that could have led to changes in adaptive abilities and challenging behaviors. Disruptions in school attendance not only limited the opportunity for social interaction with peers, but also made daily life less predictable in a population known to benefit from routine and structure. A key question is how the presence of co-occurring psychiatric symptoms in autistic children might influence the impact of COVID-19 on children's outcomes, including their challenging and adaptive behavior and the potential worsening of psychiatric symptoms.

#### Objectives:

The present study aimed to characterize changes from before the pandemic to mid-pandemic in a) challenging behaviors, b) hyperactive and impulsive behaviors, and c) adaptive behaviors in children diagnosed with autism spectrum disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD), co-occurring ASD+ADHD, and neurotypical (NT) children.

#### Methods:

Families participated in this research study at two time points, once before the pandemic (Mean age = 5.5 years) and again during the pandemic (Mean age = 7.7 years), with an average of 24.83 months between time points. Before the pandemic, children were evaluated with gold-standard diagnostic assessments, including the ADOS-2 and ADI-R for autism diagnosis and the Mini Neuropsychiatric Interview for ADHD diagnoses. Parents completed the Aberrant Behavior Checklist (ABC), the ADHD Rating Scale (ADHD-RS), and a smaller subset completed the Vineland Scales of Adaptive Behavior-3 (VABS-3) at both time points. Families completed the surveys electronically for the second time point between March and July 2021, before school returned in person for many families. The final sample (N = 58) included 24 children with ASD, 10 with ASD+ADHD, 13 with ADHD alone, and 11 NT. Survey responses were analyzed using paired-samples t-tests.

#### Results:

Parents reported an overall reduction in challenging behaviors on the ABC ( $p=0.01$ ) as well as reductions in irritability ( $p=0.04$ ) and hyperactivity ( $p=0.004$ ). On the ADHD-RS, parents reported decreases in overall ADHD symptoms ( $p=0.0001$ ), which was driven primarily by reductions in hyperactivity ( $p<0.0001$ ). Improvements in adaptive behavior were also reported by parents ( $p=0.04$ ), and specifically observed in improvements in daily living skills ( $p=0.02$ ). Table 1 provides more information on parent reported before and during the pandemic. Ongoing analyses will examine group-based differences in behaviors.

#### Conclusions:

Parents reported improvements in hyperactivity, irritability, and daily living skills in their children. It is possible that reduced demands in the school setting (e.g., social pressures) may have behavioral health benefits. More time spent at home likely gave children opportunities to better develop daily living skills. These results warrant more detailed investigation into what factors might have led to improvements in children's behavior and daily living skills, so that these factors can be considered in the context of return-to-school plans.

#### **419.126 (Poster)** Influence of Co-Occurring ADHD on Working Memory Skills in Young Autistic Children

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**Background:** Difficulties with executive functioning (EF), including working memory skills, have been documented for individuals diagnosed with autism and those with attention-deficit/hyperactivity disorder (ADHD). Difficulties with EF can impact overall functioning (e.g. adaptive behavior, social skills, reciprocal language abilities) and are emerging as an important focus for intervention. Despite 40-60% of autistic children having co-occurring ADHD, little is known about how co-occurring ADHD influences EF in young autistic children, when working memory skills are developing. Until around 7-years of age, children develop increasingly complex working memory abilities, moving from retrieving simple information over a short delay (retrieval), to updating memory to include information from previous choices (substitution), and finally to manipulating information they are holding in memory (transformation). Understanding working memory development in young autistic children with and without ADHD and children with ADHD can inform treatment targets that improve overall functioning.



**Objectives:** Explore patterns of working memory skills in young autistic children, children with ADHD, and autistic children with co-occurring ADHD as compared to each other and to neurotypical children.

**Methods:** Participants were 99 children, 3-to-8 years old ( $M=75.39$ ,  $SD=14.63$  months) from four groups: neurotypical (NT;  $N=17$ ), autistic ( $N=30$ ), ADHD ( $N=24$ ), and Autistic+ADHD ( $N=28$ ). Working memory skills were assessed with two subtests from an adapted version of lab-based experimental tasks, the Preschool Executive Functioning Battery (PEFB): The Hide&Seek task, which measures retrieval and substitution, and the Magic Wand task, which measures transformation. Dependent variables were proportion (of total possible score) correct on retrieval, substitution, and transformation trials, and proportion of perseverative and non-perseverative errors. Group differences were tested using general linear models and covariates (full-scale IQ and age) that impeded overall model were iteratively removed until best model performance was achieved. Follow-up pair-wise t-tests were corrected for multiple comparisons using Tukey's HSD.

**Results:** For all children, after controlling for IQ, it was found that the older a child was, the better they were at in both retrieval ( $F=10.57$ ,  $P<.01$ ) and transformation ( $F=17.92$ ,  $P<.0001$ ), but not substitution ( $F=3.49$ ,  $P>.05$ ) abilities. Comparing across the four groups, there was no difference in the proportion of correct retrieval trials. Controlling for both age and IQ, Autistic+ADHD children had significantly lower proportion correct for substitution trials as compared to the other three groups ( $F=3.16$ ,  $P<.05$ ). Similarly, this group also had a higher number of non-perseverative errors compared to the other three groups ( $F=3.94$ ,  $P=.01$ ). Controlling for age, but not IQ as it was not significant in the model, Autistic+ADHD children also had significantly lower proportion correct for transformation trials than the NT and ADHD groups ( $F=3.22$ ,  $P<.05$ ), but performed comparably to the autistic children without ADHD.

**Conclusions:** Autistic+ADHD children demonstrate more working memory difficulties than autistic children without ADHD, children with ADHD, and NT children. This was evident on several dimensions of working memory, including both the ability to make substitutions and transformations. Understanding the relationship between co-occurring ADHD symptoms and working memory skills in young autistic children can help inform EF-based treatments that focus on these skills in both autistic and ADHD children.

**419.127 (Poster)** Mitochondrial Dysregulation Is Associated with Right-Sided Colonic Hypomotility in Children with Autism Spectrum Disorder  
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**Background:** Gastrointestinal (GI) symptoms are more common in children with autism spectrum disorder (ASD) compared to typically developing (TD) children. Of the GI symptoms most commonly observed in children with ASD, chronic constipation is reported by parents to be especially problematic. In children with ASD who have sought medical assistance for chronic constipation on a background of colonic inflammation, two clinical trends (phenotypes) have been observed based on the children's response to anti-inflammatory therapy: (1) patients who experience remission from constipation while undergoing anti-inflammatory therapy (*fast responders*), and (2) patients who experience recurrent right-side fecal loading while undergoing anti-inflammatory therapy (*slow responders*). In an earlier study we showed that total gene expression derived from right colon biopsies of 35 patients (15 *fast responders*, 20 *slow responders*), distinguished the fast responders from slow responders.

**Objectives:** The objective of this study was further characterization in two distinct clinical subgroups of GI-symptomatic children with ASD, through microRNA (miRNA) and total gene (mRNA) co-expression analysis, to identify potential molecular regulators of the atypical constipation phenotype.

**Methods:** In the original pilot study, hierarchical clustering of the right colon gene expression profiles from 35 patients resulted in two distinct clusters; the separation was based largely on clinical phenotype (*fast* vs *slow* responder; **Figure 1** – left panel). In this follow-up study, miRNA expression profiles were assessed for 12 of the 35 original right colon biopsies (6 *fast responders*, 6 *slow responders*) and analyzed together with mRNA profiles. Total RNA was quantified using a NanoDrop spectrophotometer and miRNA expression was assessed through assay of ~800 known miRNAs using the NanoString nCounter SPRINT protocol. Differential expression of miRNA in *fast* vs. *slow* responders was determined using nSolver software and miRNA-mRNA co-expression was evaluated using Ingenuity Pathway Analysis (IPA).

**Results:** We identified 12 significantly differentially expressed miRNAs ( $p=0.05$ ; **Figure 1** – right panel) between *fast* and *slow* responders and 8 of those had been experimentally observed to target 400 unique mRNAs (IPA). IPA co-expression analysis showed that 24 of those 400 mRNA targets were found to be differentially expressed between *slow* and *fast responders* ( $p=0.01$ ). Results demonstrate an upregulation of transcripts involved in oxidative phosphorylation, reactive oxygen species and oxidative stress, and a downregulation of oxidative-stress response elements in *slow responders* that is suggestive of an overall decreased mitochondrial function in cells of the right colon.

**Conclusions:** The central finding of the co-expression analysis was an increased expression of genes involved in mitochondrial dysregulation pathways in *slow responders* compared to *fast responders*, resulting from a decreased expression of their respective inhibitory miRNAs. As mitochondrial function contributes to intestinal epithelial cell homeostasis, this dysregulation in the right colon suggests an underlying mechanism to explain atypical motility that is observed in *slow responders* even after treatment for inflammation.

**419.128 (Poster)** Resilience in the Face of a Pandemic: An Examination of Anxiety and Depression in Autistic Adolescents in a Post-COVID World  
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**Background:** The COVID-19 pandemic exacerbated anxiety and depressive symptoms worldwide (Salari et al., 2020). However, disruptions to services, routines, social activities, and supports during the pandemic likely disproportionately impacted the lives of autistic individuals, an already vulnerable population with high rates of co-occurring mental health diagnoses (Lai et al., 2019). Indeed, research has demonstrated that autistic adults showed greater increases in mental health symptoms in response to the pandemic as compared to neurotypical adults (Adams et. al, 2021; Oomen et. al, 2021). Parents have similarly reported that their autistic children have exhibited greater behavioral and mental health challenges following the pandemic (Colizzi et al., 2021; Vasa et al., 2021). Notably, qualitative themes illustrating some positive impacts of COVID-19 have also emerged, such as more quality time with family and improved youth mood (Mumbardo-Adam et al., 2021). As the pandemic continues, more research is needed to understand the impact of the pandemic and its broader sequelae (e.g., remote service provision, social distancing guidelines) on the autism community.

**Objectives:** This study aims to compare pre- and post-COVID levels of social anxiety and depressive symptoms in autistic adolescents presenting for social skills treatment at the UCLA PEERS® Clinic. Given even fewer opportunities for social interaction during the pandemic, we hypothesized that teens presenting for treatment post-COVID would have higher levels of mental health symptomatology as compared to those who presented to treatment pre-COVID.

**Methods:** Participants included 143 teens ( $M_{age}=14.00$ ,  $SD=2.01$ ; 70.6% Male) with pre-existing diagnoses of autism spectrum disorder who were screened for participation in the evidence-based social skills intervention, PEERS® for Adolescents program (Laugeson et al., 2012). Participants included were evaluated between 2018-2021 ( $n=64$  post-pandemic: March 2020-September 2021). The Social Anxiety Scale (SAS; La Greca, et. al, 1988) was used to assess social anxiety symptoms while depressive symptoms were measured through T-scores on the Children's Depression Inventory, 2<sup>nd</sup> edition (CDI-2; Kovacs, 2015). Independent samples t-tests were utilized to compare symptomatology pre- and post-pandemic.

**Results:** Initial results revealed no significant differences between pre-pandemic ( $M=51.69$ ,  $SD=15.56$ ) and post-pandemic ( $M=52.50$ ,  $SD=16.84$ ) self-reported social anxiety symptoms on the SAS,  $t(139)=0.21$ , *ns*. Similar findings were observed for parent-reported social anxiety symptoms, with no emergent significant differences,  $t(135)=0.86$ , *ns*. Further, depressive symptoms on the CDI-2 pre-pandemic ( $M=57.50$ ,  $SD=11.39$ ) did not significantly differ from those post-pandemic ( $M=59.17$ ,  $SD=13.27$ ),  $t(133)=-0.77$ , *ns*.

**Conclusions:** Contrary to our hypothesis, anxiety and depressive symptomatology of autistic adolescents did not worsen after COVID-19 pandemic. These results suggest resilience and adaptation in the face of the many changes caused by the pandemic. It is also possible that remote school instruction facilitated a reduction of social demands alongside increased control over environment (e.g., sensory stimulation, ability to take breaks) that mitigated deterioration of mental health for teens on the spectrum in the face of stress. Importantly, the current treatment-seeking sample may not be representative of autistic youth at large. As such, ongoing monitoring and nuanced examination of moderators of resilience is necessary to proactively identify and meet the needs of autistic adolescents and their families.

#### **419.129 (Poster) Risk of Cancer Among Autistic Individuals Compared to Non-Autistic Individuals**

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**Background:** Autistic individuals have greater mental and physical health risks than others, which may affect their longevity. Existing genetic and epidemiological studies examining cancer risk have found mixed results—with some studies suggesting decreased risk, no difference in risk, or even increased risk of cancer overall or of hormone-associated cancers specifically.

**Objectives:** To determine whether there are differences in risk of cancer overall or for hormone-associated cancers between autistic and non-autistic individuals in a large population sample.

**Methods:** We utilized anonymized general practitioner records from the Clinical Practice Research Datalink (CPRD) and linked records from the National Cancer Registration and Analysis Service (NCRAS) to test for cancer risk overall as well as for breast, ovarian, testicular, and prostate cancer risk specifically. The sample included  $n=13,994$  autistic individuals and  $n=69,970$  general population controls, matched 5:1 on age ( $\pm 2$  years), gender, and healthcare practice.

We utilized Cox regression to estimate unadjusted and adjusted models of cancer risk. All of our adjusted models controlled for time-varying binary measures of obesity, alcohol misuse, and smoking status; we also controlled for socioeconomic status based on quintiles provided from the Office of National Statistics Indices of Multiple Deprivation Score in 2015. Individuals with a record for birth control or hormone replacement use, as well as all autistic and non-autistic participants matched to them, were excluded from the adjusted analyses of overall cancer risk (leaving a subsample of  $n=12,392$  autistic individuals and  $n=61,960$  general population controls for this analysis). Finally, as some cancers tested are sex-specific, we used sub-samples by gender for relevant unadjusted and adjusted analyses.

**Results:** Autistic individuals who do not use birth control or hormone replacement therapy had far lower relative rates of cancer than their age, gender, and practice-matched general population peers of the same demographics (See Table 2 below). There were no differences in risk of breast or prostate cancer among autistic and non-autistic individuals in either the unadjusted or adjusted analyses. Due to low counts, we were unable to conduct adjusted analyses of ovarian and testicular cancers; however, unadjusted analyses suggest non-significant but greater than expected numbers of ovarian and testicular cancer cases among autistic individuals compared to non-autistic peers (See Table 1 below).

**Conclusions:** These results suggest that autistic individuals of certain demographics may be less likely to have cancer compared to others. This study cannot provide information on the cancer risk of autistic individuals who use birth control or hormone replacement therapy; this group must be

considered in future research, as autistic individuals are more likely to have co-occurring conditions like polycystic ovarian syndrome, which may require the use of birth control and increase cancer risk. Further, while this study uses records from individuals across the lifespan, the majority of records come from young participants (aged 30 years or younger); as such, the results must be interpreted with caution, as they may indicate lower risk of cancer overall or may indicate a different age-related pattern of cancer risk for autistic individuals.

**419.130 (Poster)** Serum Metabolome Profiles Distinguish Children with Gastrointestinal Inflammation and Autism Spectrum Disorder From Typically Developing Controls

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**Background:** We have previously shown that children with ASD and gastrointestinal (GI) inflammation display a unique gene expression profile both in GI biopsy tissue and peripheral blood, when compared to non-ASD GI-symptomatic children without GI inflammation. The differential gene expression patterns identified in peripheral blood can provide clues regarding the pathobiology that underlies the inflammation and/or ASD. To explore this hypothesis further we have assayed serum from the same individuals to determine if the metabolite profiles: (1) also differ significantly between the groups and, (2) if they provide additional mechanistic insight.

**Objectives:** The goal of this study was the measurement of serum metabolite profiles in GI-symptomatic children with ASD and ileocolonic inflammation (ASD<sup>IC+</sup>) and from GI-symptomatic typically developing children (without evidence of ileocolonic inflammation; TD<sup>IC-</sup>), to compare metabolite composition and abundance between these groups.

**Methods:** Global metabolite profiles were determined in serum samples derived from 40 individuals as follows: (a) the “control” group (TD<sup>IC-</sup>) consisting of 14 males and 5 females and, (b) the “case” group (ASD<sup>IC+</sup>) consisting of 17 males and 4 females. Sample processing involved metabolite extraction, followed by ultrahigh performance liquid chromatography-tandem mass spectroscopy (UPLC-MS/MS). Raw data were extracted, peak-identified and QC processed. Compounds were identified by comparison to library entries of purified standards or recurrent unidentified entities. Following log transformation and imputation of missing values, if any, with the minimum observed value for each compound, Welch’s two-sample t-test was used to identify biochemicals that achieved statistical significance ( $p \leq 0.05$ ), as well as those approaching significance ( $0.05 < p < 0.01$ ).

**Results:** The dataset comprises a total of 612 compounds of known identity (named biochemicals) measured in 40 individual serum samples. A comparison between the 2 groups showed that 292 metabolites (48%; 72 higher and 200 lower in ASD<sup>IC+</sup> compared to controls) reached a level of statistical significance and another 36 metabolites (12 higher/24 lower in ASD<sup>IC+</sup>) approached significance. Many of these metabolite level differences between ASD and TD samples have been reported in other studies, while some of the individual findings here are either in disagreement, or are altogether new, compared to published reports. Overall, the data showed that the two groups were distinguishable (i.e., significantly separated) by principal component analysis and the ASD<sup>IC+</sup> profiles, as a group, appeared to be more heterogeneous (**Figure 1** - top). Using the primary groupings of “case” and “control”, random forest analysis resulted in a predictive accuracy of 95% for the serum samples (**Figure 1** - bottom).

**Conclusions:** Comparison of metabolome profiles between ASD<sup>IC+</sup> and TD<sup>IC-</sup> showed that levels of nearly half of the serum metabolites are statistically significantly different between the two groups and that these metabolome profiles are largely phenotype-specific. Moreover, many of the specific metabolite level differences have previously been reported in metabolome studies comparing ASD and control samples, however in some cases the changes we found are either discordant or novel compared to published reports. This is not surprising since our pilot study examined differences in serum from children with ASD and gastrointestinal inflammation to serum from children with neither condition.

**419.131 (Poster)** Sleep Disturbances in Individuals with Autism Spectrum Disorder: Clinical, Developmental, Medical, Psychometric, Familial and Biological Correlates

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**Background:** Sleep disturbances (SDis), reported in 40-80% of individuals with ASD, have been associated with more severe daytime behavioral symptoms and worse quality of life (QoL) in the family. The neurobiological link between ASD and SDis has not been fully elucidated, although reduced melatonin synthesis and release is partly involved.

**Objectives:** (1) To assess the prevalence and characteristics of SDis in ASD; (2) to define their behavioral, medical, familial and biological correlates in a large sample of ASD patients.

**Methods:** A stage-I sample of 906 individuals with ASD (mean age  $8.2 \pm 5.7$ , range 1-47 yrs; M:F=764:137) was used to define the correlates of “presence/absence of SDis” through parental report. In a stage-II subsample including 276 of these 906 patients, SDis subtype was characterized. This information was then correlated with: (a) clinical, developmental, and family history information collected from parents; (b) medical (MRI, EEG, etc), neurological, behavioral and comorbidity information derived from direct observation, and (c) tests and questionnaires including ADOS, ADI-R, VABS, PEP-3, IQ/DQ measures, CBCL/TRF, SRS, SSP, ABC, RBS, CARS and parental WHOQoL. Biological variables include head circumference, serotoninemia, and urinary p-cresol. Chi-squared and t-tests were performed, applying Bonferroni’s correction. Multivariate analyses are under way.

Results: SDis were present in 457/906 (50.4%) stage I patients. Among 154/276 (55.8%) stage II patients with SDis, parents reported difficulty falling asleep (13.0%), night awakenings (21.7%), both (14.9%), early morning awakening (2.2%), mixed features (2.9%), and parasomnias (1.1%). SDis occurred more frequently in young adults compared to children and adolescents ( $P=3 \times 10^{-4}$ ,  $N=904$ ), and are associated with self-injurious behavior ( $P=3.2 \times 10^{-5}$ ,  $N=822$ ) and reduced pain sensitivity ( $P=0.007$ ,  $N=801$ ). The SSP confirms abnormal sensitivities especially through the visual and auditory channels ( $P<0.001$ ,  $N=207$ ). The timing of developmental milestones is generally typical, except for delayed/absent sphincter control ( $P=0.0033$ ,  $N=837$ ), but parents surprisingly report higher incidence of “loss of single words after initial development” ( $P=0.0043$ ,  $N=847$ ) and “behavioral regression at autism onset” ( $P=5.4 \times 10^{-5}$ ,  $N=870$ ), in coincidence with an “infectious disease at autism onset” ( $P=5.0 \times 10^{-6}$ ,  $N=886$ ). The CBCL documents greater aggressive ( $P=0.001$ ,  $N=194$ ) and externalizing behaviors ( $P=0.004$ ), whereas VABS composite IQ is significantly lower (73.3 vs 68.9,  $P=0.001$ ,  $N=538$ ). SDis in the proband worsens the QoL of both mothers ( $P=0.001$ ,  $N=225$ ) and fathers ( $P=0.002$ ,  $N=225$ ). SDis are associated with low serotoninemia ( $P<0.002$ ,  $N=602$ ), while brain MRI and blood aminoacids may influence SDis subtype. The presence and subtype of SDis is not significantly correlated with IQ, autism severity, gastrointestinal or allergic disturbances, EEG abnormalities or history of seizures, nor is co-sleeping linked to SDis.

Conclusions: To our knowledge, this is the largest national study assessing SDis in ASD to date. SDis are a highly prevalent co-morbidity with a very negative impact on the behavioral and adaptive skills of patients with ASD, as well as on the QoL of the entire family. These results provide some suggestions in reference to the mechanisms underlying SDis in ASD.

#### **419.132 (Poster)** The Health Impact of Insomnia on Children with Autism Spectrum Disorder

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Background: Insomnia and poor sleep quality are frequently reported in children with autism spectrum disorder (ASD), with prevalence rates ranging from 40-80%. These sleep disturbances have been shown to be associated with higher sensory sensitivities and more severe aberrant behaviors. However, the association of sleep disturbances with other clinical co-morbidities and their potential impact on the utilization of health services in children with ASD is unknown.

Objectives: The aim of this study was to quantify the impact of insomnia on clinical and behavioral aspects and the utilization of health services in children with ASD.

Methods: We conducted a retrospective, cross-sectional study of 541 children with ASD, between the ages of 1-11 years old, registered in the database of the National Autism Research Center of Israel (NARCI; [www.autismisrael.org.il](http://www.autismisrael.org.il)). Children were included in the current study if they were members of Clalit Health Maintenance Organization, and their parents completed the Children's Sleep Habits Questionnaire (CSHQ). Pediatric insomnia was defined as a total sleep disturbance score of  $>48$  on the CSHQ. Sociodemographic and ASD diagnostic measures including the Autism Diagnostic Observation Schedule, 2nd edition (ADOS-2) comparison scores, DSM-5 levels of required support, cognitive scores, and Aberrant Behavior Checklist (ABC) scores of these children were obtained from the NARCI database. Data about chronic comorbidities, medication usage, hospitalizations, visits to the emergency room, and visits to specialists one year before and after completion of the CSHQ were obtained from the Clalit electronic patient record system. The association between pediatric insomnia and these sociodemographic and clinical characteristics were tested using standard univariate and multivariate statistical tests.

Results: Of the 541 children with ASD, 257 (47.5%) had insomnia. Children with insomnia compared to children without insomnia had significantly higher scores on all ABC subscales including irritability (17.90 vs. 9.31;  $p<0.001$ ), hyperactivity (14.50 vs. 9.32;  $p=0.0002$ ), lethargy/withdrawal (7.34 vs. 4.37;  $p=0.0004$ ), stereotypic behaviors (22.7 vs. 13.10;  $p<0.0001$ ), and inappropriate speech (4.54 vs. 3.12;  $p=0.0017$ ). In addition, ASD children with insomnia were more likely to suffer from other developmental and psychiatric comorbidities ( $OR=1.61$ , 95% CI [1.01, 2.58],  $P=0.0435$ ; and  $OR=2.42$ , 95% CI [0.99, 6.52],  $P=0.0516$ , respectively), and more likely to be prescribed medications for the management of chronic diseases ( $OR=1.72$ , 95% CI [1.22, 2.45],  $P=0.0031$ ). Finally, ASD children with insomnia had 50% more visits to the emergency room (mean[SD] = 0.63[1.19] vs. 0.42[1.01];  $p=0.0153$ ) and had 2.7 times higher rate of hospitalizations (mean[SD] = 0.19[0.60] vs. 0.07[1.30];  $p=0.0042$ ) when compared to ASD children without insomnia.

Conclusions: Our findings demonstrate that there is a significant association between insomnia and a greater clinical burden among children with ASD. Thus, treating sleeping problems in children with ASD may have a broad clinical impact that extends beyond the expected improvement in the sleep quality of these children and their parents.

#### **419.133 (Poster)** The Prevalence and Correlates of Somatic Symptoms, DSM-5 Somatic Symptom Disorder, and Functional Somatic Syndromes in Autistic Adults

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**Background:** Nonspecific somatic health complaints and symptoms are common in the general population, varying on a continuum of severity. When these symptoms are persistent and impairing, they often result in a diagnosis of one or more functional somatic syndromes (FSS), such as fibromyalgia or irritable bowel syndrome. Despite the prevalence and impact of somatic symptoms and FSS in the general population, there has been very little research investigating these issues in autistic individuals. Furthermore, no study to date has quantified the prevalence of DSM-5-defined somatic symptom disorder (SSD) within the autistic population.

**Objectives:** To estimate the prevalence and clinical correlates of somatic symptoms and SSD in a large sample of autistic adults, including their associations with previous FSS diagnoses.

**Methods:** Independent autistic adults aged 18–60 years ( $n=830$ ,  $M_{Age}=34.96$  years, 64.3% female sex, 80.1% non-Hispanic White) were recruited from the Simons Powering Autism Research for Knowledge (SPARK) participant pool (Feliciano et al., 2018) as part of a study of sensory differences in autism (RM0111Woynaroski\_DST). Symptoms of SSD were quantified using the Somatic Symptoms Scale–8 (SSS-8) and Somatic Symptom Disorder–B Criteria Scale (SSD-12). A combination of  $SSS-8 \geq 9$  and  $SSD-12 \geq 23$  was used to classify participants as meeting SSD criteria (Toussaint et al., 2021). Participants also provided information regarding previous diagnoses of FSS. Bayesian regression models were used to investigate the clinical correlates of SSD status.

**Results:** Somatic symptoms were common in our sample, with individual SSS-8 items being endorsed “Quite a bit” or “Very much” by 7.1–52.4% of participants (Males: 4.4–37.8%; Females: 8.6–60.5%). Additionally, 48.9% of the sample (Males: 33.8%; Females: 57.3%) reported “High” or “Very high” levels of overall symptom burden ( $SSS-8 \geq 12$ ), and 27.7% of the sample (Males: 17.2%; Females: 33.5%) met SSS-8/SSD-12 criteria for SSD. Lifetime FSS diagnoses were present in 42.9% of the sample (Males: 25.7%; Females: 52.4%), with irritable bowel syndrome, migraine, and fibromyalgia being most common. Even after controlling for age, sex, and current symptoms of both anxiety and depression, SSD status was associated with higher levels of autistic traits (SRS-2;  $d=0.238$ ,  $CrI_{95\%}$  [0.100, 0.374]), more symptoms of decreased sound tolerance (IHS;  $d=0.298$ ,  $CrI_{95\%}$  [0.174, 0.425]), a higher prevalence of distressing tinnitus (OR=2.46,  $CrI_{95\%}$  [1.73, 3.49]), a slightly higher number of lifetime psychiatric diagnoses (IRR=1.19,  $CrI_{95\%}$  [1.08, 1.31]), and reduced overall quality of life (PROMIS Global–10;  $d=-0.426$ ,  $CrI_{95\%}$  [-0.554, -0.301]). Notably, only 48.4% of individuals with high/very high somatic symptom burden and 58.6% of individuals meeting criteria for SSD reported a prior FSS diagnosis from a medical professional.

**Conclusions:** Multi-organ somatic complaints were highly prevalent in the present sample of autistic adults, particularly those assigned female at birth, and over 25% of the current sample screened positive for SSD. After accounting for age, sex, anxiety, and depression, SSD status was independently associated with psychopathology, sensory complaints, and lower quality of life. Somatic symptoms and associated FSS diagnoses represent an often-overlooked area of autism comorbidity, and we urge clinicians working with autistic individuals to more routinely screen for and treat these often-disabling symptoms.

**419.134 (Poster)** The Recurrence Rate of First Nonfebrile Seizure in Pediatric Patients with Autism Spectrum Disorder.  
*L. Boursoulian, Pediatrics, Vanderbilt Childrens Hospital, Nashville, TN*

Background: Epilepsy prevalence is higher in children with Autism Spectrum Disorder (ASD) and is a contributor to morbidity and mortality. Little is known about the recurrence rate after the first nonfebrile seizure in this population, specifically regarding seizure type and electroencephalogram (EEG) findings.

Objectives: Despite the increased prevalence of Epilepsy in Children with ASD, there has been only few reports of the risk of seizure recurrence after a single unprovoked seizure. The American Academy of Neurology guidelines suggest not to treat the first nonfebrile seizure in general because of the risk of recurrence is not that high. The purpose of this study is to look at this specific patient population to better determine risk of further seizures and the development of epilepsy.

Methods: We reviewed de-identified pediatric medical records at our institution through the synthetic Derivative (SD) between 2006 and 2016 for subjects with ASD who had a first seizure. We then looked for risk of a recurrent non-provoked seizure within the next two years.

Results: The recurrence rate in this study was 70.9% . This is much higher than the general population. The recurrence rate was higher in patients who had a generalized convulsion compared to those who had a behavioral arrest. A logistic regression model adjusted for gender and EEG found that the odds of experiencing a recurrent generalized convulsion is 5.36-fold higher than in patients with a behavioral arrest seizure, 95% CI 2.14–13.42,  $p < 0.001$ . An abnormal EEG was a strong predictor of seizure recurrence in both seizure types.

The odds of experiencing recurrence in patients with an abnormal EEG is 19.23-fold higher than in patients with normal EEG, 95% CI 5.8–63.77,  $p < 0.001$ . Even with a normal EEG, generalized convulsions were more likely to recur within 2 years compared to behavioral arrest (OR 6.3, 95% CI 2.1–19).

Conclusions: The recurrence rate for nonfebrile seizures in children with ASD is much higher than the general population, especially for generalized convulsions. An abnormal EEG has a strong predictive value for seizure recurrence. However, even when the EEG is normal, the recurrence rate for generalized convulsions is quite high.

The higher recurrence rate of the first nonfebrile seizure in pediatric patients with ASD could impact clinical decisions of when to start anti-seizure medications. This is important because epilepsy contributes to morbidity and mortality in this group.

**419.135 (Poster)** The Relationship between Camouflaging and Co-Occurring Psychiatric Problems: Are There Differences Among Subgroups?  
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Background:

The use of (un)conscious strategies to hide one's autistic traits (camouflaging) has been associated with the presence of co-occurring psychiatric problems in autistic adults. However, given the heterogeneity in autism spectrum conditions (ASC), the association between camouflaging and co-occurring psychiatric problems might differ across subgroups.

#### Objectives:

We aim to investigate whether camouflaging and co-occurring psychiatric problems are associated and if this association differs across subgroups.

#### Methods:

In this study, 657 (of which 349 autistic) adults aged 30 to 92 years filled in the Dutch Camouflaging Autistic Traits Questionnaire (CAT-Q-NL), the Symptom Checklist-90 Revised (SCL-90-R), the Autism Quotient (AQ) and the Positive and Negative Affect schedule (PANAS). Analyses were preregistered (Aspredicted #45095). First, we analyzed the association between camouflaging and co-occurring psychiatric problems. Second, we used model based recursive partitioning analyses to investigate whether the association between camouflaging and co-occurring psychiatric problems varied based on biological sex, age, education, autism characteristics and positive and negative affect.

#### Results:

Preliminary analyses showed a moderate correlation between CAT-Q-NL total score and SCL-90-R total score in autistic and non-autistic adults ( $r_{ASC} = .45$ ,  $r_{comparison} = .30$ ). Next, for autistic adults we found that (a) the association between the CAT-Q-NL and SCL-90-R only differed for varying levels of negative affect., (b) this association differed for varying levels of AQ-scores, but (c) negative affect explained more variance compared to AQ-score. Next to negative affect and AQ-score, positive affect played a role in this association in non-autistic adults but not in autistic adults. We will further investigate the stability of our results and whether we replicate our findings when co-occurring psychiatric problems are measured using interviews instead of self-report questionnaires. These analyses will be run before INSAR 2022.

#### Conclusions:

Based on preliminary analyses, we conclude that camouflaging and co-occurring psychiatric problems are associated. However, this association seems to differ based on someone's affect or ASC characteristics, while biological sex, age, and educational level do not seem to play a role. As the relationship between camouflaging and co-occurring psychiatric problems differs across individuals, one needs to be careful with group based conclusions regarding the (negative) impact of camouflaging.

#### **419.136 (Poster)** Understanding Psychiatrist's Knowledge and Attitudes to Suicidal Ideation and Behavior in Individual with Autism Spectrum Disorder

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**Background:** There has been increased attention to the association between suicidal behavior and autism. Studies showed high rates of suicidal thoughts and behaviors in individuals with autism spectrum disorder (ASD). Population-based studies also suggest that autistic individuals are over 7.5 times more likely to die by suicide and have higher rates of suicidal ideation. Despite the risk of suicidal behavior, little research has investigated how to determine and decrease this risk for the individual with ASD effectively.

**Objectives:** To date, little research has been done to study mental health professionals' behavior and knowledge of suicidal behavior in autism. The present study attempted to investigate the psychiatrists' perspective and awareness related to suicidal behavior during follow-up. In particular, we focused on psychiatrists' knowledge and attitudes towards investigating and preventing suicidal behavior in individuals with ASD. Our aims were to examine psychiatrists' assumptions and intervention practices about suicidal behavior in autistic adolescents and adults.

**Methods:** The authors created the online survey due to the lack of specific tools to assess clinicians' practice about suicidal behavior. Participants were asked to answer questions about assessing suicidal thoughts and behaviors in individuals with ASD and non-ASD clients. We also investigated the self-efficacy and safety planning intervention (SPI) of those clinicians.

**Results:** One hundred forty-three adult psychiatrists (n=55) and child and adolescent psychiatrists (n=88) completed the cross-sectional survey. Compared to non-ASD clients, clinicians reported lower suicidal ideation and behavior rates in ASD individuals ( $p<0.05$ ). The usage of screening tools was significantly lesser in the ASD group ( $p<0.05$ ). Clinician also significantly reported lower self-efficacy in assessing suicidal ideation and behavior in adolescents and adults with ASD. The majority of clinicians who have stated low self-efficacy reported not know how to evaluate the risk of suicidal behavior in the ASD group. Additionally, clinicians were more likely to use SPI with non-ASD clients ( %21 in individuals with ASD and %49.4 in non-ASD clients). Lastly, most clinicians agreed to make adaptation in SPI to be applicable to individuals with ASD.

**Conclusions:** Our study investigated the psychiatrists' knowledge, confidence, and screening practices for autistic adolescents and adults. Increasing knowledge about screening and intervention practice for risk of suicidality in individuals with ASD is essential. Encourage the clinicians' skills and usage of validated tools which is not common currently, may reduce the suicidal behavior in ASD clients.

#### **419.137 (Poster)** Using Canonical Correlation Analysis to Examine the Relationship between Creativity and Psychopathology

**Background:** Although creativity and neuropsychiatric conditions have been previously connected, the precise contours of that relationship remain unclear. Prior research has shown that creativity is supported, at least in part, by common genetic variants that show pleiotropic effects with neuropsychiatric conditions. Understanding the relationship between creativity and brain development has implications ranging from basic biology to minimizing stigma.

**Objectives:** Using a sample of over 760 children with autism, we aimed to model the relationship between creativity and mental health-related traits. We further aimed to quantify SNP-heritability of traits related to creativity phenotypes, thus laying the groundwork for identifying pleiotropic mechanisms.

**Methods:** In partnership with the nationwide (US) genetic study, SPARK, we distributed online parent- and self-report surveys assessing intellectual ability, creativity, and psychopathology in SPARK participants (children with autism and their parents). The analysis presented here is our first look at the Kaufman Domains of Creativity Scales(KDOCS ) data from this study, a 50-question *assessment* that yields a score that ranks a person's perceived creative abilities as compared to their peers. We conducted a Canonical Correlation Analysis (CCA) using the KDOCS subscale scores (measuring domains of creativity) along with the Child Behavior Checklist(CBCL) DSM subscale scores (measuring psychopathology). In addition, a generalized linear model was used to test if family history of mental illness significantly predicted creativity scores. SNP heritability estimates were carried out on a sub-sample of 747 children who also had complete genetic data available.

**Results:** The CCA of creativity and mental illness revealed 5 phenotypes(Scholarly creative, Somatic and Oppositional Defiant Nerd, High conduct/low everyday creativity, Somatic Art Creative, Depressive Somatic, Low overall creativity/psychopathology). Scholarly creativity was explained by combinations of scores from CBCL depressive, antisocial, and conduct problems subscales. Scholarly creativity and depressive, antisocial and conduct problems were inversely related ( $p<0.005$ ). A higher family history of schizophrenia, bipolar disorder and depression was predictive of higher creativity scores across all domains ( $p<0.01$ ). However, family history of eating disorders was predictive of lower creativity scores across all domains ( $p<0.01$ ). However, no significant SNP heritability was found in any of the KDOCS subscale scores. The relationship between the mother and father's KDOCS subscale scores and the child's KDOCS subscale scores were examined using a Spearman correlation test. The mother's subscale scores were positively correlated with the child's KDOCS subscale scores  $r(1300), 0.19, p<0.001$ . However the father's KDOCS subscale scores were not significantly correlated to the child's KDOCS subscale scores  $r(153), p=0.91$ .

**Conclusions:** These results suggest that creativity in autism broadly is significantly associated with family history of mental illness. The lack of heritability present in all the KDOCS subscales and its positive association with specific family histories of mental illness, may suggest that further work is needed to elucidate the relationship between creativity and mental illness. Further research should examine SNP heritability in a larger cohort of individuals and examine the role intellectual ability plays in the relationship between creativity and mental illness. In addition to this, self-reports of creativity should be examined in combination with ratings of psychopathology.

## VIRTUAL POSTER SESSION — MEDICAL AND PSYCHIATRIC COMORBIDITY

### 519 - Medical and Psychiatric Comorbidity --- (V)

#### **519.112 (Virtual Poster)** A Psychological Network Approach to Sleep and Daytime Functioning in Autistic Adolescents

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**Background:** Sleep problems commonly occur among autistic adolescents, with prevalence rates of up to 88% (Hodge et al., 2014). While it is known that sleep is associated with increased daytime sleepiness, mood disturbances, and diminished concentration, it remains unclear which aspects of sleep are related to which aspects of daytime functioning. To unravel the relationship between specific sleep variables and daytime functioning it is important to include both objective measurements and self-reports of sleep since self-reports have shown mixed reliability compared to objective sleep measures in typically developing adolescents (Tremaine et al., 2010; Wolfson & Carskadon, 2003). Moreover, self-reports and objectively measured sleep could lead to a different outcome with regard to daytime behavior (Bruni et al., 2007; Mazurek & Sohl, 2016). To get a clear picture of the relationship between sleep and daytime functioning in autistic adolescents we used a network analysis approach involving both objective measurements and self-reports of several relevant sleep and daytime variables.

**Objectives:** To what extent are characteristics of sleep (objectively measured and self-reported sleep onset latency, total sleep time, wake time after sleep onset) related to aspects of daytime functioning (mood, concentration, daytime sleepiness)?

**Methods:** In a repeated measures design with daily measurements over a period of three weeks 32 adolescents completed a web-based sleep diary in the morning and questions about their daytime functioning in the evening. Additionally, sleep tracker data were collected from 16 of these 32 adolescents. We used a network approach to investigate the relationship between sleep and daytime functioning. A network contains of nodes (included variables) that are connected by edges (association among the variables). We computed two networks: (1a) adolescents' self-reported sleep together with their self-reported daytime functioning and (1b) adolescents' objectively measured sleep together their self-reported daytime functioning.

**Results:** In network 1a (self-reports of sleep) we found that a higher sleep quality was associated with a better concentration and mood and less daytime sleepiness the following day. Moreover, we saw that physical exercise was related to total sleep time (TST), indicating that more physical exercise before the night's sleep was associated to a shorter TST. Objectively measured sleep variables (1b) showed also that sleep quality was directly connected to concentration and daytime sleepiness, however, the connection to mood disappeared. Another difference with the previous network were the appearing connections between TST and mood, indicating that a shorter TST was associated with a better mood. Moreover, in this network we found direct connections between sleep hygiene and sleep; the longer the time of caffeine intake before bedtime the longer the TST and the more mental effort during the day the shorter the SOL.

**Conclusions:** The results revealed that in the network with self-reported sleep only perceived sleep quality was related to daytime functioning. However, in the network with objective measures of sleep also TST was associated to daytime functioning. This study showed that self-reports and objective measures of sleep were differently related to daytime functioning.

**519.113 (Virtual Poster)** Characteristics Associated with Injuries Requiring Emergency Care or Hospitalization in Pre-School Age Children with Autism

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**Background:** Previous studies have reported associations between injury risk and several conditions that co-occur with autism spectrum disorder (ASD), e.g., attention-deficit/hyperactivity disorder (ADHD), anxiety and depression. Excess injury risk observed in children with ASD may also relate to their symptom severity or other characteristics associated with ASD, specifically, wandering (leaving a supervised space or care of a responsible person) or delayed adaptive behavior. For example, greater difficulties with social communication could affect comprehension of verbal or nonverbal warnings, wandering may expose children to potentially harmful situations, and delayed adaptive behavior may cause difficulties maintaining safety during daily routines or understanding and communicating about situational risks.

**Objectives:** We examined associations of ASD symptom severity, wandering, and delayed adaptive behavior, as well as other behavioral and developmental characteristics, with injury requiring emergency care or hospitalization among pre-school age children with ASD.

**Methods:** The Study to Explore Early Development is a multi-site case-control study of children aged 30-68 months. Detailed sociodemographic, health, behavioral and developmental data were gathered by caregiver interviews and self-administered questionnaires, and in-person child evaluations. ASD cases (n=693) were determined using gold-standard diagnostic instruments. The child's caregiver reported whether the child ever had an injury resulting in emergency care or hospitalization ("injury"). Principal independent variables were: ASD symptom severity assessed as a continuous variable using the Autism Diagnostic Observation Schedule Calibrated Severity Score; wandering, from the Child Behavior Checklist (CBCL) item asking whether the child "wanders away," categorized as "yes" if parent reported "very true or often true," otherwise "no"; and delayed adaptive behavior, from the Vineland Adaptive Behavior Scales-Second Edition composite score dichotomized as delay present/absent. We also examined associations of injury with CBCL internalizing and externalizing scales (continuous T-scores) and ADHD diagnosis. Associations of each principal independent variable with injury were examined in separate multivariable logistic regression models that also included other behavioral characteristics, adjusting for sociodemographic characteristics.

**Results:** Neither ASD symptom severity (Adjusted Odds Ratio=0.98 [95%CI: 0.87, 1.10]) nor delayed adaptive behavior (adjusted odds ratio (AdjOR)=1.13 [0.71, 1.84]) were associated with increased odds of injury. Wandering was moderately associated with increased odds of injury (AdjOR=1.53 [0.97, 2.40]). In this model, ADHD diagnosis was associated with increased odds (AdjOR=2.11 [1.11, 3.95]) and CBCL internalizing score with reduced odds (AdjOR=0.98 [0.96, 0.99]) of injury. Results were similar in an adjusted model including all of these characteristics.

**Conclusions:** Among pre-school children with ASD, we found a modest (albeit nonsignificant) association between wandering and injury that was not explained by co-occurring ADHD, ASD symptom severity, delayed adaptive behavior, internalizing symptoms or sociodemographics considered in the analysis. Further exploration of this association is warranted. More severe ASD symptoms and delayed adaptive behavior were not associated with injury risk. We confirmed the previously reported association of ADHD with injury risk in this population, highlighting the importance of proactive planning for injury prevention (e.g., secure medication storage, pool barriers) in children with co-occurring ASD and ADHD. The observed protective association between internalizing symptoms and injury differs from some previous reports, warranting further study.

**519.114 (Virtual Poster)** Chronic Stress Predicts Obesity in Autistic Individuals: An Analysis of U.S. Medicare and Medicaid Administrative Claims Data

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**Background:** Autistic individuals are 40% more likely to experience obesity than the general population, and have disproportionate rates of type II diabetes mellitus, cardiovascular disease, and mortality. In other marginalized populations, chronic stress—persistent and cumulative stress over the life course that creates multi-systemic “wear and tear”—is a key mechanism underlying obesity. Indeed, autistic individuals experience pronounced chronic stress in the forms of lifelong stigma, abuse, and victimization. Despite these findings, chronic stress has not been investigated as a mechanism underlying obesity in autistic populations.



**Objectives:** Utilizing 2008-2012 administrative claims from the Centers for Medicare & Medicaid Services Medicaid Analytic eXtract, the current study aimed to estimate the risk ratio of obesity among a) autistic beneficiaries, relative to a random sample of beneficiaries without autism; and b) autistic beneficiaries with and without clinical service record encounters related to chronic stress.

**Methods:** The sample included 571,774 autistic Medicaid beneficiaries with and without co-occurring intellectual disability as well a random sample of 3.3 million beneficiaries without autism. All participants were under age 65 at first observed enrollment and enrolled in Medicaid for at least one year. Autistic beneficiaries were identified based on International Classification of Diseases, Ninth Edition (ICD-9) diagnoses of Autism Spectrum Disorder with or without co-occurring intellectual disability. Beneficiaries were identified as having autism or intellectual disability diagnoses if they had at least one inpatient claim or two outpatient claims with those diagnoses. Beneficiaries with chronic stress were identified utilizing ICD-9 V62-Codes, which reflect clinical service record encounter reasons of abuse, maladjustment, and/or other psychological or physical stress. We relied on diagnosis categories and rules from the Centers for Medicare & Medicaid Chronic Conditions Warehouse to identify beneficiaries with obesity and other medical conditions that served as control variables in our analyses. We utilized unadjusted and adjusted modified Poisson models to estimate the risk ratio of obesity among a) all beneficiaries with and without autism and b) autistic beneficiaries with and without clinical service record encounters related to chronic stress.

**Results:** The risk of obesity among autistic beneficiaries was 1.56 (95% CI: 1.53,1.58) times the risk of obesity relative to beneficiaries without autism or intellectual disability, adjusting for age at enrollment, sex, race, eligibility group and state. Among autistic beneficiaries, the risk ratio of obesity among those with chronic stress-related clinical service record encounters was 1.50 (95% CI: 1.46,1.54) times the risk for those without chronic stress-related clinical service record encounters, adjusting for co-occurring psychiatric diagnoses, anti-psychotic medication usage, co-occurring intellectual disability, age at enrollment, sex, race, eligibility group, insurance type and state.

**Conclusions:** The current study adds to the existing evidence base that finds that autistic individuals experience disproportionate rates of obesity. This is one of the first national studies to demonstrate that experiences of chronic stress predict obesity in this population. Findings have the potential to guide obesity interventions for this population and make them more effective.

**519.115 (Virtual Poster)** Co-Occurrence of Avoidant/Restrictive Food Intake Disorder and Its Impact on Psychosocial Functioning in Younger Adults with Autism

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**Background:** Eating-related challenges are commonly co-occurring with autism spectrum disorder (ASD). The DSM-5 indicates that avoidant-restrictive food intake disorder (ARFID) is fairly common in people with ASD. A recent study found indications of ARFID in 21% of a large cohort of autistic children and adolescents and in 17% of their parents. However, no studies have examined ARFID co-occurrence in a sample of younger autistic adults, nor has adequate attention been given to potential sex differences in ARFID co-occurrence among individuals with ASD.

**Objectives:** Evaluate the overall rate of and potential sex differences in co-occurring ARFID in a sample of younger adults with ASD and the impact that co-occurring ARFID has on psychosocial impairment in autistic adults.

**Methods:** 252 younger autistic adults (ages 20-41, M=31.3 years; 170 assigned female at birth) without a documented history of intellectual disability participated in this study. Participants were recruited via Simons Powering Autism Research and Knowledge (SPARK) research match and completed a battery of online questionnaires about eating-related behaviors, including two key measures utilized here, the Nine Item Avoidant/Restrictive Food Intake Disorder Screen (NIAS) and the Clinical Impairment Assessment (CIA) for disordered eating. Three types of ARFID were evaluated using the NIAS: Picky Eating (PE-ARFID), Appetite (A-ARFID), and Fear (F-ARFID). All analyses were run initially with the whole sample and then re-run after excluding those with dietary restrictions (e.g., vegetarianism, medical conditions impacting diet; n=142) that could affect NIAS scores.

**Results:** Screening positive for ARFID was relatively common in this younger adult sample with ASD (PE-ARFID: 77/252--31%; A-ARFID: 49/251--20%; F-ARFID: 29/251--12%). Autistic women reported greater rates of all three ARFID subtypes compared to men ( $\chi^2>6.85$ ,  $ps<.01$ ). While no differences in psychosocial impairment (using the CIA) were observed between PE-ARFID screen-positive vs. screen-negative groups ( $ps>.10$ ), those screening positive for A-ARFID reported greater social ( $F=11.33$ ,  $p=.001$ ,  $\eta^2=.04$ ) and cognitive ( $F=22.81$ ,  $p<.001$ ,  $\eta^2=.09$ ) impairments than those screening negative, and those screening positive for F-ARFID indicated more personal ( $F=5.24$ ,  $p=.02$ ,  $\eta^2=.02$ ), social ( $F=12.14$ ,  $p=.001$ ,  $\eta^2=.05$ ), and cognitive ( $F=25.82$ ,  $p<.001$ ,  $\eta^2=.09$ ) impairments than those screening negative (all three analyses controlled for the effects of age and sex). Re-running analyses excluding participants reporting any type of dietary restriction did not alter the pattern of results reported above.

**Conclusions:** First, we observed relatively high rates of all three types of ARFID in younger autistic adults, particularly in women. While the existing literature suggests that ARFID is more common among males in the general population, we observed more autistic females screen positive for all ARFID subtypes. This could be a function of the sample, which was composed of autistic adults and included a large number of autistic females. Secondly, while screening positive for A-ARFID or F-ARFID was associated with greater psychosocial impairments, screening positive for PE-ARFID was not. Why this might be is unclear, but mirrors findings from at least one study of neurotypical adults. More work is needed to fully understand eating-related challenges and their impacts on the daily lives of people with ASD across the lifespan.

**519.116 (Virtual Poster)** Longitudinal Changes in the Mental Health of ASD Individuals and the Role of Social Functioning, Low Self-Esteem, and Gender As Potential Risk Factors for Depression during the COVID-19 Pandemic.

**Background:** Depression and anxiety are common concerns in individuals with autism spectrum disorder (ASD). The interplay between depression and ASD symptoms poses a challenge for identifying individuals at risk for depression, the clinical diagnostic process, and meeting individual treatment needs. Moreover, gender differences in prevalence rates of both depression and ASD indicate a need for gender specific research.

**Objectives:** To assess and compare levels of depression and anxiety problems prior to and during the pandemic among autism spectrum disorder (ASD) and neurotypical (NT) individuals. To explore the underlying factors that contribute to depression, including social functioning, perception of self or self-esteem, and how these effects differ by diagnosis and sex assigned at birth.

**Methods:** Participants (N=145, ASD n=54, NT n=81) were tested at two different time points [Wave 1: 2012-2015] and [Wave 2: 2020-2022]. DSM-5 oriented depression and anxiety problem t-scores were obtained from the CBCL during Wave 1, and the Adult Self-Report (ASR) and Youth Self-Report (YSR) during Wave 2. We generated a self-esteem variable by combining line items from the YSR and ASR. Reliability of the self-esteem variable was calculated using Cronbach's alpha (coefficient alpha=.706/.843). Socialization domain scores were obtained from the Vineland-3 during Wave 1. All statistical analyses were completed using SPSS.

**Results:** There was a significant increase over time in depression ( $p<.001$ ) and anxiety ( $p=.001$ ) problems among NT participants, but not ASD participants (depression,  $p=.569$ ; anxiety  $p=.969$ ). NT females ( $n=37$ ) saw greater increases in levels of depression over time than NT males, but this difference was only marginally significant ( $p=.064$ ). No sex differences were observed in the NT participants for anxiety problems. Within the ASD participants, no sex differences were observed for longitudinal changes in depression or anxiety. In terms of current levels of depression, our data suggest that better parent report of social functioning was a significant predictor of depression in ASD but not in NT, independent of sex ( $p=.033$ ). Self-esteem was a significant predictor of depression in females but not males, independent of diagnosis ( $p=.016$ ).

**Conclusions:** Our results revealed heterogeneity in the specific risk factors for depression. ASD individuals with better social functioning were more vulnerable to developing depression concerns than NT individuals, for whom better social functioning appears to be protective. Moreover, low self-esteem increased the likelihood of having higher depression scores to a greater degree in females than in males. Notably, ASD individuals did not experience significant increases in depression and anxiety from pre-pandemic to current levels. Overall, our results indicate differences in the effects of certain depression risk factors among ASD vs NT individuals. Further research is needed to find the underlying cause of these differences, and how sex differences may contribute to depression prognosis.

#### **519.117 (Virtual Poster) Sex Differences in the Relationship between Depressive Symptoms and Pupillary Light Reflex in Children with ASD: Results from the ABC-CT Main Study**

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**Background:** Depression and restricted and repetitive behaviors (RRBs) are commonly observed in autism spectrum disorder (ASD) and show sex differences (the former higher in non-ASD females, the latter higher in ASD males). Both are hypothesized to associate with function of the autonomic nervous system (ANS). Based on findings from the pupillary light response (PLR), a putative biomarker for ANS function, the ANS may function differently in ASD and typically developing individuals with depression. However, sex differences in the relationship between depressive and RRB characteristics and the PLR response have not been investigated in children with ASD.

**Objectives:** To examine the relationship between (a) depressive and (b) RRB features and PLR latency and relative pupil constriction (RPC) across sex.

**Methods:** PLR was collected across five sites from 278 children with ASD ages 6-11 (213 males; age  $M = 8.54 \pm 1.64$ ; FSIQ  $M = 96.58 \pm 18.11$ ) as part of the Autism Biomarkers Consortium for Clinical Trials (ABC-CT) study. Using the SR EyeLink 1000+, participants were shown white flashes of light during a passive eye-tracking task. In total, participants completed 16 trials with video clips dispersed between trials. PLR was characterized by latency and RPC. The Social Responsiveness Scale, Second Edition (SRS-2) was used to characterize ASD RRB symptoms. The Child and Adolescent Symptom Inventory, Fifth Edition (CASI-5) was used to obtain parent-reported depressive symptoms. Correlations and independent-samples t-tests were conducted to determine associations between SRS RRB scores, depressive symptoms (CASI-5 MDE subscale T-score), and PLR latency/RPC.

**Results:** There was a significant difference in PLR RPC across sex ( $p < 0.01$ ) such that males demonstrated larger RPC. PLR latency and RPC were significantly correlated with SRS RRB scores in females ( $r = 0.33, p < 0.01$ ;  $r = -0.28, p = 0.02$ , respectively) but not males ( $r = 0.01, p = 0.91$ ;  $r = 0.11, p = 0.11$ , respectively). In contrast to RRBs, PLR RPC was significantly correlated with depressive symptoms in males ( $r = 0.17, p = 0.01$ ) but not females ( $r = -0.09, p = 0.46$ ). Ongoing analyses are exploring the relationship between individual CASI item endorsements and PLR dynamics.

**Conclusions:** These findings provide initial evidence of sex-based relationships among depressive and RRB symptoms and PLR response in children with ASD. These results suggest that mechanistic differences in ANS function may influence differential expression of RRBs and depression in males and females. Future directions include utilizing PLR as an index to target diagnosis and treatment for different clinical presentations of ASD and depression. Understanding these relationships may help inform the impacts of psychiatric co-occurring conditions on the experience of individuals with ASD.

**519.118 (Virtual Poster)** Temperament in Infancy Predicts Internalizing and Externalizing Problem Behavior at Age 5 in Children with an Increased Likelihood of Autism Spectrum Disorder

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**Background:** Differences in temperament have been linked to later mental health (Aldao et al., 2016; Bos et al., 2018; Gross & John, 2003). Children with autism spectrum disorder (ASD), including siblings of children with ASD, are at an increased likelihood of experiencing temperamental problems in toddlerhood (Garon et al., 2016; 2021; Clifford et al., 2013), as well as problems with mental health, including anxiety, depression, and attention deficit/hyperactivity disorder, during their school-age years (Jones et al., 2020; Simonoff et al., 2008). However, the relationship between early temperament and later mental health is not well understood within the context of ASD.

**Objectives:** To assess relations between temperament in infancy and internalizing and externalizing behavior at age 5 years in children at an increased likelihood (IL) of being diagnosed with ASD (i.e., younger siblings of children with ASD).

**Methods:** Participants included 178 infant siblings of children with ASD (107 boys; 71 girls), 51 of whom were diagnosed with ASD at age 3. Temperament was measured using the parent-reported Infant Behavior Questionnaire (IBQ) at 6 and 12 months of age and the Toddler Behavior Assessment Questionnaire-Revised (TBAQ-R) at 24 months of age. Mental health problems were measured using the parent-reported Child Behavior Checklist (CBCL) at age 5. The data were analyzed using hierarchical multiple regressions, with internalizing or externalizing behavior total score as the dependent variable and individual temperament subscale scores as single predictor variables (Subscale Score) in the first block, Autism Diagnostic Observation Schedule total severity scores at age 3 in the second block, and expressive and receptive language scores (from the Mullen Scales of Early Learning) at age 3 in the third block of each model.

**Results:** First, IBQ temperament subscale scores did not differentiate between IL siblings with and without ASD until 12 months of age. Second, 4 of 6 IBQ subscales at both 6 and 12 months significantly predicted internalizing and externalizing problems at age 5. Third, 9 and 8 of 13 TBAQ-R subscales at 24 months significantly predicted internalizing and externalizing problems, respectively, at age 5 (see attached Table 1).

**Conclusions:** The results of this study support the supposition that temperament is a trans-diagnostic risk factor for later mental health conditions (Aldao et al., 2016; Bos et al., 2018; Gross & John, 2003). Exploring temperament profiles and trajectories may illuminate early avenues for prevention in siblings of children with ASD who are at an increased likelihood of experiencing mental health problems, regardless of ASD diagnostic status.

**519.119 (Virtual Poster)** The Association between Social Skills, Anxiety, and Depression in Autism Spectrum Disorder: Parent and Youth Perspectives

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**Background:** Social impairment is common among adolescents with autism spectrum disorder (ASD). While there is emerging evidence that social factors contribute to internalizing difficulties in this population, there is a dearth of research examining the explicit links between social skills difficulties and internalizing difficulties (Smith & White, 2020). A common hypothesis is that higher rates of internalizing difficulties amongst adolescents with ASD may be explained by a combination of greater social awareness, challenges navigating social environments, and more experiences with social failures (Bellini, 2004; Kerns and Kendall, 2013). In addition, the suggestion that social challenges are linked to internalizing difficulties comes from evidence demonstrating that social skills interventions (SSIs) indirectly affect internalizing symptoms (Schiltz et al., 2018). Existing research has largely relied on parent reports rather than self-reports, representing a significant gap in the literature, since the inclusion of self-reports capture a more comprehensive picture of internalizing and autism symptomology.

**Objectives:** This study aims to investigate the association between social skills deficits, and anxiety and depression in a community sample of youth with ASD (without Intellectual Disability [ID]) who are enrolled in a novel, community-based SSI program. In addition, the study will examine the concordance of parent-reported and youths' self-reported anxiety and depression scores.

**Methods:** Data collected at three time points from implementing a community-based SSI will be analyzed. Parents rated severity of social problems on the *Social Responsiveness Scale – Second Edition (SRS-2)*, and emotional and behavioral difficulties on the *Behavior Assessment System for Children Parent Rating Scales - Third Edition (BASC-3 PRS)*. The youth also rated their behavioral and emotional difficulties on the *BASC-3 Self-Report of Personality (BASC-3 SRP)*. Pearson correlations will be calculated between the scores of social skills (SRS-2), and the *BASC-3 PRS* and *SRP* Anxiety and Depression subscale scores. In addition, separate regression analyses will be computed for the parent-report and for the self-report to estimate the unique contributions of each *SRS-2* subscales on anxiety and depression scores. Finally, to analyze concordance/discordance between

parent and self-report of anxiety and depression scores, paired-samples t-tests between the parent and child-reported anxiety and depression scores will be carried out.

**Results:** It is hypothesized that poorer social skills are associated with greater internalizing symptoms in youth with ASD (without ID), and that social skills will explain a significant proportion of the variance in mental health difficulties in youth with ASD, without ID. In addition, it is anticipated that parents and participants will report on anxiety and depression differently.

**Conclusions:** The anticipated strength of association between social skills and internalizing mental health difficulties suggest that targeting social skills as part of a comprehensive treatment plan for youth with ASD may be a way to assist in treating mental health issues. Strengths in this study include a self-report of internalizing symptoms from youth with ASD, to obtain their personal perspective on the association between social skills and mental health. This study could be further extended by incorporating mixed methods to assess social competence, and adolescents' perspectives on anxiety and depression.

**519.120 (Virtual Poster)** The Clinical Profile of Referrals to the Gender and Autism Program, a Novel Clinical Service for Gender Diverse Autistic Youth and Young Adults

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**Background:** The intersection of autism and gender diversity (GD) is common: Autism spectrum disorder (ASD) is 3-6.4 times more prevalent in transgender compared to cisgender individuals (Warrier et al., 2020). Co-occurring ASD and GD is associated with increased mental health risks, above and beyond mental health risks in autistic or gender-diverse populations independently (Strang et al., 2021). The Gender and Autism Program (GAP) at Children's National Hospital (Washington, D.C.) is the first clinical service specifically designed for the many youth and young adults who are gender-diverse/transgender and autistic. The GAP provides evaluation services for autism and gender needs, consultation services to support youth and families and community integration, and support group programs (described in Strang et al., 2020).

**Objectives:** Examine patterns of referral, including reasons for referral and clinical profiles in youth accessing care through the GAP.

**Methods:** Clinical data for 50 consecutive GAP referrals were collected and characterized. Key patient demographics (i.e., age, gender identity, assigned sex at birth (ASAB), and race/ethnicity) and clinical/diagnostic characteristics (i.e., type of referral, ASD diagnostics/status, and gender-related medical status) are included. Brief qualitative analytic methods were used to categorize reasons for referral.

**Results:** Most referrals received were from older adolescents ( $M_{age} = 16.32$ ,  $SD_{age} = 4.18$ , 6.39-26.93) seeking gender-affirming medical care. Reasons for referral were as follows: gender-related needs in the context of autism/neurodiversity (90%), autism-related characterization in the context of GD (46%), transition to adulthood in the context of being autistic and GD (28%), and educational considerations in the context of being autistic and GD (20%). 66% of patients were referred for multiple reasons.

ASAB of clinic referrals was evenly split (46% female). The majority of referrals were binary transgender. Among assigned females, 57% were binary transgender male and 43% were nonbinary or another gender. Among assigned males at birth, nonbinary genders were much less common (19%).

Most referrals had existing ASD diagnoses (66%), and most seeking ASD diagnostic clarification were found autistic (71%). Of those requesting gender-related medical treatment (including youth already receiving some type of gender-care), gender-affirming hormone requests were the most common (65%). Requests for pubertal suppression were less common (proportionally), apparently due to the age at which youth arrived at the clinic (i.e., considerably older than the typical 8-12-year-old range for starting pubertal suppression). The ethno-racial identities of participants skewed toward White and non-Hispanic/Latinx.

**Conclusions:** This study provides information on the profiles of youth and young adults accessing a service specifically designed for autistic gender-diverse individuals. Most of these young people were seeking gender-affirming medical care, yet typically were too old upon clinic intake to access pubertal suppression medications, suggesting a disparity in care access compared to non-autistic GD youth. Autism diagnosis was confirmed in nearly all patients. Race/ethnicity-related disparities in access to autism care as well as gender care may be intensified for youth at the intersection of autism and gender diversity; the patient sample was significantly skewed toward White and non-Hispanic/Latinx. Future work should address disparities in access to care by age as well as race/ethnicity.

**519.121 (Virtual Poster)** Assessing the Moderating Role of Behavioral Regulation on the Longitudinal Relationships between Anxiety and Social Communication Among Autistic Children

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## Background:

Co-occurring anxiety disorders affect many autistic children, with far-reaching impacts on their adaptive functioning, physical health, and family relationships. Evidence suggests anxiety in autism is related to difficulties across social (i.e., social communication) and cognitive (i.e., executive functioning) domains. However, research has yet to examine these associations longitudinally in a community sample of autistic children. It remains unclear whether anxiety predicts greater social communication difficulties over time (or vice versa) in autism, and whether executive functioning – particularly behavioral regulation (BR) – acts as a protective factor, by moderating these relationships.

## Objectives:

To: (1) investigate longitudinal associations between anxiety and social communication difficulties among school-aged autistic children, and (2) assess the moderating effect of BR.

## Methods:

Participants were drawn from *Pathways*, a pan-Canadian, longitudinal cohort study of autistic children (N = 157; 15% female; mean FSIQ = 84.8). We focused on two time points during pre-adolescence (Age 9: mean age = 9.7 years, and Age 10: mean age = 10.7 years; mean interval between assessments = 12.2 months). To limit informant bias, parent and teacher reports were gathered at each time point. Specifically, the parent-reported Child Behavior Checklist (Anxiety Problems subscale) assessed anxiety, and the teacher-reported Social Responsiveness Scale (Social Communication Index) and Behavior Rating Inventory of Executive Function (Behavior Regulation Index; BRI) assessed social communication and BR difficulties, respectively.

We ran a cross-lagged panel model, controlling for IQ, to test whether anxiety levels at Age 9 predicted social communication difficulties at Age 10 and vice versa (cross-lagged pathways). Next, we ran a multigroup analysis to test for similarity in cross-lagged pathways across different levels of BR ability. Grouping was based on median BRI scores at Age 9 (high-BR difficulty: n = 57; low-BR difficulty: n = 55).

## Results:

Higher Age 9 anxiety scores predicted *fewer* social communication difficulties at Age 10 ( $\beta = -.169, p = .038$ ). Social communication difficulties at Age 9 did not predict levels of anxiety at Age-10 ( $\beta = .091, p = .183$ ). In the multigroup analysis, the association between higher Age 9 anxiety and lower Age 10 social communication difficulties was significant in the high-BR difficulty group ( $\beta = -.474, p < .001$ ), but not the low-BR difficulty group ( $\beta = .046, p = .949$ ), and the difference in the strength of these estimates was significant ( $p < .001$ ).

## Conclusions:

These unexpected results suggest that anxiety may lead to greater behavioural inhibition, especially among those with poorer BR, which in turn may reduce social communication difficulties over time. Our findings emphasize the importance of studying anxiety in community samples in order to gather a more complete picture of the developmental effects (both adaptive and maladaptive) of anxiety for autistic youth. Further research is required to clarify the mechanisms (e.g., behavioural inhibition) underlying the protective role anxiety may play, and to investigate how these associations continue developing into adolescence and adulthood for autistic people – in particular evaluating the longer-term mental health consequences of anxiety compared to its potential social benefits.

### 519.122 (Virtual Poster) Characterizing Adolescent Autism Diagnosis in Individuals with Prior Psychiatric Diagnoses

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**Background:** Many autistic individuals are also diagnosed with mental health conditions. Studies suggest that 70-80% of autistic individuals will be diagnosed with at least one psychiatric disorder in their lifetime (Buck et al., 2014; Lever et al., 2016). This high level of psychiatric comorbidity can make differential diagnosis difficult in individuals who do not receive a diagnosis of autism at a young age. In addition, some individuals may receive incorrect psychiatric diagnoses rather than the correct diagnosis of autism. It is important for researchers to explore how to improve diagnosis of this subset of the autism population in order to increase timely access to appropriate support and, if necessary, intervention.

**Objectives:** To characterize a sample of autistic individuals who were diagnosed during adolescence and who had existing psychiatric diagnoses at the time of their autism evaluation. The goals of this project are to 1) identify whether patterns in early signs of autism (e.g., developmental delays, social concerns) exist among this population, 2) identify whether patterns in sociodemographic factors (e.g., household income, parent education) exist among this population, and 3) describe the psychiatric histories of individuals in this population. Such information could aid in more timely autism diagnoses for individuals with similar presentations.

**Methods:** We reviewed assessment reports for individuals who received an autism diagnostic evaluation at a specialty clinic during adolescence (ages 13-18 years) between 2015 and 2020. Individuals were included in this study if they had previous and/or existing psychiatric diagnoses and they received a diagnosis of autism as a result of their evaluation. One hundred forty-two individuals (26% female, 93% Caucasian, *M* age=15.36 years) were included in the sample. Sociodemographic, phenotypic, and developmental milestone data were reviewed. In addition, information regarding current behavior concerns and medications, and current and past psychiatric and developmental diagnoses, suicidality, and non-suicidal self-injury was reviewed.

**Results:** Individuals in our sample had an average full-scale IQ of 94.22 (range=57-132) and presented with a wide range of pre-existing psychiatric and developmental diagnoses (e.g., anxiety, depression, bipolar disorder, learning disability, attention deficit hyperactivity disorder). Many individuals in our sample received these diagnoses from Psychologists or Psychiatrists, indicating they had been seen by individuals who could have provided the correct diagnosis of autism. Average age of caregiver's first concerns about social development, speech and language development, and behavior was 48 months, 38 months, and 44 months, respectively. Analysis of other data in this project is ongoing.

**Conclusions:** Individuals who receive an autism diagnosis during adolescence and who have previously received other psychiatric diagnoses are a group that may be difficult to accurately diagnose in a timely manner. This is evidenced by the fact that they are seen by diagnosticians capable of providing an autism diagnosis but nonetheless receive other diagnoses. While other psychiatric and developmental diagnoses may be accurate, it is essential to better identify these individuals with autism at younger ages in order to improve their access to appropriate support as early as possible.

**519.123 (Virtual Poster) Co-Occurrence of Externalizing Behaviors, Attention Problems, and Internalizing Symptoms Higher in Autistic Than Non-Autistic Adolescents**

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**Background:** Adolescence is often a time of onset or increase in both internalizing and externalizing behaviors. Puberty may exacerbate behaviors in vulnerable youths with existing challenges. For instance, externalizing behaviors (e.g., risk-taking, aggression) occur alongside maturation, and mental health symptoms can also pervade the adolescence experience, such as depression and anxiety. The pubertal process has a role in increasing internalizing symptoms and externalizing behaviors in non-autistic adolescents, but few studies have investigated puberty's effect on autistic adolescents. We conducted a model that accounted for commonalities among internalizing symptoms (INT), externalizing behaviors (EXT), attention problems (ATT), and repetitive behaviors and restricted interests (RRB) in a sample of autistic and non-autistic youths. Within this model, other relevant factors, such as pubertal status (PUB) and gender, were considered when examining symptom and behavior domains.

**Objectives:** The main aim of the present study was to test current "comorbidity" models and adolescent developmental models usually applied in research on non-autistic adolescents and test these models with autistic adolescents in comparison, as puberty may uniquely affect autistic adolescents. Such a model can provide insight into commonalities across symptoms and behaviors that may also relate to maturational experience.

**Methods:** Data were obtained from the National Database for Autism Research. A sample of 268 non-autistic and 241 autistic youths ages 8 to 18 years (*M* = 12.79, *SD* = 2.96, 46% female) were included in the study. Racial groups included white (80%), Asian (8%), Black or African American (7%), Hawaiian or Pacific Islander (1%), Hispanic or Latinx (12%), and more than one race (5%). Multiple linear regressions tested behavior domains (EXT, ATT, RRB) as predictors of internalizing symptoms, and then commonality analyses were conducted to test unique and common variances between and among variables. Pubertal status and gender were examined as moderators of symptom-behavior domains. Within-group analysis were conducted to examine symptom-behavior associations and moderator effects within neurotype (i.e., within non-autistic youths, within autistic youths).

**Results:** Autistic (AT) adolescents had higher INT than non-autistic (NA) adolescents with girls showing higher symptoms than boys ( $b=2.28$ ,  $p=0.03$ ). EXT and ATT co-occurred with INT ( $b=0.53$ ,  $p<0.001$ ;  $b=0.58$ ,  $p<0.001$ , respectively) for both AT and NA adolescents. Within-group analysis found AT girls had higher INT than AT boys ( $b=4.54$ ,  $p<0.001$ ) when accounting for EXT co-occurrence. The same result was found within the NA group ( $b=1.42$ ,  $p=0.03$ ). PUB did not moderate behaviors and symptoms co-occurrence in both groups, and RRB did not predict INT. Commonality analysis found co-occurrence across INT, EXT, ATT, and RRB in both AT and NA youths. Behavior domains combined shared 32% of the total variance in predicting INT for AT adolescents, while 26% of the variance were explained by EXT and ATT for NA adolescents.

**Conclusions:** This study adds to a growing literature that adolescence can be a tougher time for autistic adolescents, especially girls. Unexpectedly, pubertal status did not influence co-occurring symptoms and behaviors in this sample. Consequently, future research is needed examining longitudinal assessments to elucidate puberty's role in heterotypic co-occurring symptoms and behaviors in autistic youths.

**519.124 (Virtual Poster) Content and Extent of Worry in Autistic Adults**

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**Background:**

Autistic individuals are at a greater risk of experiencing poor mental health compared to neurotypical adults and have a higher prevalence of psychiatric conditions including anxiety and depression. While poor mental health is highly prevalent in the autistic population, few studies have

explored the presentation of worry in autistic individuals and there is limited knowledge on how worry presents, and whether the content, extent, and experiences of worry are similar to non-autistic individuals.

#### Objectives:

The aims of this study were to compare the content and extent of worry in autistic adults compared to non-autistic adults. The study objectives were to explore the differences and similarities in the content and extent of worry compared between autistic and non-autistic adults and the specific experiences of worry in the autistic population.

#### Methods:

A convergent parallel mixed-method study to explore the content and extent of the experience of worry in autistic people to identify the specific factors influencing worry and to what extent this impacts on their lives. A quantitative survey compared the content and extent of worry in 52 autistic and 169 non-autistic participants using the Penn State Worry Questionnaire (PSWQ) and Worry Domains Questionnaire (WDQ). Qualitative interviews were undertaken with 14 autistic adults and analysed thematically to explore the experiences, and impacts of worry from the perspectives of autistic adults.

#### Results:

Comparisons of worry between autistic and non-autistic adults using the PSWQ and WDQ demonstrated autistic adults had a significantly higher trait worry and extent of worry than non-autistic populations. Autistic adults had significantly greater worry across all worry domains including relationships, lack of confidence, aimless future, work incompetence, and financial domains. Qualitative interviews with autistic individuals highlighted the experiences, content and impact of worry from the perspectives of autistic adults. Worry experienced within the autistic population was grouped into four themes; 1) definition of worry, 2) impacts on daily living, 3) time of day worry is present and 4) contributions to worry. Worry was described as a never-ending cycle involving overthinking where thoughts circulated through participants' minds throughout their daily lives. One participant expressed that "... worry can be a rabbit warren of fears...". Worry was reported by autistic adults to decrease their mood and increase their fear socialising, impacting their relationships with family and friends. Worry further reduced autistic adults access to the community and was reported to contribute to health and financial issues, job instability, and overall impacting their ability to remain independent and support themselves.

#### Conclusions:

Autistic adults worry more than non-autistic adults in every aspect of daily living, with autistic adults reporting this led to more isolating behaviours. Rumination on negative thoughts was commonly expressed participants due to their feelings of uncertainty and thinking about future events. Worry was reported to have negative impacts on daily functioning including sleep, positive relationships, future planning, financial wellbeing, and general health. Worry is likely to contribute to the already known higher mortality rate among autistic adults.

#### **519.125 (Virtual Poster) Experiences and Impact of Anxiety on the Everyday Participation of Autistic Adults**

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#### Background:

Anxiety is commonly experienced by autistic individuals, with some evidence suggesting that over half of autistic individuals experience anxiety. While the prevalence anxiety is known to be greater in autistic individuals compared to the neurotypical population, few studies have sought to explore the experiences and impact of anxiety on autistic adults. The World Health Organisation (WHO) International Classification of Functioning, Disability, and Health (ICF) provides a biopsychosocial approach to appraise health, disability, and its effect on participation in everyday activities. The ICF therefore provides a comprehensive framework through to explore the impacts of anxiety on autistic adults' participation in everyday life.

#### Objectives:

Explore the experiences and impact of anxiety on everyday activities and participation from the perspectives of autistic adults.

#### Methods:

A qualitative approach was used to explore experiences of anxiety and its impact on everyday participation from the perspective of autistic adults. Semi-structured interviews were conducted with 14 autistic adults with a mean age of 40.5 years including four females and ten males. Interview data were transcribed verbatim and analysed thematically. The activity and participation domains of the ICF were used to guide data analysis, providing a comprehensive exploration of the experiences and impact of anxiety on activities and participation from the perspectives of autistic adults.

#### Results:

Autistic adults described anxiety as an uncontrollable sense of uncertainty and reluctance to commit to participating in everyday activities. A majority of autistic adults perceived anxiety to be intertwined with their identity, reporting difficulty imagining life without it: “[Anxiety] is just something you live with... it gets better, it gets worse. You don't know what it's like to live without it”.

Autistic adults described how anxiety, particularly related to uncertainty, impacted the frequency and quality of participation in home and community life, education, employment, and relationships. Illustrative examples include the impacts anxiety had autistic adults' ability to enter the community and perform self-care: “If I'm really anxious... I'll get so overwhelmed and not be able to function, cook for myself or get groceries. On some days... I'll have difficulty just leaving my bed, so even basic hygiene... getting in the shower, brushing my teeth, it will impact my ability to care for myself” and participate in leisure occupations: “I've isolated myself in the anxiety from actually breaking out and even doing some of the things that I used to enjoy”. While anxiety had largely negative impacts, autistic adults also reported some positive impacts anxiety, finding that in some cases it could as a motivator to participate in relationships, employment, and education.

#### Conclusions:

Experiences of anxiety negatively impacted autistic adults' participation in all activity and participation domains of the ICF including home and community life, education, relationships and employment. Everyday activities which were unpredictable or uncertain, or that had the potentially to be sensory overwhelming were found to contribute to anxiety, resulting in autistic adults limiting their participation in daily life.

#### **519.126 (Virtual Poster)** Exploring the Relevance of the Interpersonal Theory of Suicide in Autistic People

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**Background:** While there are known risk factors for suicidality in autism, these are often unconnected from theoretical frameworks that might explain *how* risk is elevated and guide clinical interventions. One such theory, the Interpersonal Theory of Suicide (ITS), asserts that unmet interpersonal needs (perceived burdensomeness and thwarted belongingness) are the principle drivers of suicide ideation, over and above state psychopathology, but that ideation is only translated into action if individuals have acquired capability for suicide. At present, these hypotheses have been under-investigated in autistic people.

**Objectives:** In an autistic sample, we examined the relevance of perceived burdensomeness and thwarted belongingness for suicide ideation, and acquired capability for suicide attempts. We further examined these constructs as the mediators through which certain autism-relevant factors (relationship status, co-occurring ADHD) might elevate suicide risk.

**Methods:** Autistic adults (n = 314) completed an online study including measures of depression, anxiety, ADHD symptoms and constructs from the ITS. Linear and multinomial regression analysis disentangled contributions of ITS variables from effects of depression and anxiety for past-year suicide ideation, past-year and lifetime suicide attempts. Mediation analyses examined associations between risk factors and these suicide outcomes via mechanisms proposed by the ITS.

**Results:** Past-year suicide ideation was associated with burdensomeness, mental rehearsal of suicide plans (a facet of acquired capability), and depression. Burdensomeness and reduced fear of death differentiated those who had attempted suicide from those who had (and had not) experienced suicidal ideation in the past year. Relationship status was indirectly associated with past-year suicide ideation via the mediators of depression and burdensomeness, and was associated with past-year attempts via its effect on ideation. ADHD co-occurrence was associated with past-year suicide ideation via anxiety, depression, and burdensomeness; this elevated sense of burdensomeness also mediated an association with more lifetime suicide attempts. A closer look at ADHD symptoms revealed that individuals with hyperactive and impulsive symptoms were also more likely to experience painful and/or traumatic life events, and through this more likely to acquire capability for suicide: these symptoms were associated with more numerous suicide attempts via each of these mediators.

**Conclusions:** Contrary to ITS predictions, perceived burdensomeness may be a potent factor in suicide ideation *and* attempts in autistic people. Facets of acquired capability, notably reduced fear of death and mental rehearsal of suicide plans, may likewise contribute to both ideation and attempts. These associations may underpin some of the increased risk associated with variables like relationship status and co-occurring ADHD, which justifies further investigation of how ITS constructs are conceptualised and how they should be measured in autism. The existence of a direct pathway from traumatic events to suicide attempts, contrary to the ITS hypothesis that traumatic events increase suicide risk via acquired capability, corroborates the need to explore the nature and impact of trauma and post-trauma symptoms in autistic people. As cross-sectional research is insensitive to directionality, researchers must collaborate with the autistic community to devise safe and scientifically rigorous methods to examine temporal dynamics in suicide trajectories.

#### **519.127 (Virtual Poster)** Impact of Sleeping Disorders on Anxiety-Related Clinical Scales in Individuals with Autism

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#### **Background:**



Sleep disturbances are a common comorbidity of individuals with autism. Sleep hygiene training and non-pharmacological interventions are often implemented as first-line therapies, with mixed evidence regarding their clinical efficacy. Commonly prescribed pharmacological interventions include melatonin and iron supplementation. Research has shown associations between sleep difficulties and the core symptoms of autism in children, suggesting that improving sleep could be an approach for the treatment of autism and other neurodevelopmental conditions. The impact of sleeping disorders on the clinical characteristics of autism has not been studied in a large cohort spanning a broad age range.

### Objectives:

To evaluate the demographics and longitudinal performance on anxiety and sleep-related scales in a cohort of individuals with autism with/without comorbid sleeping disorders and/or melatonin treatment.

### Methods:

oRBiting (NCT03611075) is a non-interventional, longitudinal study of participants with autism with an intelligence quotient (IQ)  $\geq 50$ , Clinical Global Impression-Severity scale  $\geq 4$  and CY-BOCS-ASD total score  $\geq 12$ . Demographics, comorbidities and trajectories of sleep and anxiety-related clinical scales (Pittsburgh Sleep Quality Index [PSQI] global score, Children's Sleep Habits Questionnaire [CSHQ] total score, Beck Anxiety Inventory score [BAI] and Hamilton Rating Scale for Anxiety [HAM-A]) measured at Week 2 and Week 12 were compared in: (1) those with versus without comorbid sleeping disorders; (2) those receiving melatonin or melatonin agonists versus those not receiving these treatments; and (3) those with sleeping disorders with versus without treatment with melatonin or melatonin agonists.

### Results:

In total, 95 participants with autism aged 5–36 years were evaluated. Based on descriptive analyses, there were no differences in the demographics and comorbidity profiles between individuals with autism with sleeping disorders versus those without. Among those with sleeping disorders ( $n=23$ , 24%), trajectories of sleep-related scales (CSHQ and PSQI) were stable; trajectories remained stable in those with a sleeping disorder receiving treatment with melatonin or melatonin agonists ( $n=16$ ). Higher baseline levels of anxiety, as indicated by mean (SD) HAM-A score, were observed among individuals receiving melatonin or melatonin agonists ( $n=18$ ) compared with non-melatonin users ( $n=77$ ; 16 [8] vs 10 [8], respectively). This was followed by a steady decline in anxiety over time. No differences between these groups were observed on the BAI scale. However, in participants with sleeping disorders, mean (SD) baseline HAM-A and BAI scores were lower for those receiving melatonin or melatonin agonists ( $n=16$ ) compared with non-melatonin users ( $n=7$ ; HAM-A: 12 [4] vs 21 [13], respectively; BAI: 17 [13] vs 19 [16], respectively). HAM-A and BAI trajectories were also more stable for those with sleeping disorders receiving melatonin versus non-melatonin users.

### Conclusions:

In this observational study, the prevalence of sleep comorbidities was lower than previous reports. While there were no clear differences in demographic characteristics between those with/without sleeping disorders, baseline anxiety levels were lower with a more stable trajectory for those with sleeping disorders receiving melatonin treatment versus non-melatonin users. Statistical analyses will be conducted to contextualize these descriptive results and will lead to improved understanding of the impact of sleeping disorders and their therapeutic management in people with autism.

### 519.128 (Virtual Poster) Pubertal Timing and Tempo in Females and Males with Autism Spectrum Disorder Compared to Typically Developing Youth

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Background: Autism spectrum disorder (ASD) is characterized by impaired social communication and poor adaptation to change; thus, pubertal development may be precarious. Puberty refers to biological maturation leading to significant cognitive, emotional, and physiological changes. Research has shown that pubertal timing, involving the onset of secondary sexual characteristics, generally provides a more robust explanation for the physical and psychosocial changes that occur during adolescence than chronological age. Pubertal tempo refers to how rapidly or slowly an individual progresses from the onset of puberty until full sexual maturation. Differences in the timing and tempo of puberty can have significant psychological, social and physiological consequences.

Objectives: The purpose of the current study was to examine interindividual differences in pubertal timing and tempo in a large sample of early-to-middle adolescents at two time points, one year apart based on biological sex (female vs. male) and group (ASD vs. TD).

Methods: Pubertal timing and tempo were measured in 244 youth with ASD ( $N=140$ ) and typical development ( $N=104$ ). Pubertal development was measured using Tanner Staging of Genital (G, males), Breast (B, females) and Pubic Hair (PH) in both sexes at Time 1 (10-13-years) and Time 2 (11-14-years). A nonlinear mixed effects model (NLME) was used to fit Tanner stage (G/B or PH stage) as a function of covariates using a sigmoid model.

Results: Interindividual differences in timing and tempo were analyzed using nonlinear mixed effects models. For both sexes, ASD and higher Body Mass Index (BMI) were associated with earlier pubertal timing. Males generally exhibited faster tempo than females. Specifically, the results for males showed that diagnosis and BMI are strong predictors of genital stage such that males with ASD enter puberty 4.9 months earlier than TD

males. For females, the results corroborate previous findings of advanced pubertal onset in females with ASD. Breast development showed a nearly 9-month difference in onset for females on the autism spectrum compared to TD peers.

**Conclusions:** To our knowledge, this is the first study examining pubertal tempo in youth with ASD and among only a few rigorously examining tempo in TD participants. Findings showing advanced and faster pubertal maturation in ASD youth suggest greater risk of psychological, social, and physiological challenges due to their lack of preparedness for the increased demands of adolescence. The initial findings underscore the importance of considering timing and tempo in adolescents with and without ASD.

**519.129 (Virtual Poster) Sleep Problems in Autism: Sex Differences in the School-Age Population**

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**Background:** Clinically significant sleep problems are highly prevalent in autism spectrum disorder (ASD); affecting from 45-86% of this population in school-age. Sleep problems can negatively impact child cognition, behavior, and health. In typical development, sleep problems decrease sharply from 4-7 years of age, so sleep problems in the school-age period may be particularly salient. In typical development, sex differences in sleep have been noted as early as 6 months of age and continue to be observed through adolescence. Two recent studies of large databases with wide age-ranges suggest that sex differences may also be evident in sleep problems in ASD (Angell et al 2021; Sara & Smith, 2020). However, very little is known about sex differences in the prevalence and type of sleep problems in ASD or about how sex differences in sleep problems may manifest during school-age.

**Objectives:** To evaluate sex differences in parent-reported sleep problems in ASD and TD school-age children.

**Methods:** Parents reported sleep problems on the Children's Sleep Habits Questionnaire (Owens, 2000) and examiners conducted assessments to establish diagnosis and intellectual ability in 6-12-year-old children (ASD n=260; TD n=114). Participants were recruited and procedures were IRB approved and conducted at the Children's Hospital of Philadelphia.

**Results:** 84.4% of the ASD female group demonstrated sleep problems compared to 65.8% of ASD males, 44.8% of TD females, and 42.4% of TD males. Linear regression models revealed a significant group by sex interaction, with the ASD female group demonstrating the highest level of sleep problems ( $p=0.047$ ). Intellectual ability was not related to sleep problems in this sample. ASD females demonstrated more difficulty than TD females across all CSHQ sleep problem subtypes except sleep disordered breathing and more difficulty than ASD males in bedtime resistance, sleep duration, sleep anxiety, and sleepiness. Future analyses will evaluate potential mediators of these relationships.

**Conclusions:** Sleep problems were highly prevalent in 6-12 year old ASD females. The pattern of sex differences in sleep problems (ASD female > ASD male > TD female = TD male) suggests a disorder-specific effect of sex on sleep problems. This is one of the first studies to evaluate sex differences in sleep in ASD utilizing a standard measure of sleep and direct assessment of ASD. Sleep problems that have not resolved by school-age may have high clinical significance. Current assessment and intervention practices may benefit from increased attention to sleep problems in ASD females to reduce negative impacts on behavior and health. Future studies are needed to evaluate contributors to sleep problems in ASD females.

**519.130 (Virtual Poster) Impact of Associated Co-Morbidities in Autism Spectrum Disorder**

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**Background:** Current standard management of Autism Spectrum Disorder (ASD) targets its core features and management of co-morbidities. The co-morbidities associated with ASD affect quality of life of these children. It is to be seen how these comorbidities affect response to applied behavioural analysis (ABA), the standard behavioural therapy as measured by childhood autism rating scale (CARS).

**Objectives:** To study the prevalence of comorbidities in Indian children with ASD and how it affects the response to standard therapy, as measured by CARS

**Methods:** Children aged 2-18 years, with ASD (DSM 5 criteria) from January 2017 to March 2021 were enrolled in the study after obtaining parental consent. These children were followed in Autism clinic at 1-3 monthly intervals. Detailed history from parents was obtained using a standard clinical proforma. Further evaluation for symptom severity and behavioral co-morbidities was done by performing Childhood Autism Rating Scale (CARS), Autism Behavior Checklist (ABC), and Childhood Behaviour Check List (CBCL) at baseline as well as on follow up visits. Children were provided ABA and medications as required. If the child had epilepsy or suspicion of ESES (n=122), sleep EEG was performed. Screening for Fragile X syndrome, Rett syndrome, chromosomal microarray, and next-generation sequencing was performed when suspected. Children were categorised according to the comorbidity noted at baseline, prospectively followed and their outcomes at 6 months were compared.

## Results:

A total of 1551 children with ASD (1310 boys, median age of 4.8 years with IQR 3.2-7 years) were enrolled. Proportion of children with comorbidity was 80% (1255/1551). Attention deficit hyperactivity disorder (ADHD) was the most common comorbidity (57.55%), followed by global developmental delay/intellectual disability (GDD/ID), sleep disturbances and epilepsy which were found in 55.58%, 47.29% and 12% of the children respectively. Learning disability was higher in females ( $p=0.013$ ). The comorbidities associated with higher CARS score at baseline were feeding disorder ( $p=0.02$ ) and disruptive behaviour ( $p=0.008$ ).

A subset of 1273 children with complete follow up records were analysed. Overall, when compared to baseline, children showed significant decrease in mean CARS score at 6 months (37.17 vs 33.88,  $p < 0.000$ ). Response to ABA was better in younger children with decrease in CARS maximum in 2-5 years (3.06,  $p < 0.000$ ) and least in those aged 15 years and above (1.44,  $p < 0.000$ ). Both males and females showed response to ABA with mean decrease in CARS score being -3.30 ( $p < 0.000$ ) and -3.23 ( $p < 0.000$ ) respectively. All the children with or without comorbidity showed decrease in mean CARS score, with differences in scores being -3.41 ( $p < 0.000$ ) and -2.74 ( $p < 0.000$ ) respectively post therapy.

Children categorised in different groups based on their associated comorbidity showed decrease in post therapy CARS score. Difference of mean CARS score (post therapy -pre therapy) amongst those with epilepsy (-3.18,  $p < 0.000$ ), sleep disturbance (-3.73,  $p < 0.000$ ), mood disorder/depression (-2.40,  $p = 0.0004$ ), ADHD (-3.63,  $p < 0.000$ ), GDD/ID (-3.01,  $p < 0.000$ ) were significant.

**Conclusions:** The burden of comorbidity in children with ASD is high. Once we manage the children holistically, presence of comorbidities does not affect ultimate response to ABA therapy significantly.

### **519.131 (Virtual Poster)** Prevalence of Sleep Problems in Preschool Children with Neurodevelopmental Disorders and Correlation with Behavioral or Serum Ferritin in Community Surveys

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**Background:** It has been reported that children with neurodevelopmental disorders (NDDs) have more sleep problems than children with typical development (TD) (Johansson et al, 2018). Decreased serum ferritin is known to be associated with restless legs syndrome, one of the common sleep problems.

**Objectives:** To estimate the prevalence of sleep problems in preschool children (5-year-old children) with NDDs including TD children in community surveys, and to clarify the effects of sleep problems on behavioral aspects and the relationship with serum ferritin levels.

**Methods:** We included 2336 children who participated in the health check-up for children aged 5 years in City A in the 2018-2019 year. We used the total score and subscale scores of the JSQP (Japanese Children's Sleep Questionnaire) to assess sleep and the SDQ (Children's Strengths and Difficulties Questionnaire) to assess behavior. We defined children with a JSQP score  $\geq 86$  as having sleep problems. The children were screened for developmental characteristics and diagnosed using the DSM-5 and grouped into TD ( $n=1890$ ), ASD ( $n=115$ ), ADHD without ASD ( $n=93$ ), other developmental disorders (Other DD) ( $n=103$ ) and Unknown ( $n=115$ ). In addition, the diagnosis of ASD was confirmed by ADOS-2. We excluded the Unknown group and included 2201 children in our analysis. We measured serum ferritin using the CLEIA method in 180 subjects who consented to a blood test. We used the  $\chi^2$  test, the Kruskal-Wallis test and multiple regression analysis for statistical analysis.

**Results:** The prevalence of sleep problems was 14.8% in the TD group, 50.4% in the ASD group and 39.8% in the ADHD group (Fig.1). The ASD and ADHD groups had significantly more sleep problems than the TD and Other DD groups. Restless legs syndrome (movement), Obstructive Sleep Apnea Syndrome, Parasomnias, Insomnia/Circadian rhythm disorders, Morning symptoms, Excessive daytime sleepiness and Daytime behavior were significantly higher in the ASD and ADHD groups than in the other groups. In terms of behavior, there was a significant positive correlation between the JSQP total score and the SDQ total score in the ASD group ( $\beta=.575$ ,  $R^2=.229$ ). The ASD group also showed a significant association with SDQ subscale scores or total scores in several of the JSQP subscale scores, suggesting that there may be an association between sleep problems and problematic behavior compared to other developmental disorders. Serum ferritin levels (mean 22.8 ng/ml) were not significantly different between the diagnostic groups, but parasomnias and serum ferritin levels showed a significant positive correlation ( $\beta=.550$ ,  $R^2=.310$ ).

**Conclusions:** Japanese 5 years old children with ASD and ADHD have more sleep problems than children with TD and Other DD. In particular, sleep problems in ASD children may be related to their daily activities and serum ferritin levels, and these need to be examined comprehensively. One part of parasomnias is known to be associated with neurological diseases. Neurological diseases may lead to high ferritin levels. The results of this study may help us to consider the pathogenesis of parasomnias and sleep problems.

### **519.132 (Virtual Poster)** Sleep Patterns in Hospitalized Children with Autism Vary By Age and Pubertal Status

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**Background:**

Sleep problems are common and detrimental for youth with autism spectrum disorder (ASD). In non-ASD youth, age- and puberty-related changes in circadian rhythms cause a shift toward “night owl” tendencies, typified by later bed and wake times. Due to early school start times, sleep/wake timing often shifts considerably between school and weekend nights, similar to moving across several time zones every week and is referred to as social jetlag. Despite the relevance of sleep for behavioral functioning in youth with ASD, the developmental course of sleep has not been examined in this population.

#### Objectives:

The primary aims of this study are to evaluate: 1) age and puberty associations with sleep and 2) the moderating role of demographic and clinical characteristics.

#### Methods:

Participants were 147 psychiatrically hospitalized children with ADOS-2 confirmed ASD, ages 5.1-20.6 (mean age=12.6±3.5 years old), 85% (N=125) male, 90.5% (N=133) white, 36.7% (N=54) minimally-verbal, 49.7% (N=73) with intellectual disability, 53.1% (N=78) with comorbid ADHD, 47.6% (N=70) with a comorbid anxiety disorder, and 19% (N=28) with a comorbid mood disorder. Following hospital admission, caregivers completed a pubertal-development rating-scale and provided information to calculate: sleep duration on school and weekend days, sleep midpoint (i.e., halfway between bedtimes and wake times) on school and weekend days, and social jetlag (i.e., the difference in sleep midpoint between school and weekend days). To control for Type I Error, we used a generalized linear multivariate model with Bonferroni adjustment for pairwise comparisons. Covariates and moderators included sex, race, non-verbal IQ, ASD severity, verbal ability, and comorbid psychiatric diagnoses.

#### Results:

In fully adjusted models, older age was associated with later sleep midpoint on weekends ( $F=9.60$ ,  $p=0.002$ ) and more social jetlag ( $F=8.94$ ,  $p=0.003$ ). Significant age by race interactions revealed that these associations were only significant for white children ( $F=4.76$ ,  $p=0.031$  and  $F=5.79$ ,  $p=0.017$ , for weekend sleep midpoint and social jetlag, respectively). Older age was associated with shorter sleep duration on school days ( $F=5.56$ ,  $p=0.02$ ) and weekends ( $F=9.26$ ,  $p=0.003$ ) for non-white children only. Associations between age and sleep also varied between children with and without a mood disorder. The positive association between age and sleep midpoint on weekends was significant only for children without mood disorders ( $F=5.02$ ,  $p=0.027$ ). Older age was associated with later school day sleep midpoints for children without mood disorders and earlier sleep midpoints for children with mood disorders ( $F=4.87$ ,  $p=0.029$ ). Finally, older age was associated with longer sleep duration on weekends for children with a comorbid mood disorder ( $F=4.41$ ,  $p=0.038$ ). Sleep midpoint on weekends was on average  $65.5\pm22.0$  minutes later for children who were in late-puberty relative to those who were pre-pubertal ( $F=2.82$ ,  $p=0.03$ ). Cell sizes for pubertal stage categories were insufficient to run moderation analyses.

#### Conclusions:

Sleep timing may follow the developmental trajectory seen in non-ASD youth. More racially diverse samples are needed to understand if non-white children with ASD experience different age-related changes in sleep and large prospective studies are needed to evaluate within-person changes in sleep and if developmental trajectories vary by descriptive characteristics or indices of clinical severity.

#### **519.133** (Virtual Poster) Seizure Events and Abnormal Epileptiform Activity Reports in People Carrying CHD8 Genetic Variants

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#### Background:

Exome sequencing studies have shown that likely gene damaging (LGD) mutations in CHD8 are highly associated with autism spectrum disorder (ASD). People harboring LGD mutations in CHD8 may have additional disorders that are co-morbid with ASD, including intellectual disability, anxiety, and attention deficit hyperactivity disorder. Additional neurological complications such as epilepsy can be particularly disruptive to quality of life, but the current literature describing the clinical phenotype of people carrying CHD8 mutations is lacking a comprehensive overview of the association of CHD8 LGD mutations with seizures and abnormal EEG that may predispose for epilepsy.

#### Objectives:

Survey current literature and databases for cases describing the clinical phenotype of CHD8 variants and to examine the prevalence of reported seizures and abnormal epileptiform activity.

#### Methods:

We reviewed the literature and publicly available databases for reported CHD8 variants (Pubmed; n=243, denovo-db; n=40, ClinVar; n=249, gnomAD; n=2545). Papers were manually curated for CHD8 variants and cases were annotated to indicate the cDNA and protein changes in CHD8 caused by the variant, the affected protein domain, the reported sex of the carrier, mode of inheritance, and clinical phenotyping information. The cases were filtered to remove duplicate reports, copy number variants, and non-exonic variants, as well as splice-site variants more than 10 base pairs from the nearest exon.

## Results:

We found 1392 reported variants in CHD8 exons and splice sites (Pubmed, n=180; denovo-db, n=24; ClinVar, n=189; gnomAD, n=999) from our literature and database survey. Of these, 16 studies described additional phenotypic information (corresponding to 115 cases) and were further screened for reports of seizures and/or abnormal EEG tests. Seizure/abnormal EEG events were reported in 14 phenotyped cases (12%). In this group, there was a 2.5: 1 male:female ratio, and all cases were reported to have ASD or intellectual disability (ID), with 71.4% reporting co-morbid ASD and ID. All of the variants carried by cases in this subgroup were LGD mutations (single nucleotide variants, n=12 and splice-site variants, n=2). An additional 6 CHD8 variant carriers were reported to have seizures and/or abnormal EEGs in the ClinVar database (3.2% of ClinVar reported variants in CHD8), and one missense mutation in CHD8 was found via targeted sequencing after Sudden Unexplained Death in Epilepsy (SUDEP).

## Conclusions:

Published reports describing people who harbor CHD8 variants are highly variable in the extent of clinical phenotyping and are particularly variable in reporting seizures and abnormal EEGs. The finding of seizure/abnormal EEG reports in 14% of phenotyped cases is likely an underestimate, as none of the studies performed additional testing to document brain activity over an extended period, and there are no longitudinal studies to determine the incidence of epilepsy with increasing age. Future studies focusing on the evolution of seizures and abnormal epileptiform events in people carrying CHD8 variants are needed to fill this gap in literature. These studies would help elucidate which specific variants have higher risk for seizure/abnormal EEG and give additional insight to design preclinical models and studies to improve treatment of CHD8-related seizures and abnormal epileptiform activity.

### 519.134 (Virtual Poster) Characteristics of Children Diagnosed with Late Childhood Autism Spectrum Disorder

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**Background:** We hereby describe our preliminary results of the data analysis of a unique group of school-aged children with prolonged difficulties in social communication functions referred to our autism and social communication difficulties center at a tertiary hospital in Israel. Our clinic serves mostly children within the normal range of intelligence, learning in the regular education system.

**Objectives:** We aimed to describe the characteristics of those children eventually diagnosed with autism spectrum disorder.

**Methods:** In total, 172 children were included (80% males, mean age 10.6+- 3.3 years), most of them ( 88%) with a history of developmental difficulties. After a multi- disciplinary evaluation, 35% were eventually diagnosed with ASD. The ADOS score (9.25 vs. 5.32, p<0.001) AND the CAST score (16.9 vs 14.85, p=0.04) correlated with the clinical diagnosis of autism according to the DSM 5.

**Results:** We did not find an association of perinatal data, early developmental interventions, or comorbid ADHD and anxiety with the diagnosis of autism. A trend was found for the association of autism in family relatives with the diagnosis of ASD in the referred child (17.4% vs. 6.1%,p=0.056). Sensory difficulties showed a second trend with the diagnosis of ASD (83% vs.68%, p=0.057).

**Conclusions:** We did not identify significant anamnestic features associated with the eventual diagnosis of late childhood ASD in this specific group of children. Further studies are needed to seek surrogate markers to guide clinicians with the diagnostic evaluation in these children.

## Molecular and Cellular Biology

### ORAL SESSION - 6A — MOLECULAR AND CELLULAR BIOLOGY

#### 306 - Neural Progenitor Cells: Insights into the Biology of Autism

##### 306.001 (Oral) Converging and Independent Pathway Level Changes in Early Maturing Neurons Induced By Autism-Related Environmental Risk Factors

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**Background:** Autism spectrum disorder (ASD) is a heterogenous childhood developmental disorder with multifactorial aetiology. There are hundreds of genes and genetic variants that contribute to ASD. Additionally, several environmental factors, such as neurotoxic compounds, endocrine

modulators, neuropsychiatric medication, and environmental pollutants, have been associated with ASD outcomes. There is a lack of studies in human neurons showing the effects of environmental factors. Here, we investigate a high-throughput experimental design to study multiple environmental risk factors and human induced pluripotent stem cell (iPSC) lines in context of ASD.

**Objectives:** We aim to (1) establish the fractional factorial experiment design for the *in-vitro* study of extrinsic risk factors in context of different genetic backgrounds, (2) perform transcriptomic profiling of the effects of six adverse environmental conditions associated with ASD in iPSC derived early neurons, and (3) validate the identified transcriptomic pathway-based changes using a multi-omics approach.

**Methods:** iPSC lines from two neurotypical donors (male and female) and two male donors with ASD and associated rare genetic conditions were included. The iPSC-derived neuroepithelial stem cells were differentiated into pre-mature neurons for five days. The culture conditions were modulated with a combination of six ASD associated environmental risk factors (lead, bisphenol A, ethanol, valproic acid, fluoxetine and zinc deficiency) in accordance with a fractional factorial experiment design (L8 Orthogonal Array). Transcriptomic changes were identified with bulk RNA sequencing followed by differential gene expression analysis and gene-set enrichment analysis. Significantly modulated pathways for all environmental factors, jointly and independently, were visualized using EnrichmentMap. Validation of relevant changes in the identified pathways were done using direct infusion electrospray ionisation mass spectrometry.

**Results:** Significantly expressed genes were identified in early neurons exposed to lead and fluoxetine. For lead, significant upregulation was detected in pathways related to synapse structure/activity ( $q=0.0192$ ), and axon guidance ( $q=0.0196$ ). For fluoxetine, significant upregulation was observed in pathways related to steroid biosynthesis ( $q=0.0036$ ). Significant downregulation was seen in pathways related to axonemal dynein assembly ( $q=0.0150$ ). In our joint analysis across different exposures, the converging (with at least two contributing factors) top gene-ontology terms upregulated were steroid/phospholipid metabolism, synaptic vesicle priming and cholinergic neurotransmission, and downregulated was microtubule formation. Subset analysis of pathway effects in ASD and neurotypical cell lines separately revealed more changes for single factors in ASD cell lines than in neurotypical cell lines but less converging changes across the environmental exposures. The validation of the findings using metabolomics is on-going and preliminary results have confirmed the changes in lipid metabolism after fluoxetine exposure.

**Conclusions:** Our research aims to elucidate the effects of environmental exposures at neuronal level and their connection to genetic background. We have shown that the fractional factorial design can be used for high-throughput transcriptomic analysis to detect relevant changes at the pathway level. We have also shown that lead and fluoxetine respectively modulate pathways related to synaptic function and lipid metabolism. However, the changes are more coherent in the cell lines without genetic predisposition for ASD. Further studies are needed to understand the role of these findings in ASD.

### **306.002 (Oral)** Thyroid Hormone Therapy in the Differentiation of Neural Progenitor Cells into Cortical Neurons: Potential Contribution to Autism Spectrum Disorders

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**Background:** Thyroid hormone (T3) is crucial for brain development and during the first years of life. Irregularities in T3 can affect behaviors, the nervous system functioning and cognitive development. In our ASD-IDRP-QBRI cohort (Qatar), we observed that mothers of ASD children have thyroid irregularities (hypothyroidism) being treated with T3 at high dose throughout their pregnancy.

**Objectives:** To investigate the role of T3-treatment (in hypothyroidism) in the functionality and neuronal development and explore how it influences neural cell development using neural precursor cells (CRTD5-NPCs) and cortical differentiated neurons.

**Methods:** Cytotoxicity was performed before and after exposure to 10 different T3 gradient concentrations (10nM - 1000nM). The time course study consisted of 4 points of analysis: week 0 (W0), which represented NPCs after 5 days of T3-treatment, and differentiated cortical neurons measured at weeks 3 (W3), 6 (W6) and 8 (W8). Each time frame was performed in triplicates and included respective controls. BrainPhys™ Neuronal Culture Medium was used to differentiate CRTD5-NPCs to cortical neurons. To assess neuronal function, voltage-gated Ca<sup>2+</sup> channels (VGCCs) and whole-cell patch clamp electrophysiology were used. IHC staining was used to detect mature neuron markers: MAP2, NeuN and phosphorylated-neurofilament-H. RNA-seq was performed for the molecular profiling of cortical neurons with high T3-treatment and controls. MitoTracker dye was used to assess mitochondrial presence within neurons.

**Results:** VGCCs results showed that starting from W3, cells differentiated to neurons and responded to KCL stimulus. However, readings obtained at W3 and W6 on cells subjected to high T3-treatment, showed a lower response, from neurons, to KCL. However, at W8, a higher quantity of neurons responded compared to controls, suggesting that these neurons, under high T3-treatment, may have matured at a faster rate compared to controls. The patch clamp results further showed that the percentage of neurons generating multiple action potentials increases as neurons differentiate, suggesting that CRTD5-derived cortical neurons physiologically mature and functional over time. Starting from W6, the high T3-treatment significantly increased the percentage of neurons generating action potentials compared to their respective control. Moreover, the frequency of action potentials increases significantly in neurons under high T3-treatment at W6 (from 5 to 7) and W8 (from 5 to 10) differentiated neurons,  $p=0.03$  and  $p=0.03$ , respectively. Additionally, the peak increase and the intervals shorten significantly in W6 neurons by 50% ( $p<0.01$ ), suggesting that both expression of voltage-gated Na and K channels increase because of high T3 doses. In W8 neurons, T3-treatment causes no changes in the peak and interval, suggesting that it is saturated, and T3-treatment advances the cortical neuronal differentiation. IHC staining showed that the expression of neuronal markers was present. Whole transcriptome showed that ion receptor pathways are upregulated in W8.

**Conclusions:** High T3-treatments might increase neuronal maturity and be considered to be a model of ADHD, main comorbidity in ASD. The results further open areas of investigation that involve the effect of unregulated T3-treatments during pregnancy, its influence on the dopaminergic system, and its association with neuronal tonic spikes and dopamine release on the outcome of learning and motor function.

**306.003 (Oral)** Uncovering Novel Neuroimmune Mechanisms Regulating Brain Overgrowth in Autism Using Human Pluripotent Stem Cells  
**S. Chetty<sup>1</sup>, J. F. Hallmayer<sup>2</sup>, R. O'Hara<sup>3</sup>, C. W. Nordahl<sup>1</sup>, M. Solomon<sup>4</sup>, S. M. Rivera<sup>6</sup> and D. G. Amaral<sup>5</sup>,** (1)Psychiatry and Behavioral Sciences, Institute for Stem Cell Biology and Regenerative Medicine, Stanford University, Stanford, CA, (2)Psychiatry & Behavioral Sciences, Stanford University, Stanford, CA, (3)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (4)Department of Psychiatry and Behavioral Sciences, UC Davis, Sacramento, CA, (5)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (6)Department of Psychology, University of California, Davis, Davis, CA

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Background:

Approximately 15-20% of individuals with Autism Spectrum Disorder (ASD) have disproportionate megalencephaly (ASD-DM), with disproportionate enlargement in both gray and white matter volume. Individuals with ASD-DM have more severe behavioral and cognitive problems and are less responsive to standard therapeutic interventions, leading to very poor prognoses relative to individuals with ASD and normal head circumferences. Increases in brain size often precede clinical symptoms, suggesting that understanding the underlying mechanisms regulating brain overgrowth could provide a window of opportunity for intervention or mitigation of symptoms.

Objectives:

Here, we use human induced pluripotent stem cell (hiPSC) technology to model brain overgrowth in ASD-DM and investigate the underlying cellular and molecular mechanisms involved. The overarching goals are: 1) to investigate whether gray and white matter enlargement are due to an increase in cell proliferation, increase in cell survival, improper elimination of damaged cells, and/or a combination of all; and 2) to identify therapeutic targets by understanding the underlying cellular and signaling mechanisms involved.

Methods:

As part of the UC Davis MIND Institute Autism Phenome Project (APP) and Autism Centers of Excellence (ACE), we generated ~30 human iPSCs from cohorts of children (2-4 years old) with complete clinical and phenotypic data, including A) ASD subjects with megalencephaly, ASD-DM; B) ASD subjects with normal sized brains, ASD-N; C) Typically developing (TD) subjects with megalencephaly, TD-DM; and D) TD subjects with normal sized brains, TD-N. We differentiated each of the iPSC lines into neural progenitor cells (NPCs) and oligodendrocyte progenitor cells (OPCs) and investigated changes at the molecular and cellular levels and alterations in phagocytosis in *in vitro* and *in vivo* models.

Results:

In the differentiated neural and glial progenitor cells, we observe increased proliferation and suppressed phagocytosis of NPCs/OPCs by macrophages in ASD-DM. RNA-sequencing of the differentiated progenitor cells reveals important signaling mechanisms related to the neuroimmune system in regulating cell survival, including the type 1 interferon signaling pathway. We also show that CD99 (a marker commonly upregulated on the surfaces of leukemic stem cells) and CD99 Molecule Like 2 (CD99-L2) are significantly upregulated in ASD-DM. Similarly, in genetic models of autism associated with brain enlargement, we have shown that proteins commonly associated with cancer (e.g. CD47, a 'don't eat me' signal) are overexpressed in unhealthy NPCs and OPCs in 16p11.2 deletion carriers with macrocephaly contributing to reduced phagocytosis *in vitro* and *in vivo*. Treatment of 16p11.2 deletion NPCs and OPCs with an anti-CD47 antibody to block CD47 restores phagocytosis to control levels.

Conclusions:

While CD47 and CD99 are commonly implicated in cancer progression, we document novel roles for these genes in regulating brain overgrowth in psychiatric disorders and identify new targets for therapeutic intervention. We demonstrate that anti-CD47 treatment (potentially in combination with antibodies against CD99) can act as therapeutic agents for clearing unhealthy cells in cellular and mouse models, potentially indicating that these forms of therapy could be translated to selected autistic individuals with brain overgrowth early in the disease.

**306.004 (Oral)** Relating Interindividual Differences in Cerebral Organoids to Longitudinal Infant Brain Growth

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Background:

Cortical surface area hyper-expansion in infancy prior to diagnosis has been associated with increased risk for autism spectrum disorder (ASD) (Hazlett et al., 2017). Increased cortical progenitor neurogenic fate decisions during fetal development may lead to decreased cortical surface area by depleting the progenitor pool as predicted by the radial unit hypothesis (Rakic, 2009). Induced pluripotent stem cell (iPSC) derived human brain organoids model cortical progenitors on an individual's genetic background, but have known limitations in maturation, fidelity, and reproducibility (Bhaduri et al., 2020). It remains unknown if inter-individual variability in organoid progenitors correlate with infant brain growth and clinical outcomes of the individuals from which they were derived.

#### Objectives:

We generated iPSC lines from participants in the Infant Brain Imaging Study (IBIS) at low familial risk for ASD, high familial risk without ASD, and high familial risk with ASD at 2 years old. Using organoid differentiations from 18 unique participants with representation from each group, this study aims to identify *in vitro-in vivo* correlations regardless of diagnosis, and if no correlation exists, identify possible technical factors that mask biological effects.

#### Methods:

iPSCs were generated from IBIS participants with at least 2 MR images at 6, 12, or 24 months of age and reprogrammed using a non-integrating Sendia virus into 3 clones. All experiments and analyses were performed blind to participant data and batches were randomized across diagnostic status before experiments began. Our organoid differentiation protocol generates neuroepithelial buds by differentiation day 14, and can produce cortical wall-like organization. Organoids were harvested at day 14 and day 84. One organoid per clone per participant was processed for scRNA-seq and all organoids were randomized again before barcoding. Three to five organoids were imaged for expression of PAX6 (cortical progenitors), N-Cadherin (tight junctions), Ki-67 (proliferation) and To-PRO-3 (nuclei).

#### Results:

Sixty-six cell lines were harvested at day 14, and forty-three cell lines at day 84, representing all 18 participants at both timepoints. 3-D images were used to quantify N-Cadherin+ lumens and PAX6+ germinal zone-like areas. A preliminary analysis of scRNA-seq data from a subset of 8 participants suggests that day 14 organoids contain predominately *EMX2*+ cortical neuronal progenitors, their *DCX*+ neuronal progeny, and some off-target midbrain cells. Using RNA velocity estimates of future cell states based on mRNA expression, progenitors were predicted to be undergoing self-renewal or neurogenic fate decisions (Lange et al., 2020). Neurogenic fate decisions were negatively correlated with cortical surface area size at 24 months of age ( $r=0.49$ , when controlling for sex  $p=0.002$ ).

Conclusions: Preliminary analyses suggests that organoid-derived early progenitor populations favor neurogenic fate decisions in participants with smaller cortical surface areas. This agrees with the radial unit hypothesis that postulates increased neurogenesis reduces the progenitor pools resulting in decreased cortical surface area. Imaging analysis will add support if participants with smaller cortical surface area have decreased germinal-zone-like areas. Our current analyses require replicate due to small sample size, but future analysis including all 18 participants will enable more rigorous hypothesis testing in *in vitro-in vivo* correlations.

## POSTER SESSION — MOLECULAR AND CELLULAR BIOLOGY

### 404 - Molecular and Cellular Biology

#### 404.080 (Poster) Characterizing the Impact of TBR1 De Novo Mutations on in Vitro Human Brain Development

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Background: The *in vitro* differentiation of forebrain-like organoids from induced pluripotent stem cells (iPSCs) has been shown to recapitulate many processes that occur during *in vivo* midfetal cortical development. This midfetal period is a potential critical window when many autism risk genes begin to function as a network, especially in deep layer neurons. However, our understanding of how specific *de novo* mutations (DNMs) impact brain development is limited.

Objectives: Here, we perform an intensive genomic characterization of these forebrain-like organoid models using immunohistochemistry (IHC) and single-cell genomics, and utilize this system to understand the effects of DNMs in *TBR1*, a key transcriptional regulator of deep layer neuronal fate.

Methods: Using CRISPR-Cas9, isogenic pairs of a control iPSC line were edited to contain DNMs in *TBR1*. Forebrain-like organoids were generated over 90 days *in vitro* (Qian et al. 2018, StemCell Technologies Dorsal Forebrain Organoid Kit). IHC was utilized to characterize the cell-types and quality of each differentiation. Dynamic changes in epigenetic state during organoid differentiation were assessed using single-cell combinatorial indexing (sci) ATAC-seq (Mulqueen et al. 2019). Single-cell profiles were collapsed into groups using cisTopic then analyzed for enrichment of specific transcription factor binding motifs. Pseudotemporal analysis was performed to uncover the succession of putative transcription factor activity.



**Results:** To establish protocol reproducibility and to test epigenome correlation to primary samples of neurodevelopment, we first performed IHC and single-cell ATAC-seq on a control iPSC line. From the sci-ATAC assays, we obtained 31,280 cells with 183,391 open regions of chromatin passing quality control from 16 organoids (two independent organoid differentiations). Across differentiation time points, we observed clear shifts in cell-type populations and epigenomic reconfiguration consistent with waves of transcriptional regulatory activity controlling differentiation and neurogenesis. Leveraging new publicly available data sets on primary fetal tissue, we observed correlating chromatin signatures of cell cycle stages and improved our differentiation trajectory through chromatin dynamics of differentiation. Using the same control line, we are currently generating forebrain-like organoids with two well-established organoid protocols. We are comparing between the two protocols, which have different *in vitro* time scales, the trajectory of development, reproducibility, and robustness of organoid formation. These data will be used to select the optimum method for modeling *TBR1* DNMs. We have generated multiple isogenic pairs with and without *de novo* autism-associated *TBR1* frameshift mutation, A136PfsX. Data from the analogous mutation generated in mouse suggests this is a loss-of-function mutation. With these lines, we are conducting the same organoid differentiation and single-cell characterization, which will be evaluated prior to the meeting.

**Conclusions:** *In vitro* modeling allows us to manipulate the cellular genome and study the impact of specific DNMs on early human brain development. Our data on control lines demonstrates these models recapitulate the transcriptional waves of activity that are key controllers of cell-fate during corticogenesis. We believe this system will be a powerful model for discovering the molecular and cellular impacts of autism-associated DNMs, specifically in transcriptional regulators like *TBR1*.

**404.081 (Poster)** Human Endogenous Retroviruses Re-Activation, Autism Spectrum Disorder and Maternal Perinatal Depression: Upcoming Results of HERS Expression in Mother-Child Pairs.

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#### Background:

Growing evidence reported an abnormal expression of Human Endogenous Retroviruses (HERVs) within Autism Spectrum Disorder (ASD). HERVs are genetic elements derived from their exogenous retroviral counterpart by a process of germline infection and proliferation within the human genome. Our previous works showed that ASD children and their mothers share abnormal expression of HERV families (HERV-H) and cytokines (TNF- $\alpha$ , IFN- $\gamma$ , IL-10) suggesting a close mother-child association in ASD and supporting the hypothesis of an interplay between HERVs and the innate immune response in autism. Increasing evidence pointed out the relationship between maternal conditions of inflammation – including Perinatal Depression (PD) - and derailed developmental trajectories in offspring, highlighting the role of inflammation and immune response in ASD pathogenesis.

#### Objectives:

Given research attention for the possible involvement of HERVs in psychiatric disorders' etiopathogenesis and based on our previous findings, we aimed to evaluate HERVs' activity and the inflammatory profile (IL-10, TNF $\alpha$ , IFN $\gamma$ ) of mother-child pairs according to both maternal and child diagnosis: presence or absence of maternal Perinatal Depression (PD or NO-PD); presence or absence of ASD diagnosis in offspring (ASD or NO-ASD).

#### Methods:

A total of 58 mother-child pairs were enrolled:

-9 mothers (median age 43 years) with a history of PD and their respective 11 children (median age 5 years) of which 3 NO-ASD (males), 8 ASD (2 females, 6 males);

-21 mothers (median age 44) without Perinatal Depression (NO-PD) and their 21 children with typical development (median age 5.1; 5 females, 16 males);

-28 mothers (median age 43) without PD (NO-PD) and their 31 ASD children (median age 5; 3 females 28 males).

Expression of HERV-H, HERV-K, HERV-W, IL-10, TNF $\alpha$  and IFN $\gamma$  was evaluated in peripheral blood mononuclear cells by quantitative Real-time PCR.

#### Results:

PD women and their offspring shared a specific transcriptional profile with higher HERVs' (HERV-H, HERV-K) and cytokines levels (TNF- $\alpha$ ) in comparison to NO-PD mother-child pairs (Fig.A). Only in offspring of PD women was also observed a higher levels HERV-W and IL-10. Considering PD (Fig.B-C), women with ASD children presented higher levels of HERVs (HERV-H, HERV-W) in comparison to PD women with No ASD children. The comparison between women with and without PD who had ASD children, showed similar levels of HERV-H, HERV-K,

IL10; while higher of HERV-W and TNF $\alpha$ , and lower of INF $\gamma$  have been found in PD women. ASD children of PD women presented higher values of HERV-H, HERV-K, HERV-W, IL10, TNF  $\alpha$ . Among ASD children - of mothers affected or not by PD- , higher levels HERV-H, HERV-K, HERV-W, emerged in offspring of PD women.

#### Conclusions:

Although preliminary, our findings report that specific transcriptional profiles emerged both in terms of maternal PD and ASD condition in offspring and that, at a biological level, PD may represent a possible detrimental factor leading to a more abnormal transcriptional profile in both mothers and their ASD offspring. The investigation of HERVs re-activation in PD represents a possible pathway for the future identification of a molecular signature of psychiatric conditions.

#### 404.082 (Poster) The Intellectual Disability Gene DDX3X in Sex-Specific Neuronal Morphogenesis

A. Mossa<sup>1,2,3,4</sup>, Y. Park<sup>1,2,3,4</sup>, Z. Akpinar<sup>1,2,3,4</sup>, M. Hannah<sup>1,2,3,4</sup>, O. Pistone<sup>1,2,3,4</sup>, D. C. Ung<sup>1,2,3,4</sup>, A. Romagnoli<sup>5</sup>, J. D. Buxbaum<sup>1,2,3,4,6,7</sup>, D. Di Marino<sup>8</sup> and S. De Rubeis<sup>1,2,3,4</sup>, (1)Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (2)Friedman Brain Institute, Icahn School of Medicine at Mount Sinai, New York, NY, (3)The Mindich Child Health and Development Institute, Icahn School of Medicine at Mount Sinai, New York, NY, (4)Seaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY, (5)New York-Marche Structural Biology Center (NY-MaSBiC), Polytechnic University of Marche, Ancona, Italy, (6)Department of Neuroscience, Icahn School of Medicine at Mount Sinai, New York, NY, (7)Genetics and Genomic Sciences, Icahn School of Medicine at Mount Sinai, New York, NY, (8)Faculty of Biomedical Sciences, Institute of Computational Science, Università della Svizzera Italiana, Lugano, Switzerland

Background: DDX3X syndrome is a rare form of intellectual disability caused by mutations in the *DDX3X* gene. Most *DDX3X* mutations are *de novo*, lead to haploinsufficiency, and are found only in females. The few mutations found in males are inherited from healthy mothers. *DDX3X* regulates mRNA translation, but the mechanisms of action in neurons, the target genes, and the impact of clinical mutations have not been studied yet. Also, the influence of sex remains unknown.

Objectives: Our goal is to: 1) capture sex-specific neuronal changes resulting from mutations in *DDX3X*; 2) map the molecular mechanisms underlying *DDX3X* syndrome to identify new therapeutic targets.

Methods: We generated a mouse with loxP sites around exon 2 of *Ddx3x* (*Ddx3x<sup>lox</sup>* mice). Using this model, we generated male (*Ddx3x<sup>lox/y</sup>*) and female (*Ddx3x<sup>lox/+</sup>*) cortical neurons and transfected them with Cre and mCherry constructs. With this strategy, we can model *Ddx3x*-haploinsufficient female neurons or *Ddx3x*-null male neurons (and respective controls). We also introduced sex-specific mutations in female and male neurons, after manipulating *Ddx3x* dosage. We then examined morphogenesis, synaptogenesis, *DDX3X* targets and interactors, translation of specific mRNAs.

Results: *DDX3X* contributes to sex differences in neuronal morphogenesis. Sex-specific *DDX3X* mutations have differential impact, with female-pathogenic mutations being more severe. Indeed, *Ddx3x* loss differently affect neuronal morphology towards a more simplified dendritic arbor in females and males. Moreover, female pathogenic mutations completely disrupt neuronal morphology, while male pathogenic mutations cause a milder phenotype. In addition, the lack of *Ddx3x* also affects spine density in males but not in females, supporting a sex-specific role for *DDX3X* in regulating neuronal development.

Conclusions: Our data lay the bases to understand the sex biases in the prevalence and severity of *DDX3X* syndrome. A deeper insight on the molecular mechanisms underlying this sex difference will also shed the light for more personalized treatment for girls and boys.

## Sensory, Motor, and Repetitive Behaviors and Interests

### PANEL — SENSORY, MOTOR, AND REPETITIVE BEHAVIORS AND INTERESTS

#### 212 - Where Do Motor Impairments Fit within the Broader Framework of Autism Spectrum Disorder (ASD) and What Is Their Value in Screening/Diagnosis and in Predicting Future Outcomes?

**Panel Chair:** Anjana Bhat, Department of Physical Therapy, University of Delaware, Newark, DE

**Discussant:** Catherine Lord, UCLA Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA

**212.001 (Panel)** Persistent Barriers to Motor Assessment and Intervention, Despite Early Caregiver Awareness of Motor Symptoms.

H. L. Miller<sup>1</sup>, N. E. Fears<sup>2</sup>, A. Luna-Smith<sup>3</sup>, S. Mupparapu<sup>3</sup>, A. Ganesh<sup>3</sup>, K. Martinez<sup>3</sup>, G. M. Sherrod<sup>4</sup> and N. L. Bugnariu<sup>5</sup>, (1)School of Kinesiology, University of Michigan, Ann Arbor, MI, (2)School of Kinesiology, University of Michigan, Ann Arbor, MI, (3)University of North Texas Health Science Center, Fort Worth, TX, (4)Department of Psychology, University of Alabama at Birmingham, Birmingham, AL, (5)University of the Pacific, Sacramento, CA

Background: Motor symptoms of autism are not formally evaluated as part of the diagnostic process, and are only partially captured by autism-specific assessments in the context of stereotyped motor behaviors. Despite this, a growing body of literature suggests that both gross- and fine-motor

problems are evident and clinically-significant in autism across the lifespan. These include postural instability, difficulty with handwriting, and challenges with activities of daily living. Some autistic people are assessed for motor problems because of the line of service through which they enter the diagnostic pipeline, for example, pediatric neurology. Severe motor problems often warrant a co-occurring diagnosis of Developmental Coordination Disorder (DCD). However, caregivers and clinicians do not consistently recognize motor problems as early signs related to autism. As a result, there is a striking lack of uniformity in the manner by which families access motor assessment and corresponding accommodations and interventions, particularly in comparison to behavioral and social-communication symptoms.

**Objectives:** To characterize caregivers' and self-advocates' understanding of the relationship between motor symptoms and autism.

**Methods:** We administered a service utilization questionnaire to a racially- and ethnically-diverse sample of 100 caregivers and autistic adults ( $M_{age} = 42.67$ ,  $SD = 9.86$ ,  $Range = 20-70$  years), and subsequently interviewed 49 families (caregivers and autistic adults) about their experiences with the diagnostic process and their awareness of motor symptoms. Interviews were transcribed and we conducted a qualitative analysis, extracting key concepts using thematic analysis. We then used this information to contextualize the results of the survey and assess relationships between caregivers' and autistic adults' knowledge, experiences, and perceived barriers to care for motor problems.

**Results:** Preliminary results suggest that most participants were aware of the presence and functional impact of motor symptoms. Caregivers expressed difficulty knowing whether the motor symptoms they observed were "worth bringing up" to clinicians, versus part of development. They noted early differences in gait, manual dexterity and handwriting, balance, and coordination. Pediatricians, occupational therapists, and neurologists were most often reported as lines of service where motor symptoms were discussed or addressed; but caregivers often reported that clinicians "dismissed" or "glossed over" motor concerns. Almost unanimously, caregivers reported that no one had discussed risk of falls or injury with them.

**Conclusions:** Taken in context with prior work, the results of this study suggest that while some caregivers identify motor symptoms early in their autistic children, many do not recognize that they are related to autism. This may be in part because they are not a standard component of the diagnostic process, despite high observed rates of clinically-significant motor problems in our studies of autism and others. We discuss these new results as they relate to our recent finding that over 90% of children with autism meet the diagnostic criteria for DCD. Finally, we discuss how this information can be used to inform attempts to create more uniform processes for assessment of motor development in autism, identification of motor problems across the lifespan, and the development and provision of appropriate accommodations and interventions that serve person-centered goals.

#### **212.002 (Panel) Value of the Developmental Coordination Disorder Questionnaire (DCD-Q) As a Screener for Co-Occurring Motor Problems in Children with Autism Spectrum Disorder**

**T. Van Damme**, *Department of Rehabilitation Sciences, Research group Adapted Physical Activity and Psychomotor Rehabilitation, KU Leuven, Leuven, Belgium; Child Psychiatry, Expertise center Autism, UPC Z.Org KU Leuven, Leuven, Belgium*

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**Background:** Most children with autism spectrum disorder (ASD) demonstrate motor problems, but the prevalence rates tend to differ depending on the instruments and cut-off points being used. Moreover, the impact of co-occurrence with other neurodevelopmental disorders, such as intellectual disability or ADHD, is rarely considered. Due to the high occurrence rates and the fact that motor problems are easily overlooked and often remain underdiagnosed, it has been recommended to include motor assessment as part of the routine clinical investigation of children with ASD. However, there is also a subset of children with ASD who do not demonstrate motor problems. In these cases, a comprehensive motor assessment is time-consuming, expensive, and redundant; especially since the procedures can put a substantial burden on the child as they can be challenging and can cause significant stress. Therefore, screening for motor problems can provide valuable information to guide the decision whether referral to a full motor assessment is required.

**Objectives:** In this presentation, I will discuss the sensitivity and specificity of the DCD-Q screening tool to identifying/rule out true motor impairments in a large number of children with Autism Spectrum Disorder.

**Methods:** Children referred to the Expertise Center for Autism (Leuven, Belgium), receive an extensive multidisciplinary diagnostic assessment protocol, allowing a rigorous examination of each developmental domain. A comprehensive motor assessment battery is included in the standard assessment procedure.

**Results:** We will present data on the prevalence, severity, and heterogeneity of motor problems of children referred to our center (>300 children), across a full range of cognitive abilities. Furthermore, we will present data on the precision of the Developmental Coordination Disorder Questionnaire (DCDQ) as a screening tool for co-occurring motor problems in children with ASD. Lastly, we will outline the agreement in classification between the results on a standardized motor assessment battery, a parent-based screening questionnaire (DCDQ), and clinical decision making.

**Conclusions:** There is a high prevalence of motor problems in children with ASD. However, the high levels of heterogeneity in motor profiles and the existing subset of children with ASD without motor problems, suggest that motor impairment should be considered as a specifier within the diagnostic criteria for ASD in the DSM-V.

#### **212.003 (Panel) Motor Impairment Relates to Social Communication Impairment More Than Repetitive Behavior Severity in School-Age Children with Autism Spectrum Disorder (ASD): A SPARK Dataset Analysis.**

**A. N. Bhat**, *Department of Physical Therapy, University of Delaware, Newark, DE*

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**Background:** Eighty-seven percent of a large sample of children with Autism Spectrum Disorder (ASD) from the SPARK study cohort are at risk for motor impairment based on their performance on the Developmental Coordination Disorder Questionnaire (DCD-Q) (Bhat, 2020). Moreover, motor impairments were associated with both core social communication impairments and repetitive behaviors as well as general delays in cognition, language, and functioning (Bhat, 2021). In spite of the high prevalence for motor impairment in children with ASD, it is not considered among the diagnostic criteria or specifiers within DSM-V. Motor impairments in school-age children with ASD remain under-recognized and unaddressed due to lack of effective motor screening, assessment, and intervention.

**Objectives:** In this presentation, I will describe data from the Vineland Adaptive Behavioral Scales (VABS-3) and relate it to other core and co-morbid impairments using other standardized measures, to better understand how motor impairments in children with ASD fit within the broader diagnostic framework of ASD.

**Methods:** The SPARK study dataset (N=4,257) was analyzed to examine associations between multiple developmental domains (social, communication, daily living, and motor) of the Vineland Adaptive Behavior Scales, Third Edition (VABS-3), social communication impairment using the Social Communication Questionnaire (SCQ), repetitive behavior severity using the Repetitive Behaviors Scale – Revised (RBS-R), motor impairment using the Developmental Coordination Disorder Questionnaire (DCD-Q), and parent-reported current level of cognitive, functional, and language impairments (i.e., some being ASD specifiers).

**Results:** In terms of the VABS-3 dataset, children's overall adaptive functioning based on the Adaptive Behavior Composite (ABC) standard scores were moderately associated with social communication performance ( $r=-0.45$ , using the SCQ total) and motor performance scores ( $r=0.5$ , using the DCD-Q total) and weakly correlated with repetitive behavior severity ( $r=-0.2$ , using the RBS-R total). Children's VABS communication, daily living, and socialization scores were also moderately associated with social communication performance ( $r=-0.38$  to  $-0.48$ , using the SCQ total) and motor performance scores ( $r=0.42$  to  $0.48$ , using the DCD-Q total) and weakly associated with RB severity ( $r=-0.15$  to  $-0.21$ , using the RBS-R total). In terms of gross-motor performance, "control during movement/gross motor" totals on DCD-Q were associated with personal care subdomain of VABS daily living skills ( $r=0.44$ ). In terms of fine-motor performance, fine motor total scores on DCD-Q were moderately associated with the communication domain ( $r=0.51$ ) and related VABS subdomain scores (receptive, expressive, and written,  $r=0.45$  to  $0.48$ ). Once again, various VABS subdomain scores weakly correlated with RB severity ( $r=-0.1$  to  $-0.26$ ).

**Conclusions:** These findings provide evidence for linkages between motor and social communication functioning in children with ASD and opens up the possibility of including motor problems as part of ASD criteria. It is important to facilitate early motor development and its cascading effects on social communication development through appropriate motor screening and assessment. Timely evaluations and motor intervention referrals could help improve the plateaued and persistent motor and social communication deficits observed in the school-age children with ASD from the current study.

#### **212.004 (Panel) Unique Motor Differences in ASD and Their Structural and Functional Neurological Basis**

**L. aziz-Zadeh**, USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy, USC, Los Angeles, CA; USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy; Psychology, University of Southern California, Los Angeles, CA; Brain and Creativity Institute, Dornsife College of Letters, Arts and Sciences, University of Southern California, Los Angeles, CA

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**Background:** Most motor studies of ASD compare with typically developing (TD) groups and indicate motor deficits in ~80% of the ASD group. However, for motor measures to characterize and facilitate diagnosis of ASD, it is critical to discriminate between ASD and developmental motor differences that occur independently of ASD, such as developmental coordination disorder (DCD). Few prior studies have compared ASD to DCD, with equivocal findings. Thus, we conducted behavioral and brain imaging studies comparing ASD, DCD, and TD groups. To further distinguish ASD from DCD, we applied machine learning (ML) to kinematic data from an iPad game, which has previously classified TD from ASD with ~93% accuracy.

**Objectives:** Define unique motor differences in ASD, their neurobiological basis, and their relationship with social functioning.

**Methods:** We compared youth aged 8-17 years with ASD to those with DCD or TD youth in behavioral ( $Ns = 33$  ASD, 28 DCD, 35 TD), ML ( $Ns = 18$  ASD, 16 DCD, 20 TD), fMRI ( $Ns = 30$  ASD, 23 DCD, 33 TD), and DWI ( $Ns = 22$  ASD, 16 DCD, 22 TD) studies. Assessments included motor (MABC-2) and praxis (FAB-M) abilities, social skills (SRS-2), alexithymia (low emotional awareness), and theory of mind (ToM; NEPSY-II) skills. ML was used to classify groups using kinematic feature data (e.g., gesture acceleration) from a 5-min iPad coloring game. During fMRI, children performed hand and face action observation and execution tasks.

**Results:** Imitation of meaningful gestures (on FAB-M) was the only motor or praxis measure that distinguished ASD from DCD ( $p<.05$ ; ASD significantly worse), with or without controlling for FSIQ, SRS-2, ToM, age, and sex. Further, classification accuracies derived from iPad motor data were: 76% ASD from TD, 71% ASD from DCD, and 78% DCD from TD. fMRI data indicated that the IFG was hypoactive during action observation in ASD, and during imitation in both ASD and DCD. DWI data further showed that the underlying motor (and/or social) deficits in ASD may derive from structural connectivity patterns. We found diffusion differences in the ASD group in the cingulum, compared to both TD and DCD groups, which significantly correlated with motor (MABC), social (SRS-2), alexithymia, and autism severity (ADI-R). Further we found that the ASD group alone showed differences in quantitative anisotropy (QA) compared to TD in the inferior fronto-occipital fasciculus (IFOF), a ventral pathway important for connecting visual body-form processing with frontal areas (e.g., IFG), and IFOF integrity is significantly correlated with autism severity (ADOS) as well as a trend with praxis and motor ability. These fMRI and DWI differences may underlie some of the unique motor (and social) deficits observed in ASD.

Conclusions: These findings indicate unique motor differences in the ASD group (imitation of meaningful gestures, control of acceleration and distance of actions) compared to other neuro-developmental motor disorders, which could be used for screening. Underlying neurological markers may include hypoactivity in the IFG, and diffusivity differences in the cingulum and IFOF. These motor and related neurological differences may assist with ASD characterization, and screening/diagnosis.

## PANEL — SENSORY, MOTOR, AND REPETITIVE BEHAVIORS AND INTERESTS

### 217 - Utilizing Sensory Phenotypes to Understand Sensory Processing Abilities in Autism

**Panel Chair:** Nichole Scheerer, *Psychology, Western University, London, ON, Canada*

**Discussant:** Ryan Stevenson, *University of Western Ontario, London, ON, Canada*

#### 217.001 (Panel) Utilisation of Sensory Subtyping to Understand Functional Impacts and Intervention Responsiveness in Autism

A. E. Lane<sup>1</sup>, D. Blackwell<sup>2</sup>, J. Brent<sup>3</sup>, G. Easey<sup>3</sup>, L. Rowlandson<sup>3</sup>, T. Johnson<sup>3</sup>, R. Lange<sup>4</sup>, U. Schall<sup>5</sup>, L. E. Campbell<sup>5</sup> and S. J. Lane<sup>6</sup>, (1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, VIC, Australia, (2)La Trobe University, Melbourne, VIC, Australia, (3)University of Newcastle, Callaghan, NSW, Australia, (4)University of Newcastle, Newcastle, NSW, Australia, (5)School of Psychology, University of Newcastle, Newcastle, Australia, (6)Occupational Therapy, Colorado State University, Fort Collins, CO

Background: Phenotyping based on meaningful clinical features has been proposed as a method by which the significant diversity of needs associated with autism can be better understood (Beversdorf et al. 2016). Substantial progress has been made in this area with relation to sensory features. To date, there are seven published proposed models of sensory subtypes, all of which have identified distinct patterns of sensory features within autistic toddlers, children and adolescents (Lane, 2021). Significantly, the work completed to date indicates a high degree of congruence between sensory subtype models suggesting that variation across the autism spectrum may be productively examined using a sensory lens. Importantly, insights into sensory subtype may promote the understanding of likely functional impacts and intervention responsiveness which will inform customised support approaches.

Objectives: The objectives of this presentation are to: 1) summarise what is known from the extant literature about functional impacts and intervention responsiveness as a function of sensory subtype in autism; and 2) report preliminary findings from new work examining responsiveness to the Alert Program for self-regulation by school-aged autistic children with varying sensory subtype profiles.

Methods: 1) A narrative review of the literature examining the relationship of sensory subtype to functional impacts and intervention responsiveness will be conducted and reported. 2) Participants were autistic children (n=19; mean age=9.4 years; females=7) with sensory features and an IQ>70. All participants and their caregivers completed the Alert Program in a clinic setting with a trained, registered occupational therapist in individual sessions over 10 weeks. Prior to the intervention, caregivers identified two self-regulation goals relating to daily activities utilising Goal Attainment Scaling and completed questionnaires regarding adaptive behaviour, sensory features, anxiety and parent effort and stress. Follow up ratings were completed at the conclusion of the intervention. At baseline, all participants were profiled using the sensory subtyping model developed by Lane and colleagues (2014) using the Short Sensory Profile (McIntosh et al. 2001). Each participant was assigned a sensory reactivity score and a sensory integration score using Lane et al.'s (2014) algorithm.

Results: Paired sample t-tests indicate that all participants regardless of sensory subtype benefited from the intervention through: improved daily self-regulation behaviours (p=0.001), reduced overall anxiety (p=0.001) and reduced parent effort at home (p=0.04). Elevated sensory reactivity at baseline, however, was associated with less reduction in generalised anxiety (rho=0.35) and less improvement in adaptive behaviour (rho=0.55). Conversely, difficulties with sensory integration at baseline were associated with more reduction in parent effort at home (rho=-0.33) versus the community (rho=0.54), and greater reduction in generalised anxiety (rho=-0.3).

Conclusions: Sensory subtype models are well-established in the autism literature, however, confirmation of their utility in understanding both functional impacts and intervention responsiveness is required. Preliminary data from our group indicates that sensory subtype may be associated with the level and nature of gains made in response to the Alert Program for self-regulation.

#### 217.002 (Panel) Cluster Analysis Reveals Sensory Phenotypes Associated with Specific Genetic Profiles in Autism Spectrum Disorder

A. M. Lyons-Warren<sup>1</sup> and Y. W. Wan<sup>2</sup>, (1)Pediatrics, Baylor College of Medicine, Houston, TX, (2)Molecular and Human Genetics, Baylor College of Medicine, Houston, TX

Background: The diagnostic criteria for Autism spectrum disorder (ASD) include unusual interest in sensory aspects of the environment or demonstrating hyper or hypo reactivity to sensory input. Indeed, up to 94% of patients with ASD exhibit symptoms in at least one sensory modality. However, individual sensory phenotypes are heterogeneous and the relationship between which sensory areas will be affected remains unknown. Prior studies have proposed sensory profiles as a distinguishing feature to better categorize ASD subtypes, but have not correlated these groups with genetic features.

Objectives: To test if sensory subtypes within ASD are associated with unique genetic profiles.

**Methods:** Short Sensory Profile (SSP) and whole genome sequencing data from 378 individuals with ASD were obtained from Autism Speaks' MSSNG database. We performed cluster analysis on responses to all 38 questions, followed by a second cluster analysis using only a subset of questions selected specifically to assay hyper- and hypo-sensitivity to sensory stimulation. Cross-comparison of the resulting clusters characterized the final subgroups. To test for shared underlying etiologies, we correlated gene variant frequency across subgroups for each of 24,896 genes. Gene variant frequency (GVF) combined all single nucleotide variants with a CADD score greater than 15 within each gene. To be significantly associated with a subgroup, a gene variant frequency had to be greater than four standard deviations (SD) from the mean frequency for all subgroups and 3 SD different from each subgroup.

**Results:** We identified six distinct sensory-based subgroups characterized by (1) atypical sensory responses in all areas, (2) typical responses in all areas, (3) isolated differences in tactile and auditory responses, (4) hyposensitivity in tactile and auditory responses, (5) isolated differences in taste and auditory responses and (6) mixed. There was no difference in mean age, adaptive behavior score, socialization score or full-scale IQ between subgroups.

The mean GVF for all genes across all individuals was 8.44%. Most genes had a low GVF, with the mean GVF at 2SD being only 27%. The mean GVF for each *subgroup* was less than 10% (range 7.0% - 9.9%) indicating that for more than half of the genes, less than 10% of participants in each subgroup had a variant. However, each of the subgroups was associated with a small number of genes ranging from 5 to 58 genes per subgroup.

**Conclusions:** Sensory features can reliably be used to generate clinically distinct subgroups within a heterogeneous population of individuals with ASD. Further, these subgroups correlate with specific genetic profiles that may provide clues to underlying molecular mechanisms leading to those sensory-phenotypes.

**217.003 (Panel) Sensory Profiles of Children on the Autism Spectrum: A Six Year Longitudinal Study**

**K. Simpson<sup>1</sup>, M. Stainer<sup>2</sup> and D. Adams<sup>3</sup>, (1)Autism CRC, Brisbane, QLD, Australia, (2)School of Applied Psychology, Griffith University, Gold Coast, QLD, Australia, (3)Autism Centre of Excellence, Griffith University, Brisbane, Australia**

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**Background:** Children on the autism spectrum are reported to display heightened differences in their response to sensory information. Previous cluster analysis has identified heterogeneity in children's responses and mixed responses based on age, however, little is known about an individual's profile development over time.

**Objectives:** To explore the sensory profile patterns of children on the autism spectrum across a six-year period using the Short Sensory Profile 2 (SSP-2).

**Methods:** Two groups of children on the autism spectrum (4-5 years, n= 130; 9-10 years, N = 140) were followed across four time points, over a six-year period. At each time point, caregivers completed the SSP-2. Group z-scores were compared for each subdomain (avoiding, sensitivity, seeking, registration) in the two age groups. Latent profile analysis was used to identify profiles at each time point.

**Results:** Parents of children in the younger group reported heightened differing responses on the four domains. The number of best fit profiles varied across the time period (between 4-6) and there was a high degree of movement between these profiles. Children in the older group were also reported to have heightened differing responses across the four domains but there was a decreasing trend in these differences over time. There was also a more consistent cluster profile of four profiles generated.

**Conclusions:** The difference in profiles between age groups, and the movement between profiles, particularly evident in the younger cohort, suggests an individual's profile may change over time. Awareness changes may occur in an individual's sensory profiles has important implications for practitioners supporting the sensory needs of children on the autism spectrum.

**217.004 (Panel) Exploring Sensory Phenotypes in Autism Spectrum Disorder and Attention-Deficit / Hyperactivity Disorder**

**N. E. Scheerer<sup>1</sup>, A. Pourtousi<sup>2</sup>, C. Yang<sup>3</sup>, B. Stojanoski<sup>4</sup>, E. Anagnostou<sup>5</sup>, R. Nicolson<sup>6</sup>, E. Kelley<sup>5</sup>, S. Georgiades<sup>6</sup>, J. Crosbie<sup>7</sup>, R. Schachar<sup>8</sup>, X. Liu<sup>9</sup> and R. A. Stevenson<sup>9</sup>, (1)Psychology, Western University, London, ON, Canada, (2)Western University, London, ON, Canada, (3)Autism Research Centre, Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (4)Department of Psychiatry, University of Western Ontario, London, ON, Canada, (5)Department of Psychology, Queen's University, Kingston, ON, Canada, (6)McMaster Autism Research Team, McMaster University, Hamilton, ON, Canada, (7)Department of Psychiatry, The Hospital for Sick Children, Toronto, ON, Canada, (8)Genomics, Queen's Genomics Lab at Osgowada, Kingston, ON, Canada, (9)University of Western Ontario, London, ON, Canada**

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**Background:**

Atypical reactions to the sensory environment are often reported by both autistic individuals and individuals with attention-deficit/hyperactivity disorder (ADHD). These sensory difficulties are highly heterogeneous, varying across individuals and sensory modalities. Recently, researchers have identified stable sensory phenotypes, or sensory processing patterns that reliably co-occur within autistic individuals, that can help parse this sensory heterogeneity. These phenotypes have not been investigated in individuals with ADHD. Given autism and ADHD share many diagnostic features, a better understanding of sensory processing differences across these groups may improve differential diagnosis.

**Objectives:**

This research aimed to identify whether the sensory phenotypes that have been identified in autistic individuals are transdiagnostic in nature. To this end, we first aimed to identify sensory phenotypes in autistic individuals and individuals with ADHD. Next, we explored the similarity of these phenotypes. In addition, we examined whether these sensory phenotypes are differentially associated with autism-related characteristics, such as social communication difficulties and repetitive behaviours, and ADHD characteristics, such as inattention and hyperactivity.

#### Methods:

Short Sensory Profile data measuring sensory processing abilities across 7 domains (tactile, taste/smell, movement, underresponsive/sensory seeking, auditory filtering, low energy/weakness, and visual/auditory) was collected from parents of 495 autistic children and 461 children with ADHD between the ages of 1-21 years. Data were subjected to a K-means cluster analysis. Clustering involves grouping individuals with similar sensory processing abilities together in such a way that individuals in the same cluster have more similar sensory processing abilities to each other than individuals in other clusters. The resultant clusters can be thought of as sensory phenotypes. Follow up analyses compared age, IQ, sex assigned at birth, as well as autism and ADHD traits across the diagnostic groups, the resultant sensory phenotypes, and their interaction.

#### Results:

Overall, autistic children and children with ADHD demonstrated highly similar patterns of sensory processing abilities. A five-cluster solution characterized sensory processing abilities in both diagnostic samples (see Figure 1). The resultant sensory phenotypes are best described as sensory adaptive, generalized sensory differences, taste and smell sensitive, under-responsive and sensation seeking, and low energy with weakness. Age differed across these sensory phenotypes ( $p < .001$ ), but showed relatively similar patterns across diagnostic groups (see Figure 2). IQ was higher in the ADHD group, but did not differ across sensory phenotypes ( $p = .909$ ; see Figure 2). Sex assigned at birth did not differ across the sensory phenotypes, or diagnostic groups ( $p > .05$ ). Autism and ADHD traits differed across the five phenotypes ( $ps < .001$ ), but these patterns were very similar across the diagnostic groups (see Figure 2).

#### Conclusions:

Sensory difficulties in autistic individuals and individuals with ADHD can be clustered into sensory phenotypes, representing a meaningful transdiagnostic way to parse the heterogeneity in sensory abilities. These sensory phenotypes are associated with unique behavioural/clinical profiles. Given that these sensory phenotypes do not differ in IQ, these results suggest that sensory abilities may provide a novel, meaningful way to understand behavioural heterogeneity in autism and ADHD. Further, these results suggest that transdiagnostic etiologies may underlie sensory abilities in these groups.

## ORAL SESSION - 11A — SENSORY, MOTOR, AND REPETITIVE BEHAVIORS AND INTERESTS

### 317 - Sensory, Motor, and Repetitive Behaviors and Interests

#### **317.001** (Oral) The Sensory Observation Autism Rating Scale (SOAR): A New Measure of Early Sensory Behaviours in Autism

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**Background:** Sensory symptoms are highly prevalent in autistic individuals, with previous research demonstrating that these symptoms negatively impact a range of outcomes including daily living skills, academic performance, and psychological wellness. It is vital that sensory difficulties are quantified as early and accurately as possible so that the necessary supports can be provided. However, sensory measures are typically designed for older children and are heavily reliant on parent report, introducing bias. Additionally, of the more objective observation measures available, many do not assess all sensory modalities of interest and importantly, they all require the administration of tasks within the observation. Assessments requiring administration of tasks are often inaccessible to children with attention or cooperation difficulties, along with increasing administration time and training costs, all of which limit useability. Therefore, the Sensory Observation Autism Rating Scale (SOAR) was created specifically for young autistic children, with all relevant modalities and without requiring the administration of tasks.

**Objectives:** To examine initial reliability and validity of the Sensory Observation Autism Rating Scale (SOAR).

**Methods:** Target behaviours to be assessed using SOAR were identified following a rigorous and systematic review of current validated measures and the literature. Further, a series of focus groups with autistic individuals and parents of autistic children ( $n=13$ ) were conducted to ensure the measure reflected autistic experience. SOAR items assess behaviours across six sensory modalities (auditory, tactile, visual, oral/gustatory, proprioceptive and vestibular) combined into three subscales (hyper-responsivity, hypo-responsivity, and sensory seeking, e.g. “peering at an unusual angle” – Visual-Seeking code). Five-minute video recordings of 105 age- and gender-matched autistic and developmentally delayed children (aged 13-36 months; 38 female) were coded retrospectively using SOAR by researchers blinded to diagnosis. The video recordings were of the free play session within Autism Diagnostic Observation Schedule-2 assessment. An additional 25% of the sample were coded by both researchers to investigate interrater reliability (IRR; Intraclass Correlations, ICC). Discriminant validity (autistic vs developmentally delayed children) was assessed using a series of MANOVAs (hyper-responsivity, hypo-responsivity and seeking behaviours).

Results: Excellent IRR was achieved ( $ICC=.83-.93$ ,  $p<.001$ ) across the frequency and duration of hyper-responsivity, hypo-responsivity and seeking behaviours. Discriminant validity analyses demonstrated that SOAR scores differed between the two groups on the hyper-responsivity domain, with developmentally delayed children assessed as more hyper-responsive than autistic children ( $F(2, 99)=3.79$ ,  $p=.03$ ; Wilks'  $\Lambda = .93$ ; partial  $\omega^2 = .05$ ).

Conclusions: These preliminary indications of excellent interrater reliability and discriminant validity suggest that SOAR is a promising measure to assess early sensory behaviours in autistic children. Indeed, SOAR is the first measure to include a range of modalities, as well as not requiring the administration of tasks, suggesting its utility in a wide range of contexts including retrospective investigations of sensory profile. Additional analyses confirming and expanding these findings to other psychometric properties (e.g. internal consistency) is required. Following this, SOAR could be used by clinicians and researchers to fully characterise sensory behaviours in autistic children, and where appropriate, identify and implement supports.

**317.002 (Oral) Sensory Processing Subtypes in Young Children with ASD: Differences in ASD Symptomatology, Adaptive Skills, and Attentional Problems**

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Background: High, but variable, prevalence rates of sensory differences are reported among individuals with autism spectrum disorder (ASD). Additionally, sensory differences have been associated with social and adaptive skills in ASD. However, our understanding of sensory profiles in ASD has been complicated due to the heterogeneity of sensory symptom presentation. One way to better understand this heterogeneity is to use statistical approaches that allow for the identification of more homogeneous sensory subtypes in otherwise heterogeneous groups.

Objectives: (1) Using Short Sensory Profile (SSP) subscale scores to identify homogenous subtypes of sensory processing in children with ASD based on both severity and modality, and (2) to examine whether sensory subtypes differ in terms of ASD symptomatology, adaptive skills, and attentional problems.

Methods: Participants included 211 children with ASD between 2-4 years of age. ASD diagnoses were confirmed using the Autism Diagnostic Observation Schedule-2 (ADOS-2) and Autism Diagnostic Interview-Revised (ADI-R) along with expert clinical judgment by a licensed clinical psychologist. Using latent profile analysis (LPA), we sought to identify distinct patterns of sensory profiles based on subscale SSP scores. Analysis controlling for age and nonverbal Developmental Quotient and accounting for multiple comparisons were then conducted to examine whether sensory subtypes differed in ASD symptomatology (ADOS-2 severity scores, Social Responsiveness Scale-2 [SRS-2] subscale and Total scores), adaptive skills (Vineland Adaptive Behavior Scale-2 [VABS-2] Socialization and Communication subscales), and attentional problems (Childhood Behavior Checklist [CBCL] Ages 1.5-5 attention and ADHD subscales).

Results: Based on the pattern of both severity and sensory modalities (Figure 1), the four subtypes identified by LPA were named Moderate/Mixed (35.5% i.e., probable-to-definite differences in all modalities except in MS and LEW), Severe/Broad (8.5% i.e., definite sensory differences in all modalities except in LEW), Moderate/Broad (14.6% i.e., probable-to-definite differences in all modalities), and Low/Mixed (41.1% i.e., typical scores in most modalities with only probable differences in TSS, USS, and AF). Subsequent analysis showed that the Severe/Broad subtype had greater ASD symptomatology and lower social skills compared to the remaining subtypes. Finally, the Moderate/Mixed, Severe/Broad, and Moderate/Broad subtypes showed higher levels of attentional problems and ADHD-related behaviors compared to the Low/Mixed group (Table 1).

Conclusions: We found evidence of distinct sensory subtypes in a sample of young children with ASD. While a subset of children with ASD displayed normative sensory-related behaviors, the majority showed a combination of both hypo- and hyper-reactivity to various types of sensory stimuli. The subtype characterized by Severe/Broad sensory differences exhibited greater problems in variety of areas such as social, adaptive, and attentional skills, whereas the Low/Mixed subtype showed overall fewer problems. Identification of homogenous subtypes may be useful for neurophysiological/imaging studies that aim to study underlying mechanisms linked with specific sensory patterns. These findings may also help clinicians identify children with greater differences in sensory processing, which might have a role in difficulties the child is having in social, adaptive, or attentional domains with potential implications for intervention.

**317.003 (Oral) Development of Restricted, Repetitive, Behaviors and Internalizing Symptom Outcomes in Longitudinal Study of Autism**  
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Background: Restrictive and repetitive behaviors (RRBs) are a core feature of autism spectrum disorder (ASD). Factor analyses of the Autism Diagnostic Interview, Revised (ADI-R) have identified Insistence on Sameness (IS) and Repetitive Sensorimotor (RSM) factors. (Richler, 2010). The literature suggests RSM and total RRBs decline with age while IS increase. (Bishop, 2013; Evans et al, 2006). However, there is little research examining RRB trajectories beyond mid-childhood. Additionally, prior work has found associations between IS and total RRBs and internalizing symptoms (Rodgers, 2012; Gotham, 2014; Lam, 2004), however, the connection between RRBs and internalizing in adulthood remains unexplored.

Objectives: Investigate trajectories of raw ADI-R current RRB, RSM, and IS scores from 2-18, and compare internalizing symptoms in early adulthood across trajectory groups.



**Methods:** 197 adults were drawn from a longitudinal study. Raw current scores from the C-Section of the ADI-R were used to create total RRB, RSM, and IS scores. Trajectories were identified via group-based modeling. Multilevel modeling was used to investigate change in the slopes of trajectory groups. Internalizing symptoms were measured at ages 18 and 26 using Beck's Depression Inventory (BDI) and the Adult Manifest Anxiety Scale (AMAS).

**Results:** Three total RRB trajectory groups emerged: Low-Stable (30.8%), Some-Stable (50.9), and High-Declining (18.3%; Figure 1). Two IS groups emerged: Slight-Increasing (81.5%) and Mild-Decreasing (18.5%). Three RSM groups emerged: Low-Stable (28.2%), Mild-Decreasing (44.4%), and High-Fluctuating (27.3%).

There was a significant effect of trajectory group on the slope of all three models, indicating the rate of change in total, RSM, and IS scores varied by trajectory group (Table 1). There was no significant effect of age in the total and RSM models, suggesting participants' total and RSM -raw scores at ages 2 and 18 were similar. The IS model included a significant effect of participant age ( $p < .001$ ); on average, IS scores decreased.

There were no significant differences between total RRB, RSM, and IS trajectory groups in internalizing symptoms at 18. Participants in the mild-decreasing RSM trajectory had significantly higher AMAS scores at 26 than participants in the low-stable and high-fluctuating groups ( $p = .028$ ).

**Conclusions:** As increasing numbers of autistic individuals enter adulthood, understanding developmental changes in the presentation of ASD becomes increasingly important. These results provide insight into how RRBs may shift from early childhood into adulthood. On average, RSM and total RRBs were stable; IS behaviors decreased with age. This study failed to replicate prior findings relating IS and total RRBs to internalizing symptoms, but found preliminary evidence that RSM development may be related to anxiety in adulthood.

### **317.004 (Oral) Early Developmental Profiles of Sensory Patterns in a Community Sample: Associations with Later Autistic Traits and Adaptive Functioning**

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**Background:** Previous sensory-based subtyping studies have demonstrated the heterogeneous manifestation of sensory patterns in children with ASD. However, there is a lack of evidence on sensory subtypes as defined by longitudinal variability beyond ASD populations.

**Objectives:** The current study aimed to identify subtypes of sensory pattern trajectories from age 1 to 6 years among a large community sample of young children, and to characterize these subtypes in terms of their demographics and school-age outcomes, including autistic traits and adaptive/maladaptive behaviors.

**Methods:** Sensory patterns of 1,517 children were assessed at three time-points (infancy, preschool-age, and school-age) with parent-report questionnaires (First Years Inventory and Sensory Experiences Questionnaires). Multivariate latent class growth analysis (LCGA) was fitted with two to six classes to identify distinct subtypes based on trajectories across three sensory patterns (hyperresponsiveness [HYPER], hyporesponsiveness [HYPO], and sensory interests, repetitions and seeking behaviors [SIRS]) with child's sex, race, and parent education as covariates. Associations between class membership and school-age outcomes (measured by Social Responsiveness Scale and Vineland Adaptive Behavior Scales) were examined on a subset sample with outcome data (N=389) using Bolck-Croon-Hagenaars three-step approach that adjusts for classification errors.

**Results:** Based on the model fit indices (Table 1) and clinical interpretability of these class solutions, five distinct sensory-trajectory classes were identified (see Figure 1): an *Adaptive-All Improving* class with very low sensory features (Class 1; 35%), an *Elevated-All Worsening* class (Class 5; 3%), and three other classes (Class 2 to 4; 62% combined) generally characterized by moderate levels of sensory features with varying patterns across constructs. Children in Class 5 were more likely to be boys and have parents with lower education levels and were associated with the most elevated autistic traits and poorest adaptive/maladaptive outcomes at school age ( $\chi^2=46.2$  to  $133.3$ ,  $p$  all  $< .001$ ; compared to Class 1). Also, children in this class were almost 123 times more likely than those in the most adaptive class (i.e., Class 1) to have parent-reported ASD-related outcomes/elevated autistic traits (odds ratio=122.9, 95% CI=[28.8, 524.6]). Children who were classified to the moderate-severity classes with increasing trajectories in some sensory constructs, particularly HYPER and HYPO, tended to show weaknesses in certain domains of adaptive functioning: Comparing to Class 1, Class 2 had lower social communication skills ( $\chi^2=6.7$  to  $16.2$ ,  $p<.05$ ) while Class 4 had lower daily living and motor skills ( $\chi^2=5.7$  to  $11.6$ ,  $p<.05$ ). Both these classes were also associated with more maladaptive behaviors ( $\chi^2=9.5$  to  $58.5$ ,  $p$  all  $< .01$ ).

**Conclusions:** Large longitudinal variability of sensory patterns was observed in a community sample of children and could be parsed out into clinically meaningful subtypes given their differential associations with autistic traits and adaptive/maladaptive behaviors at school age. Thus, profiling children based on their early sensory trajectories may help to identify those who are more likely to experience developmental challenges at school age, thus introducing opportunities for early intervention. Moreover, the presence of a sensory trajectory profile that was highly associated with ASD-related outcomes indicated the potential utility of sensory features for early identification of ASD.

#### **405.085 (Poster)** A Pilot Study of Active Social Touch in Autism

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**Background:** Social/affective touch processing has been an area of interest in autism, as our earliest social interactions tend to occur in the context of caregiver touch that is processed via distinct neural pathways from those tuned to process nonsocial touch. Accordingly, this sensory system plays a foundational role in socioemotional development and is increasingly processed reciprocally between individuals as one matures and gains motor autonomy. Though some studies provide evidence of altered social touch perception in autism, to our knowledge, no prior approaches have characterized how individuals on the autism spectrum apply social touch during interactions with others. CAREtaker RoBot (CARBO), an animal-like robot containing an array of trackballs used as tactile sensors, was designed to objectively measure properties of active touch while approximating affective touch preferences of animate beings.

**Objectives:** This study aimed to preliminarily characterize active social touch in youth on the spectrum compared to typically developing youth.

**Methods:** Participants included  $n=15$  autistic youth (AUT, ages 8-17) and  $n=15$  typically developing youth (TD, ages 6-12). One individual in the autism group was excluded from analyses due to difficulty with task comprehension, leaving  $n=14$  individuals in final analyses. We compared performance between groups on CARBO's "ColorMe" game. In the "ColorMe" game, participants are instructed to swipe across CARBO's trackballs in a specific direction, mimicking petting an animal. CARBO's trackballs are illuminated with the desired color if swiped in the preferred direction and velocity; corrective feedback is generated in response to non-preferred speed or direction. The "ColorMe" game ended when the number of illuminated trackballs surpassed the game's threshold. Accuracy in preferred velocity, average speed, variation in speed, and number of trackballs targeted per swipe were compared between groups.

**Results:** In this initial pilot study, we did not find differences in accuracy, speed, or number of targeted trackballs between the groups that met criteria for statistical significance. However, several preliminary trends in performance may warrant further investigation. Most notably, the speed of swipe was slower for autistic participants than typically developing participants (Cohen's  $d = -0.41$ , Figure 1A). Additionally, group patterns may suggest greater movement consistency in autism, including a more stereotypical number of trackballs targeted ( $d = 0.32$ , Figure 1C).

**Conclusions:** Trending differences in speed of swipe are consistent with known differences in motor development in autism; future work may aim to disentangle the extent to which differences in active social touch may relate to general motor differences versus specific to social touch processing. Additionally, a more stereotypical number of targeted trackballs per swipe in the autism group suggests that autistic individuals may apply a more consistent strategy towards game completion, compared to typically developing individuals. One limitation of the current work is that our typically developing participants were on average younger than our autistic participants, so age-matched samples may further clarify findings. In addition to collecting more data, future directions also include studying the extent to which patterns of active touch to an "animal-like" robot may translate to humans.

#### **405.086 (Poster)** Adherence to the Two-Thirds Power Law and Kinematic Differences in Children with Autism during Ellipse Drawing and Tracing Activities on Smart-Tablet

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**Background:** Individuals with autism often demonstrate atypical motor control, especially in the area of fine motor skills. Studies assessing writing and drawing have revealed larger peak velocities and more variable trajectories in autistic participants. Similarly, during upper limb reaching movements, those with autism show greater levels of jerk and more movement units than those with typical development. These atypical kinematic features require further investigation. One method that can be used to characterize motor control is the two-thirds power law ( $\frac{2}{3}$  PL) that produces movement in which velocity co-varies with curvature ( $Tangential\ Velocity = K * Radius\ of\ Curvature^{\frac{1}{3}}$ ). The  $\frac{2}{3}$  PL extends to several types of human movement, including of the hand and foot, for example during drawing, and of the eyes during tracking.

**Objectives:** The goal of this study is to assess adherence to the  $\frac{2}{3}$  PL during drawing movements in children with autism and children with typical development (TD). The law has yet to be studied in autism, and it may offer deeper insight into atypical motor development and provide a better metric by which to assess motor kinematics.

**Methods:** The present study uses an innovative approach by capturing movement kinematics through an iPad activity that is accessible and appealing to children. Participants included 10 children with autism ( $Age=87$  months) and 26 children with TD ( $Age=82$  months), ages 4 through 8 years. Participants were instructed to first (i) Draw then (ii) Trace ellipses, chosen in order to elicit varying degrees of curvature. The bespoke application recorded these movements on the screen, in the form of x and y coordinates of finger location over time. For each continuous segment of movement, kinematic features of curvature and tangential velocity were computed and an exponent ( $\beta$ ) representing their relationship (i.e., adherence to the  $\frac{2}{3}$  PL) was derived (Figure 1). Jerk and acceleration values were also calculated.

**Results:** (i) For Drawing trials, there was a trend toward significance, in which the TD group showed lower beta values ( $M=.21$ ) than the autism group ( $M=.27$ ),  $p=.058$ . (ii) Tracing trials showed no group difference. Beta values ( $\beta$ ) for each segment are displayed in Figure 2. For both Drawing and Tracing trials, autistic participants demonstrated greater individual variability across segments (Drawing:  $M=0.072$ ; Tracing:  $M=.077$ ), compared

to TD participants (Drawing  $M=.045$ ; Tracing  $M=.051$ ),  $p=.009$  and  $p=.028$ , respectively. Participants with autism also showed greater acceleration and jerk in both Drawing and Tracing movements (Figure 3).

**Conclusions:** This novel iPad methodology revealed group differences in kinematics, with autistic participants showing more individual variability and a greater beta value, as well as greater levels of acceleration and jerk. Future investigation will examine the quality of the movement executed (e.g. size and shape of ellipses), and the relationship between these kinematic variables and other measures of social and motor functioning. This approach may provide a useful method for studying kinematics and help to expand our understanding of motor atypicality in autism, a growing area of interest and focus.

**405.087 (Poster)** Age-Related Differences in Behavioral and Physiological Responses to Sensory Stimulation in Children and Adolescents with and without Autism Spectrum Disorder (ASD)

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### **Background:**

Individuals with autism spectrum disorder (ASD) often exhibit sensory modulation atypicalities, such as sensory over-responsivity (SOR), which is characterized by demonstrating an exaggerated negative response to aversive sensory input (Leekam et al., 2007; McCormick et al., 2015; Miller et al., 2017). However, a majority of existing ASD sensory-related studies examine parent-reported data; thus, there is a strong need to develop standardized observational assessments of sensory processing atypicalities that can be used across childhood and adolescence. Additionally, heart rate (HR) responses to sensory stimulation have been shown to correlate with SOR (Jung et al., 2021), so combining observed behavior with physiology may provide insight into sensory reactivity, especially in older adolescents who may find sensory sensations unpleasant but regulate their behavioral responses.

### **Objectives:**

To explore the relationship between age and SOR in parent-reported data and an observed behavioral assessment to improve understanding of sensory processing in school-aged children and adolescents with autism spectrum disorder (ASD) and typically developing (TD) peers, and to examine how HR responses relate to observed behavior during sensory stimulation.

### **Methods:**

Forty-one ASD and 33 age- and performance IQ-matched TD participants, aged 8-17 years participated in the Sensory Processing 3-Dimensional (SP3-D) Assessment (Mulligan et al., 2019). This assessment uses ecologically valid sensory stimuli (e.g., flashing lights, musical instruments, scratchy materials) to examine participants' sensory responsivity. Behavioral responses to the stimuli were scored in tactile, visual, and auditory domains, based on whether they showed aversive or avoidant responses to the stimuli. Electrocardiogram data was collected from participants during the SP3-D to measure HR responses to sensory stimulation. Additionally, parents completed the SP3-D Inventory (Miller et al., 2017) to report on participants' SOR symptoms.

### **Results:**

Compared to TD participants, the ASD group had more atypical SOR ( $t(72)=-2.49$ ,  $p=0.015$ ) responses across visual, tactile, and auditory domains on the SP3-D Assessment. Total SOR in the SP3-D Assessment was negatively correlated with age in both TD ( $r=-0.60$ ,  $p<0.001$ ) and ASD ( $r=-0.30$ ,  $p=0.05$ ) groups. However, parent-reported SOR was not correlated with age in either group, suggesting that either older participants in the sample are able to better regulate their SOR behaviors during the lab assessment, or as children get older, parents are less attuned to improvements in their SOR behaviors. Additional analyses will correlate behavioral responses with heart rate responses using the same tasks, with discrepancies between behavior and physiology examined as a possible indication of regulation to determine whether older ASD youth are regulating more (i.e., showing high physiological arousal despite low behavioral reactivity).

### **Conclusions:**

SOR behaviors during the SP3-D Assessment were negatively correlated with age, whereas parent-reported SOR was not correlated with age. This disparity between observational data and parent-reported data may be due to the assessment's shorter timeframe and more controlled environment, whereas parents report SOR using a global impression of their children's behavior across development. Additional physiological analyses and the discrepancies between behavior and physiology could provide insight into participants' regulatory behavior during the assessment, through which older participants suppress behavioral responses to aversive stimuli during the observational assessment.

**405.088 (Poster)** An Observational Study of the Relationship between Sensory Reactivity Differences and Classroom Behaviour of Autistic Children.

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**Background:** Sensory reactivity (SR) differences are a core diagnostic criteria for autism. The classroom environment can be a difficult place for autistic children to regulate their behaviour, reducing their ability to reach their learning potential. SR differences has previously been linked to classroom behaviours using teacher reports.

**Objectives:** This research aimed to use direct observational methods to investigate how SR differences, such as hyperreactivity, hyporeactivity and sensory seeking, might be linked to classroom behaviour.

**Methods:** The Sensory Assessment for Neurodevelopmental Disorders (SAND) was used to measure SR, while classroom behaviour was assessed using the Behaviour Assessment for Children, Student Observation System (BASC-SOS). Study 1 consists of data from 24 participants aged 9-18. The study was then repeated (Study 2) with a further 30 participants from a second school aged 5-11, to replicate the findings.

**Results:** In Study 1, increased SR differences were found to be significantly correlated to both increased maladaptive ( $r = .48, p < .05$ ) and decreased adaptive classroom behaviour ( $r = -.45, p < .05$ ). Sensory seeking symptoms were found to be linked to both decreased adaptive ( $r = -.47, p < .05$ ) and increased maladaptive classroom behaviour ( $r = .42, P < .05$ ). In Study 2, there was a trend between increased SR differences and increased maladaptive behaviour ( $r = .34, p = .07$ ). Sensory hyporeactivity was linked to increased maladaptive classroom behaviour ( $r = .40, P < .05$ ).

**Conclusions:** Results from both studies demonstrated there is a link between SR differences and classroom behaviour. However, the studies differed in specific SR subtype. Findings will be discussed in terms of sample characteristics as well as school setting (specialist residential school versus specialist day school).

#### **405.089 (Poster)** Are Interests Harmonious or Obsessive? A Look at Passion in Autistic Emerging Adults

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**Background:** While intense interests can lead to interference with daily functioning, they are sometimes beneficial, namely concerning social inclusion, learning, and positive emotions. However, the impact of interests on well-being and functioning is poorly understood. Fortunately, the Dualistic Model of Passion describes two types of passions associated with negative or positive functioning. Harmonious passion is a flexible form of engagement that leads to positive emotions, a state of flow and *optimal functioning* (i.e. well-being, physical health, relationship quality, performance and contribution to society). In contrast, obsessive passion is a rigid form of engagement associated with conflict, rumination, negative emotions, and that negatively impacts optimal functioning.

**Objectives:** Using the Dualistic Model of Passion framework, the first aim was to characterize passion in autistic emerging adults. Secondly, the relation between passion, conflict, rumination, emotions, flow, and optimal functioning was examined. It was expected that harmonious passion and obsessive passion would respectively be positively and negatively associated with optimal functioning. In an exploratory aim, categories of interests (e.g.: video games) were compared to determine which interests were more adaptive in terms of passion and optimal functioning.

**Methods:** Participants were recruited on social media through different autism associations. A total of 109 autistic individuals (58 women;  $M=23.66$  years;  $SD=5.09$ ) took part in an online study. Thinking of their favorite interest, participants completed questionnaires on passion, conflict, rumination, emotions, flow and optimal functioning. Descriptive statistics and correlations were used to characterize passion and examine relations between variables, and ANOVAs were used to compare categories of interest.

**Results:** Participants were passionate about their interest, showing both high levels of harmonious ( $M=5.46/7$ ;  $SD=1.04$ ) and obsessive passion ( $M=4.20/7$ ;  $SD=1.41$ ). They spent on average 25.45 hours/week ( $SD=16.72$ ) on their interest and had been practicing it for approximately 10.6 years ( $SD=6.63$ ). Harmonious passion was positively associated with optimal functioning ( $r=.32$ ), flow ( $r=.27$ ), and positive emotions ( $r=.34$ ). Obsessive passion was associated with conflict ( $r=.79$ ), rumination ( $r=.71$ ), negative emotions ( $r=.21$ ), and lower optimal functioning ( $r=-.43$ ). Finally, passions were categorized as video games ( $n=23$ ), artistic pastimes ( $n=23$ ), knowledge acquisition ( $n=27$ ), reading and watching tv ( $n=24$ ), and active pastimes ( $n=11$ ) by two independent researchers ( $kappa=.83$ ). Knowledge acquisition was the category with the highest levels of harmonious and obsessive passion, as well as the one associated with most rumination. Video games were the category associated with the highest levels of negative emotions and the lowest harmonious passion levels. Categories did not differ in terms of optimal functioning, flow, positive emotions and conflict.

**Conclusions:** Autistic individuals are highly passionate about their interest, and more harmoniously passionate than obsessively passionate as a group. Moreover, as expected, the presence of harmonious passion is related to optimal functioning, whereas obsessive passion is related to lower optimal functioning. Results highlight that the category of interest might not be as important as the type of passion associated with the interest in predicting optimal functioning. As seen in neurotypical populations, high levels of harmonious passion may foster positive outcomes and protect against the negative impacts associated with high levels of obsessive passion.

#### **405.090 (Poster)** Characterization of Sensory over-Responsivity in a Broad Neurodevelopmental Concern Cohort Using the Sensory Processing Three Dimensions (SP3D:A) Assessment

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**Background:** Sensory Over-Responsivity (SOR), the negative response to typically non-noxious stimuli, occurs in 2.5% of elementary school children and up to 70% of children with Autism Spectrum, Anxiety, Attention Deficit/Hyperactivity, and Developmental Coordination Disorders<sup>1-7</sup>. To date, SOR in specific sensory domains (i.e. auditory and/or tactile) in community clinics treating children with neurodevelopmental concerns (NDC) has not been explored using a direct assessment of sensory processing.

**Objectives:** To characterize the incidence of auditory and/or tactile SOR in children between the ages of 8 and 12 years old referred to Cortica Healthcare, a community based neurodevelopmental clinical research center in Marin County, California.

**Methods:** This study employs an observational cross-sectional study design with direct sensory characterization by a licensed pediatric Occupational Therapist using the Sensory Processing Three Dimensions (SP3D:A) Assessment to investigate the frequency of auditory and tactile SOR in a pediatric NDC population. Children are screened for eligibility in part through a brief questionnaire of neurodevelopmental challenges (Gillberg ESSENCE-Q), to which the responses range from 'No,' 'Maybe / A Little,' to 'Yes' (Table 1). Participants are additionally evaluated for research designation of Autism Spectrum Disorders (ASD) using the Social Communication Questionnaire. If a child scores  $\geq 15$ , an Autism Diagnostic Observation Schedule (ADOS-2) is conducted to confirm research diagnosis.

**Results:** Of the total NDC population enrolled (60 male, mean age 10.4 years), 35/82 (42.7%) meet criteria for auditory SOR (AOR), 18/82 (22.0%) meet criteria for tactile SOR (TOR), 9/82 (11.0%) meet criteria for both auditory and tactile SOR and 44/82 (53.7%) meet criteria for AOR and/or TOR. 13 children (11 male) additionally meet research criteria for ASD. Of the ASD population enrolled, 5/13 (38.5%) meet criteria for AOR, 3/13 (23.1%) meets for TOR, 1/13 (7.7%) meet criteria for both AOR and TOR, and 7/13 (53.8%) meet criteria for AOR and/or TOR. Of the non-ASD population enrolled (47 male), 30/66 (45.5%) meet criteria for AOR, 14/66 (21.2%) meet criteria for TOR, 8/66 (12.1%) meet criteria for both AOR and TOR, and 36/66 (54.5%) meet criteria for AOR and/or TOR.

**Conclusions:** This glance into a broader ongoing study on sensory processing emphasizes the prominence of SOR as a presenting concern in a community-based clinic. The same percentage (54%) of each cohort (combined sample, ASD, and non-ASD) were assessed to have auditory and/or tactile over-responsivity, which suggests several key findings – first, SOR is highly prevalent with over 50% of children presenting with this as a chief concern. Second, the incidence of AOR and TOR is roughly the same in children with and without ASD, which suggests sensory modulation is likely independent from the primary social communication deficits characteristic of ASD. Third, auditory SOR is over twice as common in children with NDC as tactile SOR. And finally, these findings point towards a need for more robust delineation of the neural mechanisms of SOR both within and separate from ASD, as well as a need to define whether genetic contributors are independent or overlapping among children with SOR, attention, and social communication challenges.

#### **405.091 (Poster)** Defining and Assessing the Construct of Food Pickiness in Autistic and Neurotypical Adolescents and Young Adults

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**Background:** Picky eating is a common and well-documented phenomenon among autistic individuals, which can lead to significant health problems including obesity, malnutrition, and disordered eating. Prior research in this area has focused primarily on children, and little is known about the persistence of food pickiness into adolescence and young adulthood. Understanding the nature of food pickiness in these populations is critical for designing appropriate interventions to support long-term health.

Feeding behavior is driven by a complex integration of systems spanning sensory, perceptual, biological, social, and other factors. While the nature of pickiness is likely to be similarly complex, extant research in both ASD and neurotypical populations has defined pickiness based on individual factors, like food neophobia or broadly defined food selectivity, rather than as an integrated latent construct.

**Objectives:** The present study aimed to address these limitations by applying confirmatory factor analysis and structural equation modeling to develop and test a measurement model of food pickiness that includes multiple theoretically hypothesized indicator variables. These aims were carried out with autistic and neurotypical adolescents and young adults, allowing for assessment of model fit accounting for diagnostic status. Analyses additionally examined the factor structure of food selectivity. We hypothesized that the latent construct of food pickiness would be a common factor across the empirically driven indicator variables. Furthermore, we hypothesized that autistic adolescents and young adults would have greater levels of food pickiness compared to their neurotypical counterparts.

**Methods:** The present sample comprised 429 participants, including well-characterized autistic adolescents and young adults ( $n=80$ ) and unaffected siblings ( $n=41$ ), neurotypical adolescents ( $n=63$ ), and neurotypical college students ( $n=245$ ). The predictor variable was ASD diagnostic status. Indicator variables for the latent construct of pickiness were derived from a comprehensive assessment of preference and frequency of eating individual food items, assessment of preference based on food qualities, food neophobia (e.g., refusal to try new foods), and parent- or self-reported food pickiness (e.g., preferring variety or sameness in daily diet).

**Results:** Preliminary results indicate that autistic adolescents and young adults had greater parent- or self-reported picky eating,  $t(428) = -8.12, p < .001$ , and food selectivity,  $t(416) = -3.62, p < .001$ ; however, participants did not differ in food neophobia based on diagnostic status,  $t(426) = -1.04, p = .30$ . Additional planned analyses further examine the latent construct and potential mediators and moderators, and the factor structure of individual food item preferences to improve operationalization of food selectivity.

**Conclusions:** This novel study improves the conceptualization of food pickiness in ASD by defining it as a latent construct composed of multiple observed variables. Additionally, results indicate that food pickiness is present in autistic adolescents and young adults compared to their

neurotypical peers providing support for its persistence beyond the childhood years. The results of this study will help caregivers and providers address the nature of picky eating in ASD to promote better long-term physical, mental, and emotional outcomes.

**405.092 (Poster)** Differential and Shared Pathways to Sensory over-Responsivity and Anxiety: The Role of Hot and Cool Self-Regulation  
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**Background:** Sensory over-responsivity (SOR), characterized by heightened reactivity to sensory stimuli, occurs in approximately 56% of children with autism spectrum disorder (ASD). Research has established a strong theoretical linkage between SOR and anxiety disorders. Anxiety disorders are also common in children with ASD, occurring in around 40% of children. SOR and Anxiety share similar bottom-up, perceptual processes (physiological arousal in anxiety, sensation in SOR) and top-down regulatory processes, which relate to degree of impairment. Despite these connections, little research has examined how to conceptualize SOR within therapeutic approaches for anxiety.

Self-regulation (SR) is one process that is amenable to intervention and potentially related to congruent mechanisms between SOR and anxiety, as it encompasses top-down cognitive and behavior regulation. Conceptually, SR has been dichotomized by the degree it involves affective components, with “hot” SR entailing greater affective processes than “cool” SR. Thus, elucidating how these components differentially predict the manifestation of anxiety and SOR may inform more specialized anxiety treatment for individuals with ASD.

**Objectives:** This study aims to examine how “hot” and “cool” self-regulatory processes differentially predict anxiety and SOR, among children with developmental disabilities (DD), including ASD. We also examine how ASD and cognitive functioning affect these relationships.

**Methods:** This sample consisted of 94 school-age children ( $M = 9.25$  yrs;  $SD = 1.9$  yrs) participating in a longitudinal study exploring shared neurobiological etiology between ASD and DD. Data was collected at two time points, approximately 1 year apart. Anxiety, SOR, and cognitive functioning were measured using the CBCL, SSP, and WASI, respectively. We used BRIEF subscales to measure hot SR (emotional control) and cool SR (inhibit + shift), with higher scores indicating greater dysfunction. ASD diagnosis was confirmed using the ADOS, with 45% of the sample meeting clinical criteria. We used hierarchical regression models to test our research questions, entering ASD diagnosis and cognitive functioning as predictors in successive steps.

**Results:** Cool SR best predicted each outcome across models – anxiety, SOR-related avoidance, and SOR-related sensitivity ( $p$ 's < .001), with differential patterns across outcomes concerning the role of ASD, cognitive functioning, and hot SR. For anxiety at time 2, hot SR marginally predicted the log-odds of this outcome ( $p$ 's < .1) in addition to cool SR. For SOR-related avoidance at time 2, ASD diagnosis significantly predicted ( $p$ 's < .05) higher scores, in addition to cool SR. For SOR-related sensitivity, cognitive functioning marginally predicted ( $p$ 's < .07) lower scores, in addition to cool SR. SR and cognitive or ASD variables explained 45-47% of variance in SOR.

**Conclusions:** Our results suggest dysregulation in cool SR may underlie both SOR and Anxiety. Interestingly, SOR-related avoidance, which shares behavioral features with anxiety, was predicted by ASD status. These results suggest increasing behavioral self-regulation and decreasing behavioral avoidance may be important treatment targets for alleviating the clinical impact of anxiety and SOR for individuals with ASD. As these targets are readily incorporated into treatment protocols for anxiety, future intervention studies might examine how targeting less affective aspects of SR may influence SOR.

**405.093 (Poster)** Dynamic Complexity of Atypical Postural Control in Autistic Toddlers

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**Background:** Early delays in motor-functioning and differences in social communication are early signs of autism spectrum disorder (ASD). Studies documented the autistic individuals have difficulties in maintaining postural control throughout the lifespan. Recent advancements in digital-technologies and computer-vision open avenues to develop scalable behavioral analysis tools that have the potential to quantify subtle dynamic changes in motor behavior with high spatiotemporal resolution. In a previous study, our group designed a scalable computational phenotyping tool capable of recording and measuring postural sway. Using this tool, we reported higher rates of postural sway of young autistic children compared to neurotypical children while watching strategically-designed movies consisting of social and non-social components, shown on a tablet (Dawson et al., 2018)

**Objectives:** This study sought to replicate and extend our earlier findings with a larger, independent sample of young autistic and typically developing (TD) children. Here, we employed new methods designed to capture the complexity of head movements.

**Methods:** Toddlers aged 17-37 months were recruited at four pediatric primary care clinics during their well-child visit (TD:  $N=410$  and ASD:  $N=38$ ). Children were shown short movies consisting of social and non-social components presented on a tablet while they sat on their caregiver's lap. The tablet's front-facing camera recorded the toddlers' video while they watched the movies. Computer-vision algorithms were used to track and detect the facial landmarks, which were processed to extract the head postural sway across frames synchronized with the movies (Dawson et al., 2018). Measurements included (1) acceleration - physically related to the instantaneous control force, and (2) complexity - formally defined using multiscale sample entropy. These features can characterize the magnitude of postural sway patterns and how periodic or mathematically unpredictable they are.

**Results:** Autistic toddlers exhibited, on average, significantly higher postural sway acceleration (Actor Blowing Bubbles Movie:  $p<0.00001$ ; Make Me Laugh Movie:  $p<0.00001$ ) and complexity (Actor Blowing Bubbles Movie:  $p<0.001$ ; Make Me Laugh Movie:  $p<0.05$ ) compared to neurotypical children. These differences were accentuated when children were watching movies with high social content (see Figure 1). During movies with low social content, the differences in the patterns of postural sway between the groups were smaller for both the acceleration (Floating Bubbles Movie:  $p<0.005$ ; Dog in Grass Movie:  $p<0.001$ ) and complexity (Floating Bubbles Movie:  $p=0.12$ ; Dog in Grass RRL:  $p=.08$ ).

**Conclusions:** During movies with high social content, autistic toddlers exhibited higher acceleration in postural sway characterized by more rapid, less structured, and frequent motions. The autistic children also had higher MSE values, suggesting that the movements were less predictable. Balance relies on the integration of multisensory cues, a process requiring attentional demands. Decreased postural control during processing of social stimuli may reflect differences in the ability to adapt to the sensory information in the complex social movies. A novelty of this work is that this can be quantified using ubiquitous devices in primary care clinical settings.

**Reference:** Dawson, G., et al. (2018). Atypical postural control can be detected via computer vision analysis in toddlers with autism spectrum disorder. *Scientific reports*, 8(1), 1-7.

#### **405.094 (Poster) EEG Proxy Markers of Sensory Sensitivities of ASD**

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#### **Background:**

Biomarkers are an objective measure of biological processes which underpin more complex symptoms of behaviours. These have a range of potential purposes, including facilitating of diagnosis, prognosis, treatment target and or treatment response. Recent efforts have tried to develop biomarkers for core and associated symptoms of autism. Despite their potential usefulness, there are challenges in defining and understanding different biomarkers, and limited consensus as to how they should be used in research and clinical practice.

A number of neurophysiological markers measured using electroencephalography (EEG) have been reported in Autism Spectrum Disorder (ASD). Of particular interest are those related to sensory difficulties, which are common, emerge early, and have relatively clear biological underpinnings. However, the data are inconsistent and the use of these EEG findings with respect to biomarker development remains unclear. Critically, there are currently no formal criteria against which the performance of such biomarkers can be evaluated.

#### **Objectives:**

We aimed to screen the existing EEG studies of sensory processing in autism, alongside available biomarker guidelines to develop a tool to assess how well biomarkers achieve their intended function (diagnosis, prognosis, etc.).

#### **Methods:**

**Literature search:** 71 studies that were systematically identified across three databases; EMBASE, OVID and APA. Search terms relating to; ASD, EEG and sensory sensitivities across visual, auditory and tactile EEG studies were examined. Two independent researchers searched and extracted data from each database.

**Tool development:** The development of the assessment tool was based on current Food and Drug Association (FDA) guidelines for biomarkers. These guidelines provide information on the different types of biomarkers, however, very little information on what research studies require for biomarker qualification. Therefore, characteristics from previously approved biomarkers were also used to create a list of criteria required for biomarker qualification. A group of experts were then asked to review the criteria for different types of biomarkers to incorporate into the biomarker tool.

#### **Results:**

We identified  $n=71$  relevant papers in total;  $n=28$  papers in visual,  $n=40$  papers in auditory and  $n=3$  papers in the tactile domain (see figure 1). Based on this search and expert opinion we identified characteristics for the tool. These included general and specific characteristics and surrogate end point status (see figure 2). Our preliminary results indicate that many potential biomarkers are in the early stages of development and require further research in order to fulfil the criteria specified in our tool.

#### **Conclusions:**

Reference to biomarker guidelines and a screen of studies reporting EEG biomarkers for sensory processing in autism supported the development of a structured method to assess biomarker qualities. Preliminary application of this tool indicated that biomarker development remains at early stages for the majority of candidates reported in the literature. Building on this exercise, going forward we hope to recommend a minimum set of reporting criteria for biomarker studies to provide consensus and facilitate the translation of biomarker research into clinical settings.

**405.095 (Poster)** Examining the Association between Categories of Restricted Repetitive Behaviors and Parent Stress for Parents of Children with ASD

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**Background:**

Parents of children with autism spectrum disorder (ASD) report higher levels of parenting stress than children identified with other developmental disabilities (Eisenhower et al., 2005; Hayes & Watson, 2013). Previous studies have found links between parenting stress and child behavior problems, adaptive skills, and autism symptom severity; however, few studies have investigated the effects of restrictive, repetitive behaviors (RRBs) specifically. The limited work in this area suggests that rates of RRBs in preschool-aged children with ASD are related to parenting stress, and that increases in RRBs are associated with increases in parenting stress over time (Harrop, McBee, & Boyd, 2016). However, less is known about the relationship between parenting stress and specific subtypes of RRBs.

**Objectives:**

The goal of this study was to examine how different types of restricted and repetitive behaviors contribute to parenting stress for parents of children with ASD.

**Methods:**

This exploratory study was conducted as part of a larger randomized controlled trial investigating the efficacy of an online parenting program (Ingersoll, PI). Our sample included 60 children with an autism diagnosis, ages 18-90 months ( $M = 46.27$  months,  $SD = 17.49$  months). Data for the current study were obtained from the intake assessment. Restrictive and repetitive behaviors were measured using the Repetitive Behaviors Scale-Revised (RBS-R), and parenting stress was assessed using the Parenting Stress Index-Short Form (PSI-SF). First, we used zero-order correlations to examine whether parent demographic variables (parent age, sex, minority status, marital status, and education level), child characteristics (age, sex, verbal and nonverbal IQ, adaptive functioning, autism symptom severity), and child RRBs were significantly associated with parent stress. Only child autism symptom severity on the Social Responsive Scale (SRS) and RBS-R Subscale scores (Compulsive, Ritualistic, Self-injurious, Restricted, and Stereotyped Behavior) were correlated with parenting stress ( $p \leq .05$ ). A hierarchical linear regression predicting parenting stress was then conducted with autism symptom severity entered in step 1 and the five RBS-R Subscale scores (Compulsive, Ritualistic, Self-injurious, Restricted, and Stereotyped Behavior) entered in step 2.

**Results:**

The overall model was significant,  $F(6,53) = 4.27$ ,  $p = .001$  and accounted for approximately 25% of the variance in parent reported stress. The addition of RBS-R subscale scores resulted in a significant change in the adjusted  $R^2$  ( $\Delta R^2 = .17$ ,  $p = .03$ ). In the final model, only ritualistic behaviors ( $\beta = .49$ ,  $p = .004$ ) was an independent predictor of parenting stress.

**Conclusions:**

This study found that all 5 subtypes of restrictive and repetitive behaviors on the RBS-R were significantly associated with parenting stress and predicted parenting stress above and beyond autism symptom severity. After controlling for autism symptom severity and other RRBs, only ritualistic behaviors was a unique predictor of parenting stress. Further investigation of how different RRBs influence parent stress may indicate why certain behaviors have a larger impact on parenting stress than others and inform how to best manage parenting stress related to RRBs.

**405.096 (Poster)** Examining the Role of Attention Problems in Motor Stereotypy in Children with ASD

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**Background:** Motor stereotypy, repetitive behaviors that occur with little conscious effort and are suppressible by sensory stimuli or distraction, is a subcategory of restricted and repetitive behavior commonly associated with Autism Spectrum Disorder (ASD). They are not exclusive to ASD, and visual descriptions of motor stereotypies cannot distinguish between stereotypy in those with and without ASD. Individuals without ASD who have motor stereotypy often struggle with executive function and attention, suggesting a relationship between motor stereotypy and attention dysfunction. Our previous cross-sectional work found an association between attention problems on the Child Behavior Checklist (CBCL) and motor stereotypy on the Repetitive Behaviors Scale – Revised (RBS-R) in a large sample of children with ASD from the Simons Simplex Collection (SCC). However, due to the cross-sectional nature of the dataset, causality cannot be inferred.



**Objectives:** The goal of this study is to examine whether attention problems predict change over time in motor stereotypy in children with ASD.

**Methods:** Data were collected through the Simons Simplex Collection, a permanent repository of behavioral and genetic samples from >2,600 simplex families. Our sample included 274 children ages 4-13 years who had a diagnosis of ASD and completed follow-up assessments for the measures of interest between 46-94 months after the initial study ( $M = 67.93$  months,  $SD = 11.88$  months). Stereotypy was measured using the Stereotypy Factor derived in a prior factor analysis (Russell et al., 2019) from the RBS-R. Attention problems were measured using the Attention Problems T-Score from the CBCL. Changes over time in attention problems and motor stereotypy were examined by conducting paired samples  $t$ -tests using Time 1 and Time 2 data. We used hierarchical regression to examine the association between attention problems and motor stereotypy in the follow up sample, controlling for age, sex, and IQ. In addition, we used hierarchical regression to examine the association between Time 1 attention problems and Time 2 motor stereotypy, controlling for age, sex, IQ, and Time 1 motor stereotypy.

**Results:** CBCL Attention Problems T-Scores significantly decreased from intake ( $M=66.03$ ,  $SD=10.26$ ) to follow up ( $M=64.21$ ,  $SD=10.18$ ) assessment,  $t(273)=2.96$ ,  $p=.003$ , as did the RBS-R Stereotypy Factor Scores from intake ( $M=5.89$ ,  $SD=4.10$ ) to follow up ( $M=4.11$ ,  $SD=3.69$ ),  $t(273) = 9.01$ ,  $p<.001$ . Attention problems significantly predicted stereotypy after controlling for age, sex, and IQ at Time 2 ( $p < .001$ ), replicating our previous findings from the larger sample at Time 1. However, attention problems at Time 1 did not significantly predict stereotypy at Time 2 when controlling for Time 1 stereotypy ( $p = .354$ ).

**Conclusions:** Despite a consistent relationship between attention problems and motor stereotypy in children with ASD, attention problems do not appear to play a causal role in stereotypy. Further investigation is necessary to determine the mechanisms that influence stereotypy in ASD.

#### **405.097 (Poster)** Executive Function As a Predictor of Restricted and Repetitive Behaviors (RRB) Severity in Kindergarteners with ASD

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**Background:** Past studies have found the link between restricted and repetitive behaviors (RRBs) and impairments in executive function (EF) in individuals with ASD. However, studies focusing on ecologically valid measures examining the association between RRBs and EF in everyday settings are still limited. More in-depth investigations on how varying patterns of EF skills affect specific RRBs in young children can also guide the development of early intervention targeting EF and RRBs.

**Objectives:** To examine the link between RRBs and EF measured in everyday settings using parent reports in children aged 4-5 years with ASD and matched controls.

**Methods:** Participants included 50 children (26 ASD, 15 females) (Age:  $M=64.6$  months,  $SD=5.1$ ) (NVIQ:  $M=108.8$ ,  $SD: 12.6$ ). RRBs were measured by the Repetitive Behaviors Scale-Revised (RBS-R) Total and Subscale scores. EF was measured the Behavior Rating Inventory of Executive Function (BRIEF) Total (GEC; Global Executive Composite) and Subdomain scores (CRI; Cognitive Regulation Index, BRI; Behavior Regulation Index, ERI; Emotional Regulation Index). Regression models were used to predict RBS-R Total and Subscale scores with the BRIEF GEC while controlling for cognitive skills (NVIQ), age, gender, and diagnosis. For RBS-R scores that showed significant effects of GEC, we further explored which specific BRIEF Subdomain scores were associated with those RBS-R scores. The analyses were also repeated with the ASD sample only.

**Results:** BRIEF GEC significantly predicted total RBS-R Totals (GEC;  $B=.577$ ,  $p\leq.001$ ) and Subdomain scores (Stereotyped Behavior;  $B=.088$ ,  $p=.007$ , Routine Behavior;  $B=.160$ ,  $p\leq.001$ , Sameness Behavior;  $B=.150$ ,  $p=.001$ , Restricted Behavior;  $B=.072$ ,  $p=.031$ ). For BRIEF Subdomain analyses, ERI emerged as a significant predictor of Stereotyped Behavior ( $B=.084$ ,  $p=.013$ ), Sameness Behavior ( $B=.212$ ,  $p\leq.001$ ) and Routine Behavior ( $B=.086$ ,  $p=.038$ ) and BRI for Routine Behavior ( $B=.105$ ,  $p=.026$ ). Diagnosis was also significant for all of these models ( $p<0.05$ ). When the analyses were repeated with the ASD sample only, GEC significantly predicted total RBS-R totals (GEC;  $B=.704$ ,  $p=.023$ ) and Subdomain scores (Routine Behavior;  $B=.214$ ,  $p=.005$ , Sameness Behavior;  $B=.205$ ,  $p=.026$ ). For BRIEF Subdomain analyses, BRI significantly predicted Routine Behavior ( $B=.210$ ,  $p=.024$ ) and ERI for Sameness Behavior ( $B=.319$ ,  $p\leq.001$ ).

**Conclusions:** EF deficits predict the severity of RRBs in children with ASD and their matched peers in everyday settings. Impairments in the overall EF skills are associated with both lower and higher order RRBs. Results suggest that targeting EF, specifically emotion dysregulation, could ameliorate the symptoms of RRBs in young children with ASD.

#### **405.098 (Poster)** Gain Control for Sensory Processing in Autism Spectrum Disorder

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**Background:** Psychophysical paradigms have found reduced gain control of sensory responses in Autism Spectrum Disorder (ASD), compared to typical development (TD). Gain control refers to the modulation of responses based on context or the state of an input. These findings are intriguing for biomarker development but are based on subjective reports of sensation from participants. In order to develop biomarkers that (a) capture the wide range of ages, cognitive, and linguistic abilities in ASD, and (b) can be used for translation of findings across species, it is crucial to create paradigms that do not require following instructions or specific responses from participants. Electroencephalography (EEG)-based measures are promising in this regard, as they can be passively collected across a variety of ages, developmental levels, diagnoses, and species.

**Objectives:** We develop novel EEG-based measures of gain control and evaluate them in relation to diagnosis of ASD or TD.

**Methods:** In an ongoing pilot study, we are collecting data from children aged 36-47 months with ASD (n=5) and typically developing controls (n=5), matched across groups for age and gender. EEG was recorded while our stimuli were presented. To measure gain control in the form of habituation, an auditory temporal habituation (AuTH) paradigm consisted of repeated tones. Another set of stimuli measuring auditory spatial suppression (AuSS) consisted of tones presented at varying loudness levels. Published automated pipelines and platforms were used to clean and process the EEG. Gain control was evaluated through differences in global field power (GFP) across paradigm conditions.

**Results:** We successfully created EEG-based paradigms that measure neural responses to sensory stimuli in young children. In AuTH, we found GFP decreased with successive tone repetitions. This pattern of temporal habituation occurred at different timescales in TD (148-165ms after stimulus onset) and ASD (176-212ms). In AuSS, GFP generally increased with tone loudness in both groups; however, ASD demonstrated greater GFP in response to the loudest tones.

**Conclusions:** We have developed objective EEG measures that can be used to study the neural circuitry underlying differences in sensory processing in ASD. While based on small samples thus far, our results suggest our paradigms can measure gain control in young children. Given their objective nature, these measures could be promising for back-translation into animal studies. Future studies will be conducted with larger samples to continue exploring gain control in ASD and young children, including across different modalities and forms of gain control.

#### **405.099 (Poster)** Identification and Quantification of Stereotypical Movements from Video Recordings of ADOS Assessments Using Computer Vision and Deep Learning Techniques

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#### **Background:**

Children with autism spectrum disorders (ASD) often exhibit stereotypical movements such as hand flapping and body rocking. There is ongoing debate regarding the beneficial or detrimental effects of these behaviors. For example, stereotypical movements may enable children with ASD to self-regulate in situations involving anxiety but can interfere with social communication. A key necessity for research in this domain is the ability to identify and quantify multiple types of stereotypical movements presented by different children (Figure 1). To date, quantification of stereotypical movements has been mostly estimated with binary questions regarding their general presence or absence as reported by parents or clinicians. However, identifying and quantifying stereotypical movements is critical for assessing their impact on other symptom domains and determining changes in severity over time.

#### **Objectives:**

To develop an automated algorithm that identifies video segments containing multiple types of stereotypical movements that are exhibited by children with ASD.

#### **Methods:**

We manually annotated video recordings of ADOS assessments of 250 children with ASD who participated in research at the National Autism Research Center of Israel. The recordings were marked manually by students who identified 5333 video segments with the following stereotypical movements: hand flapping (n=1091), tapping (n=573), clapping (n=334), fingers (n=187) body rocking (n=121), tremor (n=177), running back and forth (n=129), spinning (n=239), jumping in place (n=349), head movement (n=90), playing with object (n=250), toe walking (206) and other idiosyncratic types of stereotypical movements that did not fit into the categories above (n=1587).

In parallel, we used computer vision algorithms to identify and track the skeleton of the child undergoing assessment. We extracted the skeleton on each frame using the OpenPose algorithm and detected the child using a YOLO-V5 algorithm trained specifically for this task. We then applied a spatio-temporal graph convolutional network (ST-GCN) to learn the examples described above, while training the algorithm on 80% of the exemplars and testing its accuracy on the remaining 20%.

#### **Results:**

Children with ASD exhibited large heterogeneity in the number of stereotypical movements exhibited during the ADOS assessment (Figure 1). In an initial analysis we examined the accuracy of the ST-GCN algorithm in identifying video segments containing stereotypical movements. To simplify the task, we united movement classes with similar characteristics and tested the recall/identification accuracy for the following categories:

- Hand Flapping & Clapping (recall = 76.47%)
- Tapping (recall = 65.05%)
- Body Rocking & Tremor (recall = 81.43%)

- Running back and forth & spinning (recall = 73.13%)
- Head Movements (recall = 84.44%)
- None (recall = 98.36%)

We achieved top-1 accuracy of 86.95% and a top-2 accuracy of 94.67%.

#### Conclusions:

These results demonstrate the large value of applying computer vision and deep learning techniques to the quantification of ASD symptoms. We hope that the presented algorithm will be useful for both basic and clinical research focused on understanding the causes of stereotypical movements and developing treatments for reducing their severity. Further development of the algorithm will focus on improved accuracy and extending its use to other settings (e.g., home, day care, etc.).

#### **405.100** (Poster) Sensory Processing and Autistic Traits in Young Adult Females

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#### Background:

Though the ratio has fluctuated, far more males than females are currently diagnosed with Autism Spectrum Disorder (ASD; henceforth *autism/autistic*). While some have assumed autism to truly be more common in males (e.g., the Female Protective Effect), others have suggested that the diagnostic discrepancy may be due to differences in autistic trait expression between the groups, male-centric diagnostic practices, and/or enhanced camouflaging of autistic traits by females.

Few studies have examined sex differences in sensory processing and its relationship to autistic traits and other associated characteristics-i.e., anxiety, social camouflaging, and intolerance of uncertainty. While such autistic traits are commonly observed in diagnosed individuals, they are also found to varying degrees across the neurotypical population (i.e., termed the Broad Autism Phenotype; BAP). Thus, we propose that examining autistic traits in neurotypical individuals can provide insight into autistic males and females' different experiences with sensory processing and its associated behaviors.

#### Objectives:

We aimed to examine sensory processing differences between males and females and to understand its relationship with anxiety and autistic trait camouflaging in females. We hypothesized significant differences in sensory processing and its correlates between neurotypical young adult males and females.

#### Methods:

Participants were 1020 neurotypical young adults (513 female), ages 18-26 years. Subjects completed multiple questionnaires, each measuring our behaviors of interest, including sensory processing, autistic traits, intolerance of uncertainty, anxiety, and autistic trait camouflaging. One-way ANOVA was used to test differences between males and females' questionnaire scores. Furthermore, relationships between the questionnaires were calculated and compared between females and males using correlation, regression, and mediation analyses.

#### Results:

Results revealed notable differences in sensory processing and associated behaviors between males and females. For instance, these groups differed in their taste, smell, movement, visual, and auditory sensitivity, as well as their low energy sensory scores, such that females expressed more sensory atypicalities and presented with increased sensory hyperactivity than males. Furthermore, both males and females showed significant positive correlations between autistic traits and sensory processing, though they did not differ in levels of overall autistic trait expression.

We also observed significantly more anxiety in females than males in our sample, even though significant positive correlations were found between sensory processing and anxiety, and this relationship was mediated by intolerance of uncertainty similarly in both groups. Interestingly, females showed a significantly stronger association between camouflaging and anxiety.

## Conclusions:

Our findings suggest that while the overall level of autistic traits and general relationship between sensory processing and autistic traits may be similar between neurotypical females and males, sensory processing profiles might differ between these groups. In addition, our study further supports the notion that autistic traits may be expressed differently in females, in that anxiety seemed to play a larger role in female participants. Finally, according to our findings, camouflaging of autistic traits may be a significant correlate of anxiety, especially in females. Appreciating the above similarities, differences, and relationships in neurotypical individuals may improve understanding of autism in females, potentially allowing for improved diagnostic practices and supports.

**405.101** (Poster) Intolerance of Uncertainty, Sensory Processing, and Related Correlates in Autistic Children during the COVID-19 Pandemic  
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## Background:

Autistic individuals tend to show intolerance of uncertainty (IU), a trait that is significantly associated with sensory processing and anxiety. While life situations with heightened unpredictability are challenging for most, such circumstances are potentially more difficult for autistic individuals.

The COVID-19 pandemic brought great uncertainty. Circumstances such as periods of lockdown and quarantine, social distancing, mask wearing, cancellation of school/work, and isolation from or increased exposure to family and friends have led to mental health challenges.

Recent publications have shown that disruption to routines and unpredictable circumstances were particularly negative for autistic children and their caregivers during COVID. Given the association between sensory processing and IU, it's possible that increased uncertainty was associated with concomitant increases in atypical sensory processing. However, no study to date has investigated these factors and their correlates in autism.

## Objectives:

We aimed to examine the relationship between IU, sensory processing, and other correlates in autistic children during the COVID-19 pandemic using both quantitative methods and in-depth interviews. We hypothesized that COVID-19 conditions led autistic children to experience increased IU, which was associated with heightened atypical sensory processing and stress.

## Methods:

Participants were parents of 51 children with clinical diagnoses of Autism Spectrum Disorder (ASD). All participants completed a survey detailing the experiences of their household and children during the initial months of the COVID-19 pandemic. Parents also filled out the Short Sensory Profile (SSP) and the Intolerance of Uncertainty Scale (IUS-12) twice each--once as if they were filling them out pre-COVID and another as if they were in the first six months of the COVID-19 pandemic. Furthermore, ten participants took part in interviews where they gave an in-depth recollection of their experiences during the pandemic. We used quantitative analysis (repeated measures ANOVA) to compare the pre- and during-pandemic SSP and IUS-12 scores, and conducted correlation analysis to examine associations between questionnaire scores and factors such as household, parent, and child stress. Finally, we used qualitative thematic analysis to analyze interviews.

## Results:

31 participants (61.0%) presented with significantly less favorable SSP scores following the initiation of COVID ( $F=4.96; p=0.05$ ). Similarly, 28/51 subjects (54.9%) received significantly worse scores on the IUS during early vs. pre-COVID ( $F=9.56; p=0.005$ ). In contrast, those whose SSP and IUS scores improved did not show significant improvements. Additionally, atypical sensory processing during the pandemic significantly correlated with stress in autistic children, their parents, and households. Further quantitative results concerning associations between sensory processing, IU and other relevant factors, as well as insights from in-depth interviews will be discussed.

## Conclusions:

Our findings show that COVID-19 conditions were associated with increased IU and abnormal sensory processing for the majority of participants, though others presented with more favorable or equivalent scores during vs. pre-pandemic. Additionally, our findings provide evidence of a correlation between increased atypical sensory processing and stress for autistic individuals, and their families. Increasing our understanding of these factors and their associations may lead to improvements during future times of uncertainty.

#### 405.102 (Poster) Motor Skills Predict Adaptive Behavior in Children and Adolescents with Autism Spectrum Disorder

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**Background:** There is a well-documented difference between the IQ and adaptive behavior scores of children with Autism Spectrum Disorder (ASD, autistic). Specifically, autistic children often have lower adaptive behavior scores than would be predicted based on their IQ scores. There are also well-documented differences in motor skills in individuals with ASD. These findings range from differences in grasping and arm movements to static and dynamic postural control. These differences in motor skills may explain, at least in part, the variability in autistic individuals' adaptive behavior scores, even when controlling for IQ and ADOS scores.

**Objectives:** The current study aimed to determine how measures of motor skills might explain autistic individuals' low adaptive behavior scores and which individual components of IQ (i.e., verbal comprehension and perceptual reasoning) and motor skills (i.e., manual dexterity, aiming and catching, and balance) may drive this effect.

**Methods:** We tested 45 children and adolescents with ASD (Male=38, Female=7;  $M_{age}=12.30$ ,  $SE_{age}=3.48$ ,  $Range_{age}=5.18-17.80$ ). Participants were tested on the ADOS-2, MABC-2, WASI-II. Participants' guardians reported the participants' adaptive behavior abilities on the Vineland-3.

**Results:** As expected, we found a significant difference ( $M_{diff}=25.38$ ,  $t=8.91$ ,  $p<.001$ ) in the full-scale IQ mean ( $M=103.87$ ) and the adaptive behavior score mean ( $M=78.49$ ) indicating that our participants' adaptive behavior scores were lower than would be expected given their full-scale IQ. We used correlation analyses to examine the relations between participants' age and each of the variables derived from the standardized assessments (See table 1).

We investigated whether motor skills predict adaptive behavior in children and adolescents with ASD by regressing adaptive behavior scores onto full-scale IQ scores, movement total scores, and ages. Results indicated that age ( $F_{1,40}=9.76$ ,  $b=-1.59$ ,  $SE=0.51$ , Cohen's  $f^2=0.24$ ,  $p=.003$ , Figure 1) and movement total score ( $F_{1,40}=5.67$ ,  $b=1.81$ ,  $SE=0.76$ , Cohen's  $f^2=0.14$ ,  $p=.022$ , Figure 1) were related to adaptive behavior standard scores, but ADOS-2 calibrated severity scores and, as expected, full-scale IQ scores were not ( $ps>.05$ ). As participants' movement total scores increased, their adaptive behavior scores increased. As participants' age increased, their adaptive behavior scores decreased.

To further investigate these relationships, we regressed adaptive behavior scores onto age, ADOS-2 calibrated severity scores, individual component scores of full-scale IQ (i.e., verbal comprehension, perceptual reasoning), and the individual component scores of the movement total scores (i.e., manual dexterity, aiming and catching, balance). Results indicated that age ( $F_{1,37}=9.96$ ,  $b=-1.63$ ,  $SE=0.52$ , Cohen's  $f^2=0.27$ ,  $p=.003$ ) and manual dexterity standard scores ( $F_{1,37}=4.75$ ,  $b=2.12$ ,  $SE=0.97$ , Cohen's  $f^2=0.13$ ,  $p=.036$ ) were related to adaptive behavior scores. As participants' manual dexterity scores increased, their adaptive behavior scores increased. As participants' age increased, their adaptive behavior scores decreased.

**Conclusions:** Motor skills are related to autistic individuals' adaptive behavior scores. Specifically, autistic individuals' manual dexterity explains a significant proportion of the variability in their adaptive behavior scores even when controlling for ADOS, IQ, and other motor skills scores. These results are highly impactful, clearly illustrating the need for further understanding of autistic individuals' difficulties with adaptive behavior and the potential role of motor skill difficulties that may underlie, at least in part, these difficulties.

#### 405.103 (Poster) Paired Tactile Stimulation Enhances Tactile Perception in Children with and without Autism

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**Background:** Tactile difficulties are among the most prevalent sensory symptoms in Autism Spectrum Disorders (ASD). Adaptation, a mechanism by which perception is modulated by prior exposure to a stimulus, is often reported as impaired in ASD. A sub-threshold tactile pre-stimulus can modulate the response to a subsequent stimulus. The timing between pre- and test-stimuli is thought to engage different inhibitory mechanisms. We previously showed that exposure to a sub-threshold train of stimuli worsens sensory threshold in neurotypical (TDC) but not autistic children (ASD). Few studies have systematically assessed the role of stimulus-type and -timing in adaptation in ASD. Understanding these roles may inform the biology underlying altered sensory processing.

**Objectives:** 1) Investigate group differences in adaptation on detection thresholds in ASD and TDC. We hypothesized that sub-threshold pre-stimulation would worsen detection threshold in TDCs but have a more limited effect in ASD, reflecting atypical adaption. 2) Investigate the effect of interstimulus intervals; ISI (30 ms and 100 ms) to explore the effect of ISI reflecting different inhibitory mechanisms. We hypothesized ASD to have reduced effects of paired-stimulation in both ISI conditions.

**Methods: Demographics.** Twenty-four autistic children and fifty-one controls (TDC) (8-12 yrs old,  $IQ > 100$ ) took part in the study. *Psychophysical assessment of vibrotactile perception.* All stimuli (25 Hz) were delivered to the left index and left middle finger using a Cortical Metrics tactile stimulator. Two-alternative forced choice approaches were used to estimate detection threshold (Figure 1). In the baseline condition, participants were asked on which of their fingers they felt a stimulus. In the two pre-pulse conditions, the tasks were identical with the exception that the test-stimulus was preceded by a weak (3 mm) stimulus by either 30 ms (SDT30) or 100 ms (SDT100). The order in which the tasks were completed was

counterbalanced. *Analysis.* A repeated-measures two-way (2x3) ANOVA was used to test main effects of, and the interaction between, condition and diagnosis on threshold. Pearson correlations were used to examine the relationship between condition and adaptation effect on outcomes (ADOS-2 and SEQ).

**Results:** Both pre-stimulus stimulation conditions significantly enhanced detection thresholds in both groups (ASD and TDC) for both SDT30 and SDT100 conditions compared to baseline (both  $p < 0.001$ ; Figure 2). We did not find associations between adaptation effects and clinical features (all n.s.).

**Conclusions:** In prior pre-stimulus work in which a stimulus train slowly increased in amplitude, we found worse threshold in TDC but not ASD. We expected the same effect here. Contrary to our hypothesis, detection improved at short and long ISI in both groups. Strikingly, recent work in adults reports a differential impact of single (enhanced perception) versus pulse-train (worse perception) pre-stimulation, explaining our current and prior findings. This work suggests that mechanisms underlying single-pulse pre-stimulation (linked to sensory priming) are intact in ASD, whereas those associated with pulse-trains (our prior work) are altered (linked to sensory gating). Given the clinical implication of perception on sensory and social difficulties, enhancement of sensory thresholds through pre-stimulation might have useful implications for interventions.

**405.104 (Poster)** Postural Control during Preparation and Execution of Voluntary Arm Movements in Children with Autism Spectrum Disorder  
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**Background:** Motor clumsiness has often been observed in autistic individuals (Fournier et al., 2010; Bhat et al., 2011; Gowen & Hamilton, 2013). Although many studies have reported postural differences in autism spectrum disorder (ASD; Lim, et al., 2017), causal underpinnings remain unclear. A recent theoretical framework suggests that the seemingly disparate symptoms of ASD in multiple domains may share a common core: a reduced ability to make predictions (Sinha et al., 2014; Lawson et al., 2014; van de Cruys, et al., 2014; Pellicano & Burr, 2012). Since voluntary actions require anticipatory postural adjustments (APAs) to avoid perturbations to postural balance (Aruin, 2003), this study focused on postural control prior to action execution with four motor tasks that present different degrees of postural challenges.

**Objectives:** We hypothesize that children with ASD show atypical postural dynamics, specifically during motor preparation. We examined whether the postural differences depended on the degree of self-generated perturbation.

**Methods:** Fourteen children with ASD (13 males and 1 female, age 9-12 years,  $M=11.2$ ,  $SD=1.0$ , IQ (non-verbal WISC Index),  $M=107$ ,  $SD=15.5$ ) and 14 non-autistic (NA) children (11 males and 3 females, age 9-12 years,  $M=11.0$ ,  $SD=1.0$ , IQ  $M=117$ ,  $SD=9.7$ ) participated in a series of motor tasks involving the control of standing posture. Age and IQ did not significantly differ between ASD and NA. All NA and 12 of 14 ASD children participated in all four tasks. The tasks were 1) quiet standing, 2) reaching and grasping a static object (suspended ping-pong ball) at a comfortable distance, 3) same task as 2) at full arm length, and 4) rapid lifting of straight arms above the head. For the tasks that involve voluntary actions, children were instructed to move as rapidly as possible. Arm kinematics and center of pressure (CoP) were measured with 3D motion capture (Qualisys) and force plates (AMTI), respectively. When standing still, the area of postural sway was quantified as a 95% confidence ellipse of CoP. For other tasks, we analyzed reaction and movement time as well as the CoP during the preparation and execution periods. Specifically, the CoP path length normalized by net CoP displacement change served as a metric for active postural control.

**Results:** For the arm lifting task, ASD participants exhibited less active postural control during the preparation compared to the NT participants ( $p=0.024$ ), indicating reduced APA in ASD. The metric did not show a group difference during the movement execution period. Reaction and movement time did not show any significant group differences for all tasks that require voluntary actions. Postural sway during quiet standing did not show any significant group difference.

**Conclusions:** ASD children manifest atypical CoP dynamics during movement preparation specifically in the task that generated the largest perturbations. We suggest that the reduced APA may underlie postural deficits that have frequently been found in individuals with ASD. Further, the results align with studies that support the hypothesis of reduced predictive ability in autism. With this theoretical embedding, the results have implications beyond motor control towards a more encompassing understanding of autism.

**405.105 (Poster)** Quantification of Fine Motor Skills Via a Tablet-Based Video Game in Young Autistic and Neurotypical Children  
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## **Background:**

Delays in early motor abilities are common in autistic children. Evidence suggests that the presence of early motor impairments is predictive of later acquisition of language skills. Our goal was to develop a scalable assessment tool that could provide quantitative, objective metrics of early motor skills. To this end, we developed a mobile application that can be administered on a smartphone or tablet and contains a strategically designed "bubble popping" game (Figure-1a). We also examined the association between performance on this assessment tool and standardized measures of motor and cognitive skills on the Mullen Scales for Early Learning.

## Objectives:

Develop and study a developmentally-appropriate mobile game that elicits specific motor-behavioral patterns associated with pointing, motor planning and control, and repetitive and exploratory behavior. From the touch data collected by the device, we developed a set of lower-dimensional features that can potentially be used to assess behavioral patterns in children diagnosed with autism spectrum disorder (ASD).

## Methods:

This study included 214 children, separated by age into two groups matched in terms of age, IQ, and previous experience playing videogames. The younger sample, aged 18-36 months, included 151 toddlers (128 neurotypical and 23 diagnosed with ASD). The older sample, aged 48 months to 10 years, included 63 children with ASD, 32 of whom had co-occurring attention-deficit/hyperactivity disorder (ADHD). We gathered information from the touchscreen and the kinetic device sensors and engineered features that characterize the child's motion patterns in a low-dimensional space. We quantified, among others, the number of bubbles accurately popped, the popping precision, the screen exploration, and the touch speed and force (Figure-1). We studied the correlation (Spearman's) of the motor-related features with standardized measures of motor and overall cognitive ability. Then we tested the diagnostic prediction power of the most promising set of motor features.

## Results:

Combining both samples, motor features were strongly correlated with the participants' age (e.g., number of touches  $\rho=.65$ , average touch duration  $\rho=.73$ ). After correcting for age, several of the motor features remained significantly correlated with clinical measures of motor ability. Specifically, the Mullen fine motor T-score was positively associated with the popping accuracy ( $\rho=.41$ ). Furthermore, the Mullen early learning composite score was correlated with the percentage of bubble pops that were repeated ( $\rho=.41$ ). For the younger cohort, Mullen composite score was correlated with the average error ( $\rho=-0.36$ ). In the older cohort, the total score of the ADHD Rating Scale was associated with the average touch duration ( $\rho=0.40$ ) and touches frequency ( $\rho=0.39$ ). Finally, we used a machine-learning classification paradigm combining these features and demonstrated that the motor features discriminated between autistic and neurotypical toddlers in the younger cohort (Figure-2a) and between autistic children with and without co-occurring ADHD in the older cohort (Figure-2b).

## Conclusions:

We demonstrated that an attractive on-tablet game can collect information about fine motor abilities with autistic children. Specifically, we showed that the motor variables derived from the game correlate with standardized measures of motor abilities, and that a combination of them can be beneficial for assessing early fine motor skills.

### 405.106 (Poster) Reduced Autonomic Response to Pleasant Touch in ASD Children

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## Background:

Touch includes different aspects like discrimination and affective components. Affective and social touch, essential in the development of interpersonal non-verbal interactions, could be affected in some neurodevelopmental disorders such as Autism Spectrum Disorders (ASD). This affective and social touch would mainly be mediated by the tactile affective pathway, whose input is the caress-like stimulation of the C-tactile fibers (CT-fibers) of the hairy skin. In order to study affective touch in ASD patients, even with low IQ or no language, we focused on the easily accessible responses of the Autonomic Nervous System (ANS). ANS, via its parasympathetic and sympathetic branches, influences several organs and has a key role in regulating socioemotional functions. A few previous studies have shown that affective touch can evoke measurable ANS responses, however it has never been tested in ASD patients.

## Objectives:

This study aimed at measuring several ANS responses during pleasant tactile stimulation targeting the affective and/or the discriminative tactile pathways in ASD children and typically developing (TD) children.

## Methods:

We recruited twenty 6-12 years old ASD children ( $108\pm16$  months; 18 males) and twenty TD age-matched children ( $111\pm18$  months; 7 males). We performed, in a pseudo-randomized order, 10 stimulations on the forearm (high CT-fibers density) and 10 stimulations on the palm of the hand (very low CT-fibers density) with a soft texture tool. Each stimulation lasted 4 seconds, the texture moving back and forth on a 6 cm segment of skin at a 6 cm/s speed. Three ANS measures were recorded simultaneously: pupil diameter, thanks to a 500 Hz eye-tracker (SMI RED500®); skin conductance, thanks to two electrodes on the right index and medium fingers (1 kHz, BIOPAC MP36®); and heart rate, thanks to two electrodes on the sternum and right shoulder (2 kHz, BIOPAC MP36®). Participants had to look at a screen for the whole length of the procedure while staying still on the armchair.

## Results:

We discarded pupil data in eleven ASD children due to head movements and SCR in one ASD child due to excessive hand movements. The two different sites of stimulation (affective/discriminative pathways) did elicit differences in pupil and SCR parameters in TD children, while no pupil, SCR or cardiac parameter was affected in ASD children. Comparison between ASD and TD children revealed that our pleasant stimulation evoked a heart rate deceleration, larger in TD than in ASD children ( $p < 0.01$ ). We also found a reduced SCR latency ( $p < 0.05$ ) and larger SCR amplitude ( $p < 0.01$ ) in TD compared to ASD children. The small sample of ASD children with a pupil recording prevented any significant statistical analysis, even if pupil dilation following the tactile stimulation seemed reduced in ASD compared to TD children.

## Conclusions:

Overall, we observed a diminished ANS reactivity to pleasant tactile stimulation in ASD compared to TD children, whether the stimulation targeted the more affective or more discriminative tactile pathway. We showed that accessible ANS measures in children could be relevant to characterize affective touch processing in children with ASD.

### **405.107 (Poster)** Relationship between Sensory Processing and Behavioral and Physiological Distress during Routine Dental Cleanings in Children with Autism Spectrum Disorder

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**Background:** Oral care is an essential part of pediatric health; when untreated, poor oral health can lead to pain, infection, and difficulty with eating, speaking, and sleeping. However, children with autism spectrum disorder (ASD) exhibit a higher incidence of poor oral health and are at greater risk for developing dental disease. Likewise, they experience significantly more challenges in the access and receipt of dental care. Many of these challenges have been linked to sensory over-responsivity, which is commonly experienced in this population. However, the majority of these studies have utilized parent-report measures to assess the relationship between sensory over-responsivity and oral care challenges, with few studies directly measuring challenges in situ.

**Objectives:** To examine the relationship between sensory sensitivities and behavioral and physiological distress experienced during routine dental cleanings in children with ASD.

**Methods:** As part of a larger randomized control trial, 162 ethnically diverse children with ASD between 6-12 years old received a dental cleaning. Prior to the cleaning, parents completed the Sensory Over-Responsivity Inventory (SensOR) to assess participants' sensory processing. Electrodermal activity, as a measure of physiological stress and anxiety, was collected from the child throughout the entire dental cleaning. To assess behavioral distress, dentists completed the Frankl Scale and Anxiety and Cooperation Scale immediately following the cleaning; researchers used the Children's Dental Behavior Rating Scale (CDBRS) to score behavioral distress from video-recordings at a later date. Multiple mixed effects linear regression models were run with each electrodermal and behavior variable at each dental visit as the dependent variables, crossed with each sensory measure as measured at baseline as independent variables. Additional independent variables in each model were age at sensory assessment, age at dental visit, and first vs. second dental visit. Variables were rank-scored to allow for non-normally distributed data, and standardized so that the beta estimates would represent partial correlation coefficients.

**Results:** Sensory over-responsivity was significantly correlated with behavioral and physiological distress. Specifically, the SensOR Inventory total score was correlated with behavioral distress as measured by the Frankl Scale ( $r = -.19$ ,  $p = .01$ ), the Anxiety and Cooperation Scale ( $r = .20$ ,  $p = .008$ ), and the CDBRS total score ( $r = .17$ ,  $p = .02$ ), as well as physiological distress measured by electrodermal activity ( $r = .21$ ,  $p = .006$ ); significant correlations were also found between behavioral and physiological distress and the individual SensOR Inventory subtests Tactile, Self-care, Sensations, Auditory, Visual, and Olfactory.

**Conclusions:** Sensory over-responsivity is linked to the experience of behavioral and physiological distress in children with ASD during routine dental cleanings. These findings provide insight into the potential for sensory-related interventions to improve dental care for children with ASD.

### **405.108 (Poster)** Relationships between Age and Diagnostic Status on the Presence of Restricted Interests in Toddlers with ASD, Developmental Delay, and No Delay

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**Background:** Highly restricted or fixated interests are symptomatic of a diagnosis of autism spectrum disorder (ASD); however, the presence of restricted interests is normative in early childhood (DeLoache et al., 2007). Research suggests that children with ASD display more frequent restricted interests compared to developmentally delayed (DD) and typically developing (TD) peers around 24 months of age, and that these interests differ in nature and intensity in later childhood (Richler et al., 2007; Turner-Brown et al., 2011). Although caregivers more frequently endorse restricted interests in toddlers with ASD compared to those with DD and TD across early childhood (Coulter et al., 2021a), our understanding of the specific relationships between age, diagnosis, and the presence of restricted interests is limited.

**Objectives:** This analysis aims to explore the relationships between age and diagnostic classification (ASD, DD, or TD) on the presence of restricted interests.



**Methods:** Participants were caregivers of 294 toddlers aged 12-36 months ( $M=19.20$ ) who received a developmental/diagnostic evaluation due to a positive screener or pediatrician concern. Of these children, 72 were diagnosed with ASD, 131 were DD, and 91 were TD. A semi-structured interview, the Toddler Autism Symptom Inventory (TASI; Coulter et al., 2021b), was completed with caregivers during the evaluation. Two questions from the TASI were utilized to determine presence of restricted interests in participating toddlers; (a) “Is there anything that your child seems interested in that seems like all he/she wants to do?” and (b) “Does your child enjoy carrying around or playing with items that differ from most children his/her age?”. Participants were coded as either endorsing the presence of restricted interests or not endorsing based on caregiver response to either or both questions.

**Results:** A two-way ANOVA was conducted to examine the relationships between age and diagnostic classification (ASD, DD, or TD) on the presence of restricted interests. Analysis revealed that there was no statistically significant interaction between age and diagnostic classification on the presence of restricted interests,  $F(26, 243) = .626, p = .923$ . Simple main effects analysis showed that diagnostic classification had a statistically significant effect on the presence of restricted interests ( $p < .001$ ) though age did not ( $p = .638$ ).

**Conclusions:** While diagnosis is related to the presence of restricted interests, no interaction between age and diagnostic classification was found. Results suggest that restricted interests are present from a very young age for all diagnostic classifications but are more frequently endorsed in children diagnosed with ASD, regardless of age. This finding does not support the idea that restricted interests emerge or become characteristic of ASD after 24 months of age. Given the normative presence of restricted interests in very early childhood, future analysis should examine longitudinal changes in the intensity and development of restricted interests across early to late toddlerhood.

#### **405.109 (Poster) Sensory Gating in Neurodevelopmental Disorders: A Scoping Review**

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##### **Background:**

Sensory gating refers to the ability to automatically filter out irrelevant or redundant sensory information from our environment. Without this ability, individuals would be continually overwhelmed with a constant influx of information from their sensory organs including their eyes, ears, nose, and skin, etc. Sensory gating issues have been commonly reported in a number of neurodevelopmental disorders including, not only autism spectrum disorder, but also attention-deficit/hyperactivity disorder, childhood-onset fluency disorder, and tic disorders. The extent to which sensory gating has been studied within and between these neurodevelopmental disorders remains unclear.

##### **Objectives:**

This review aims to explore the current understanding of sensory gating in neurodevelopmental disorders as a possible transdiagnostic mechanism.

##### **Methods:**

We applied methods according to the Joanna Briggs Institute Manual for Evidence Synthesis, following the population, concept, and context, scoping review eligibility criteria. Using a comprehensive search strategy in five relevant research databases (Medline, EMBASE, CINAHL, PsychInfo, and Scopus), we searched for relevant primary research articles that included one of the four neurodevelopmental disorders of interest, such as autism spectrum disorder, and used a measure of sensory gating. Two independent reviewers screened the titles and abstracts, full texts, and completed data extraction.

##### **Results:**

We identified a total of 122 relevant articles and used descriptive analyses to summarize the characteristics and outcomes of all identified studies. Sensory gating was assessed with a variety of measures including prepulse inhibition, habituation, affect-modulated startle, observational measures, and self report. Assessment tools included electromyography, electroencephalography, skin resistance changes, functional near-infrared spectroscopy, respiratory response, and functional magnetic resonance imaging. Overall, the results were very mixed such that study methodologies and participant characteristics impacted the findings in studies of all four clinical groups of interest.

Of the 122 relevant articles found, 49 included ASD as the population of interest and the sample ages spanned the life course. Evidence supports reduced habituation in autistic children and other sensory gating measures were often dependant on key characteristics of the study (e.g. the volume of the startle stimulus or the interstimulus interval) or the samples (e.g. anxiety levels or degree of sensory sensitivity). Overall, we found that the majority of studies supported intact sensory gating in autistic adults. The two areas that are still under contention include habituation and affect-related startle responses. Neurotypicals commonly experience habituation to repeated stimuli and an inhibited startle response following pleasant photos, whereas the startle response of autistic participants was not inhibited in either scenario.

##### **Conclusions:**

Overall, the evidence is inconsistent within and between disorders suggesting there is still much to learn about sensory gating in neurodevelopmental disorders. Within autism, there is evidence to suggest that sensory gating improves into adulthood; however, there appears to be specific conditions and subgroups within the autistic population that could benefit from additional study in this area.

#### **405.110 (Poster) Impact of Sensory Functioning on School Performance and Social-Emotional Outcomes**

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**Background:** Exteroceptive and interoceptive sensory processing differences are common in ASD and occur at behavioral, perceptual, and neural levels. These sensory differences may have implications for social, emotional, and occupational outcomes.

**Objectives:** To characterize interoceptive and exteroceptive sensory differences in ASD, their relationship with school performance and social-emotional traits, and their underlying neural mechanisms.

**Methods:** We compared youth aged 8-17 years with ASD to typically developing (TD) youth on sensory processing measures with: school performance ( $N_s = 26$  ASD, 26 TD), social-emotional measures ( $N_s = 35$  ASD, 40 TD), and neural responses to facial expressions ( $N_s = 28$  ASD, 37 TD). Assessments included: self or parent-reported measures of 1. *sensory/interoceptive*: a) The Short Sensory Profile 2 (SSP-2), b) Body Awareness Very Short Form (BPQ-VSF), c) interview of bodily sensation when describing emotional experience (BSE), d) physiological hyperarousal (PH-C) 2. *social-emotional*: a) Alexithymia Questionnaire for Children (AQC), b) Interpersonal Reactivity Index (IRI), and 3. *School performance*: a) Child Behavior Checklist School Competence Scale (CBCL-SCS) variables. During fMRI, children observed videos of facial expressions in the scanner. Parameter estimates were extracted from regions of interest associated with interoception and emotional empathy (anterior insula [AI], anterior cingulate [ACC], amygdala, and pars opercularis [IFGop]). Analyses included: Independent samples t-tests, Pearson correlation, and stepwise and hierarchical multiple linear regression.

**Results:** Compared to TD, the ASD group had increased SSP-2 scores, PH-C, and alexithymia; and decreased CBCL-SCS ( $p$ 's < .05); there were no group differences in interoception (BPQ-VSF or BSE) or emotional empathy (IRI). In the ASD group, an interaction between increased sensory sensitivity and reduced sensory avoidance behaviors explained the greatest amount of variance in CBCL-SCS, even after controlling for age, IQ, and ADHD symptoms. In the TD group, PH-C was positively correlated with personal distress (IRI;  $p = .027$ ) and alexithymia ( $p = .027$ ). In the ASD group, higher BSE correlated with lower personal distress (IRI;  $p = .026$ ) and alexithymia ( $p = .046$ ). However, we found a *negative* relationship between BPQ-VSF and activity in the amygdala, AI, and IFGop in the ASD group, and between the PH-C and the amygdala in the TD group. Conversely, BSE had a positive relationship with AI activity in the ASD group.

**Conclusions:** In youth with ASD, sensory processing strongly impacts school performance, with greater hypersensitivity and fewer avoidance behaviors relating to lower school performance. For the ASD group, while there is no evidence of reduced interoceptive ability (BPQ-VSF) at the group level, reduced awareness of interoceptive information during emotion experience (BSE) was related to greater alexithymia and personal distress. Neural and behavioral data suggests that in the ASD group, BPQ-VSF may index maladaptive symptoms of self-focused interoception more consistent with physiological hyperarousal than with interoceptive accuracy. Conversely, the interview method (BSE) may index interoceptive sensibility that promotes positive outcomes of attention to bodily signals (lower personal distress, lower alexithymia, greater AI activation). Our results point to the need for targeted interventions for children with ASD depending on their level of sensory sensitivity, self-regulation, physiological arousal, and interoception.

#### **405.111 (Poster) Sensory Reactivity Patterns Predict Variation in Restricted and Repetitive Behaviors in Non-Autistic Children**

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**Background:**

Restricted and repetitive behaviors (RRB) are core criteria in ASD diagnosis and can manifest in a variety of ways. Studies have examined the relationship between sensory reactivity and RRB in autistic children and found that hyper-reactivity to sensory input is associated with more RRB (e.g., Boyd et al., 2010) and RRB can be predicted from both hyper- (Schulz & Stevenson, 2019) and hypo-reactivity (Gal et al., 2010). Because sensory reactivity and RRB can be found in the general population, and can have detrimental developmental outcomes including difficulties in adaptive behavior (e.g., Dunn et al., 2016), studies have examined this relationship in non-autistic children, taking the broader autism phenotype (BAP) approach. In non-autistic children, sensory reactivity and RRB were associated (e.g., Feldman et al., 2020), and hyper-reactivity predicted specific RRB subtypes (Schulz & Stevenson, 2019). However, because different sensory reactivity patterns can co-exist in children, it is important to understand how specific sensory pattern combinations might underlie the different RRB subtypes.

**Objectives:**

The current study aims to examine how different sensory reactivity patterns predict variation in RRB subtypes in the BAP.

**Methods:**

The current sample included 52 non-autistic children ( $M_{age} = 6.59$  years,  $SD = 2.50$ , Range: 2.67-11.67). As part of a larger study, parents filled out the Repetitive Behavior Scale-Revised (RBS-R; Bodfish et al., 1999) to assess RRB and the Sensory Experiences Questionnaire (SEQ; Baranek et al., 2006) to measure sensory reactivity patterns. Total RBS-R score and the six subscale scores (stereotyped, self-injurious, compulsive, ritualistic,

sameness, restricted) were calculated as well as SEQ total and sensory response pattern scores (hypo-reactivity, hyper-reactivity, and sensory seeking).

#### Results:

Regression analysis with RBS-R total as the dependent variable and SEQ total as the independent variable showed that RRB were significantly predicted from sensory reactivity ( $F(1,50) = 32.90, p < .001, R^2 = .40$ ). A follow-up regression examined the three sensory response scores as independent variables and results showed that hypo- ( $B = 4.92, p < .001$ ) and hyper-reactivity ( $B = 4.78, p < .001$ ), but not seeking ( $p = .35$ ), significantly predicted RRB. Next, a series of regression analyses examined SEQ total score as a predictor of each of the six RBS-R subscales, and significant models were then followed up with a model using the three sensory response scores as independent variables. Results showed that SEQ total predicted all RBS-R subscales except compulsive. When examining contributions of the sensory response pattern scores, both hypo- and hyper-reactivity predicted stereotyped, ritualistic, and sameness behaviors, and hypo-reactivity and sensory seeking predicted self-injurious and restricted behaviors (see Table 1).

#### Conclusions:

The current study expanded on past work (Gal et al., 2010; Schulz & Stevenson, 2019) and found that different combinations of sensory reactivity patterns predicted different RRB subtypes in non-autistic children, with hypo-reactivity being the most influential sensory pattern (predicting five of the six RRB subtypes), and hyper-reactivity and sensory seeking predicting a smaller number of RRB subtypes. Future work will examine physiological markers that might play a role in mediating the relationship between sensory reactivity and RRB.

#### **405.112 (Poster)** Sensory Symptoms and Internalizing Behaviors in Young Adults and Adolescents with Current ASD, History of ASD, and Typical Development

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#### Background:

Sensory symptoms are one manifestation of the repetitive or restricted behaviors that are a core diagnostic feature of autism spectrum disorder (ASD). Up to 95% of individuals with ASD exhibit atypical responses to sensory stimuli (Tomcheck & Dunn, 2007), which are typically classified as sensory over-responsivity (SOR), sensory under-responsivity (SUR), or sensory seeking (Miller et al., 2009). Sensory symptoms are thought to have a cascading effect on development across many domains, with particularly strong associations with internalizing behaviors (Green et al., 2012). Studies of individuals with a clear history of ASD who *lose* the ASD diagnosis (LAD) report residual deficits due to internalizing conditions, such as anxiety and depression (Orinstein et al 2015; Fein et al., 2013). However, studies of LAD to date have not probed for the presence of sensory symptoms, and their association with internalizing behaviors.

#### Objectives:

This study measured the presence of sensory symptoms in adolescents and young adults with LAD, current ASD, and typical development (TD) and investigated associations with concurrent internalizing behaviors.

#### Methods:

Data were collected from adolescents and young adults in three groups: LAD [ $n=19$ ;  $M(SD)$  age=23.2(3.2) years]; ASD [ $n=16$ ; 19.9(4.9)]; and TD [ $n=10$ ; 21.9(4.3)]. The Sensory Reactivity in Autism Spectrum (SR-ASD; Elwin et al., 2016) measured total sensory symptoms, SOR, SUR, and sensory seeking. Internalizing behaviors were assessed via parent report with the Achenbach System of Empirically Based Assessment (ASEBA; Achenbach, 2009). Groups did not differ on age or gender. One-way ANOVAs with planned comparisons were conducted to assess diagnostic differences in sensory symptom clusters and internalizing behaviors. Linear regressions probed whether sensory symptoms predicted concurrent internalizing behaviors, above and beyond diagnostic group.

#### Results:

Groups differed in total sensory symptoms and sensory over-responsivity (Table 1). Planned  $t$ -tests revealed significantly more sensory symptoms in all clusters for ASD compared to TD, with large effect sizes (Sensory Total  $d=1.12$ ; SOR  $d=1.03$ ; SUR  $d=0.89$ ; Seeking  $d=0.84$ ). LAD/TD and LAD/ASD group comparisons did not differ. Groups also differed in internalizing behaviors (Table 1); planned comparisons showed that the ASD group exhibited more internalizing behaviors than LAD ( $d=1.21$ ) and TD ( $d=1.68$ ) with large effect sizes; LAD/TD did not differ. Regression analyses indicated that total sensory symptoms, sensory over-responsivity, and sensory seeking predicted concurrent internalizing behaviors while controlling for diagnosis (which did not account for significant additional variance); Table 2.

#### Conclusions:

Sensory symptoms were compared for adolescents and young adults in LAD, ASD, and TD groups. The ASD group exhibited significantly more sensory symptoms than TD; the difference between ASD and LAD groups was not significant, suggesting that participants in the LAD group may still experience subclinical sensory symptoms. The presence of sensory symptoms predicted concurrent severity of internalizing behaviors above and

beyond diagnosis, consistent with findings suggesting that sensory symptoms may contribute to and exacerbate internalizing problems in typical and clinical populations (Istvan, Nevill, & Mazurek, 2020; Green et al., 2012; Ben-Sasson et al., 2009). With data collection underway, future analyses will examine within- and between-group associations of sensory symptoms and internalizing behaviors.

**405.113 (Poster)** The Development and Implementation of an Anonymous Survey to Measure Caregiver Satisfaction with Sensory Interventions for Children with Autism and Related Conditions

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**Background:** Sensory reactivity symptoms are present in many individuals with autism spectrum disorder (ASD) and are incorporated into the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> Edition (DSM-5) under the Restricted and Repetitive Behaviors domain. The DSM-5 defines sensory symptoms along three dimensions: (1) hyperreactivity, (over-responsiveness), (2) hyporeactivity (under-responsiveness) and (3) sensory seeking, each of which can occur across multiple sensory modalities. Sensory-based interventions are commonly prescribed by occupational therapists and psychologists in the treatment of children with autism and related neurodevelopmental disorders (NDDs). However, there are currently no evidence-based interventions for this population, particularly those with cognitive impairment.

**Objectives:** To examine caregiver satisfaction with various sensory interventions for children with autism and related NDDs.

**Methods:** The most commonly used interventions by sensory domain (visual, auditory, tactile) were identified according to published literature and mainstream sources. A survey was structured to capture sensory preferences based on DSM-5 criteria, with options for characterizing a child with up to two types of sensory symptoms. For each sensory domain, caregivers were asked to select the interventions they had implemented with their child from a list of options. Caregivers were then asked to rate how well the identified interventions worked for their child using a 4-point scale (Never = 1, Sometimes = 2, Usually = 3, Always = 4).

**Results:** Responses for 75 individuals ages 2 to 17 (35 female,  $M_{age} = 9.4$ ) have been collected to date. Of those 75 participants, 46 were reported to have ASD (54% with intellectual disability) and 29 to have a related NDD (22% with intellectual disability). In terms of sensory preferences, caregivers reported the most seeking behaviors (69%), followed by hyperreactivity (49%) and hyporeactivity (20%). Preliminary results indicated that the most-utilized interventions in the visual domain were visual supports (e.g., visual schedules) (27%,  $N=20$ ), sunglasses (17%,  $N=13$ ), and desk partitions (12%,  $N=9$ ). In the auditory domain, the use of noise-cancelling headphones were reported by the greatest number of caregivers (37%,  $N=28$ ), followed by calming/preferred music (27%,  $N=20$ ), and music therapy (23%,  $N=17$ ). In the tactile domain, most caregivers indicated that they used fidget tools with their child (57%,  $N=43$ ), followed by tactile exploration (43%,  $N=32$ ), and massage/touch pressure (41%,  $N=31$ ). Most caregivers reported that the intervention *sometimes* (2) worked for their child for all of the interventions above, except for massage/touch pressure strategies, which most parents reported *usually* (3) worked for their child. Of all of the interventions, the lowest-rated were in the tactile domain, including brushing protocols ( $M=1.72$ ), compression vests ( $M=1.74$ ), and weighted vests ( $M=1.9$ ). The highest-rated were in the auditory domain, including calming or preferred music ( $M=2.85$ ), white noise machines ( $M=2.8$ ), and noise-cancelling headphones ( $M=2.79$ ).

**Conclusions:** Results indicate the caregivers of children with ASD and NDDs utilize a variety of sensory interventions across multiple sensory domains, most of which they perceive as only sometimes working for their child. Future research should evaluate existing sensory interventions in this population using rigorous methodology, such as randomized control trials (RCTs), to validate them as treatment options.

**405.114 (Poster)** The Predictive Relationship between Sensory Reactivity and Depressive Symptoms in Young Autistic Children with Few to No Words.

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**Background:** Depression, much like other mental health conditions, is common in autism, with autistic individuals much more likely to be diagnosed than their non-autistic peers. Sensory reactivity differences are also commonly experienced by autistic individuals and have been associated with depressive symptoms. However, there is little understanding of the predictive relationship between sensory reactivity and depressive symptoms, or the nature of this relationship in autistic children who speak few to no words.

**Objectives:** This study set out to explore the longitudinal relationship between sensory reactivity and depressive symptoms in young autistic children who speak few to no words over two timepoints.

**Methods:** 33 young autistic children (aged 3-5 at timepoint 1) who spoke few to no words, and who completed Module 1 of the ADOS-2, participated in this study. Parent-report measures of sensory reactivity (SPSI) and depressive symptoms (BASC-3) were given at timepoint 1 and at a 12 month follow up. Correlational analysis and regressions were used to analyse the data.

**Results:** We found positive correlations between depressive symptoms and hyper-reactivity and sensory seeking at both timepoints. We further found a bidirectional predictive relationship between depressive symptoms and sensory seeking.

Conclusions: These results implicate sensory seeking in the development of depressive symptoms in young autistic children who use few to no words. Our findings have important implications for preventative mental health interventions, especially for those with a developmental language delay.

**405.115 (Poster)** The Role of Sensory Processing in Feeding Challenges for Young Autistic Children and Contributions to Family Goals

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Background: Feeding challenges effect up to 84% of all autistic children, putting them at high risk of detrimental impacts on their health and development (Leader et al., 2020). In addition, feeding challenges can impact overall family wellbeing and create barriers to child engagement in mealtime. Common autistic feeding challenges include severely limited diet from food selectivity, sensory aversions to food properties, rigid mealtime routines, and difficulty participating in family mealtimes.

Objectives: Examine the role of sensory processing in feeding challenges, mealtime experiences, and functional feeding goals set by caregivers in the context of a caregiver-mediated feeding intervention.

1. Identify the relationship between parent-report sensory features and types of feeding challenges in young autistic children.
2. Characterize how sensory-based feeding concerns relate to child goals and parent concerns.

Methods: 396 families completed a survey related to feeding challenges in autistic children. A subset of those families, n=26 caregiver-child dyads, participated in the Engaged Eaters Program, a six-month caregiver-mediated in-home feeding intervention. Children were between 2 and 7 years, had a diagnosis of autism and caregiver reported feeding challenges. The Sensory Experience Questionnaire 3.0 (SEQ) was used to assess the child's overall sensory processing, the Feeding and Eating in Autism Together (FEAST) was used to assess feeding challenges, and for the families in the Engaged Eaters Program, three goals were collaboratively developed as intervention goals. All goals were developed and scaled using GAS to allow for progress measurement and comparison across families.

Results: Correlations were calculated between FEAST area of feeding challenge (i.e., Sensory, Behavior, Oral Motor, and Health) subscale scores and SEQ 3.0 sensory pattern (i.e., sensory hyperresponsiveness [HYPER], sensory hyporesponsiveness [HYPO], sensory interests, repetitions, and seeking behaviors [SIRS], and enhanced perceptions [EP]) subscale scores. Moderate to large significant correlations were identified between the FEAST Sensory subscale and HYPER ( $r=.507$ ,  $p < .001$ ) and EP ( $r=.302$ ,  $p < .001$ ); Behavior subscale and SIRS ( $r=.500$ ,  $p < .001$ ), HYPO ( $r=.438$ ,  $p < .001$ ), and HYPER ( $r=.404$ ,  $p < .001$ ); and Oral Motor subscale and HYPO ( $r=.337$ ,  $p < .001$ ). A simple linear regression was calculated to predict overall FEAST feeding challenge severity score based on overall SEQ 3.0 severity score. A significant regression was found ( $F(1,398) = 178.172$ ,  $p < .001$ ) with an  $R^2$  of .309. All 26 families had one goal (n=26) focused on expanding their child's repertoire of age-appropriate portion accepted foods. The remaining 52 family goals included the families' primary areas of concerns and were categorized into distinct focus areas (i.e., increased food flexibility, nutrition, oral motor, mealtime routines, self-help skills, and rigid eating behaviors).

Conclusions: Sensory processing plays a clear role in young autistic children's feeding and mealtime challenges. While sensory patterns differentially, contribute to various types of feeding challenges (i.e., OM, Behavior, and Sensory-based). Understanding the underlying contributors to the heterogeneous feeding challenges can help identify appropriate intervention targets to facilitate mealtime participation. In addition, the variety of family priorities and related feeding goals demonstrate that although sensory processing is a critical component of feeding, how it manifests in daily living may be variable.

**405.116 (Poster)** Towards Better Characterization of Circumscribed Interests in Children and Adolescents with Autism

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Background: Circumscribed interests (CI) are complex and heterogeneous, encompassing interests that, while typical in topic (e.g., interests in mathematics, arts or TV shows), are intense in terms of focus and/or inflexibility, henceforth labelled restricted interests (RI), and interests that are atypical in topic (e.g., road signs or dates), henceforth labelled unusual interests (UI). Although previous studies have demonstrated the high prevalence of RI and UI in autism, they were limited by sample size and almost exclusively focused on individuals in the normative IQ range, thus limiting the generalizability of findings and insights into the relationship between RI and UI with demographic, cognitive, and clinical variables.

Objectives: This study aimed to investigate prevalence and type of RI and UI as measured by the Dimensional Assessment of Restricted and Repetitive Behaviors (DARB), a novel comprehensive measure of distinct RRB subdomains, in a large, well-characterized sample of children and adolescents with autism that spanned over a broad spectra of cognitive functioning. It further aimed to characterize the pattern of associations between RI and UI with age, sex, IQ, and social and communication impairments (SCI).

Methods: Parents of 1892 children and adolescents with autism ( $M = 10.82$ ;  $SD = 4.14$ ; 420 females) recruited from the Simons Foundation Powering Autism Research for Knowledge (SPARK) database completed the DARB, as a measure of RI and UI and the Social Communication Questionnaire, as a measure of SCI. Data on children's IQ was also collected.

Results: 98.1% (n=1856) of participants demonstrated at least one RI, whilst 85.5% (n=1618) demonstrated at least one UI. The most common RI were interests related to technology, music, and TV shows and movies (endorsed by 81.8%, 80.4% and 78.9% of participants, respectively), whilst the least common RI were interests in psychology (11.3%) and watching sports (19.6%). The most common UI were attachment to a specific object

(53.1%) and fascination with a specific visual aspect of an object (48.1%), whilst the least common were fascination with a specific number (12.4%) and fascination with categorization (16.5%). Two regression models were used to characterize the effects of age, sex, IQ, and SCI on RI and UI scores. The regression model for RI was significant,  $F=13.70$ ,  $p<.001$ , with age ( $\beta=.085$ ,  $p=.001$ ), sex ( $\beta=.072$ ,  $p=.003$ ), IQ ( $\beta=.068$ ,  $p=.008$ ), and SCI as ( $\beta=-.094$ ,  $p<.001$ ) as unique predictors. The regression model for UI was also significant,  $F=7.66$ ,  $p<.001$ , with age ( $\beta=-.067$ ,  $p=.014$ ) and SCI ( $\beta=.123$ ,  $p<.001$ ) as unique predictors.

**Conclusions:** Current findings further emphasise the prevalence and diversity of RI and UI. Interestingly, RI were even more frequent in the current sample than has been reported in previous studies. However, the intensity of preoccupation with these interests is not clear. Importantly, RI and UI showed distinct patterns of relationships with key demographic, cognitive and clinical variables. This may suggest distinct processes underlying RI and UI and demonstrates the need for further research characterising the full range of CI behaviours and their mechanisms.

**405.117 (Poster)** Unsupervised Stratification of Motor Behavior in Autism Isolates a Subtype with Enhanced Motor Noise  
**V. Mandelli<sup>1,2</sup>, I. Landi<sup>3</sup>, S. Busti Ceccarelli<sup>3</sup>, M. Molteni<sup>4</sup>, A. Crippa<sup>4</sup> and M. V. Lombardo<sup>5</sup>,** (1)Center for mind/brain sciences - CIMEC, Centre for Mind Brain Sciences (CIMEC), University of Trento, Italy, Trento, Italy, (2)Center for Neuroscience and Cognitive Systems, Laboratory for Autism and Neurodevelopmental Disorders, Istituto Italiano di Tecnologia, Rovereto, Italy, (3)Scientific Institute, IRCCS Eugenio Medea, Bosisio Parini, Italy, (4)Department of Psychology, University of Milano-Bicocca, Milano, Italy, (5)Center for Neuroscience and Cognitive Systems, Istituto Italiano di Tecnologia, Rovereto, Italy

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**Background:** Considerable variability exists within the domain of motor development in autism. Motor delays are commonly associated with poorer developmental outcomes and quality of life. Early identification of subtle motor issues could improve phenotypic characterization and planning intervention. At a neurobiological level, many highly penetrant mutations linked to autism also co-occur with substantial motor issues. Many of these genetic causes of autism are also known to dysregulate excitation-inhibition (E:I) imbalance. A downstream consequence of E:I imbalance may be higher levels neural noise in motor cortex that then translate behaviorally into enhanced motor noise, operationalized as enhanced variability in executing actions. The hypothesis examined is whether a subtype exists within autism that shows pronounced motor difficulties on standardized clinical assessments of motor proficiency that also show enhancements in motor noise measured with motor kinematics data

**Objectives:** We aimed to used unsupervised clustering techniques to isolate replicable motor subtypes in autism from simple standardized clinical assessments of motor behavior. Moreover, we looked to fine-grained motor kinematics data to test whether motor subtypes differ in levels of motor noise while executing an upper-limb motor task.

**Methods:**  $n=156$  autistic children aged 3–16-year-old were assessed with the Movement Assessment Battery for Children – 2<sup>nd</sup> edition (MABC-2).  $n=94$  individuals were recruited at a research hospital in Italy (IRCCS Medea), while another  $n=62$  individuals were identified as having MABC-2 data in the National Database for Autism Research (NDAR). To understand whether subtypes could be isolated with unsupervised clustering techniques (e.g., k-means), we use a relative clustering validation framework called *reval* to identify optimal number of clusters and test for reproducibility of clustering solutions in independent data (Landi et al., 2021). Input features to *reval* were standardized scores from the 3 MABC-2 subscales (Manual Dexterity, Aiming and Catching, Balance). A subset of  $n=70$  children recruited at IRCCS Medea performed 10 trials of a *reach-to-drop* task (Forti et al., 2011) while kinematic data were acquired using an optoelectronic system. To measure motor noise, we used a multivariate dynamic time warping (DTW) algorithm to compute the pairwise distances between movement trajectories across the 10 trials in the *reach-to-drop* task. Median distance from DTW was then used to summarize motor noise, with larger distances between trials as indicating high levels of motor noise.

**Results:** *reval* was able to identify 2 motor subtypes as the optimal clustering solution, which achieved a reproducibility accuracy on an unseen test dataset of 89%. These subtypes were highly differentiated by motor noise with the highly impaired motor subtype showing the largest levels of motor noise ( $t=3.2$ ;  $p=0.002$ ; Cohen's  $d=0.77$ ).

**Conclusions:** Autism motor subtypes can be isolated with unsupervised clustering techniques applied to motor profiles present in standardized clinical assessments. Individuals with high levels of motor impairment were those that also showed high levels of motor noise. This result indicates that E:I imbalance may be a particular issue in motor cortex for these individuals. These subtypes may be important for future work on how more personalized early intervention focused on the motor domain may help improve outcomes.

**405.118 (Poster)** Using Both Explicit and Implicit Emotional Responses to Taste Cues for Understanding Taste Preferences Among Autistic Children.

**A. Singh and H. S. Seo, Food Science, University of Arkansas, Fayetteville, AR**

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**Background:**

Autism spectrum disorder (ASD) is associated with significant sensory challenges that influence feeding behavior, leading to inadequate nutritional balance. In addition to sensory characteristics of food, food evoked emotions have been shown to affect our eating behavior in terms of liking, satiation, sensory characteristics, and the amount of food consumed. Thus, to understand food choice, it is important to examine both sensory and emotional responses of autistic children towards food. Since some autistic children might have difficulties in the expression and understanding of emotions, it is imperative to identify easy methods of emotional measurements.

**Objectives:** The objective of this study was to compare explicit and implicit measurements of emotional responses of autistic children to taste stimuli.

**Methods:** Fifteen autistic children (1 Female; Mean age  $\pm$  SD = 10  $\pm$  2 years) participated in this study. They were given five basic taste solutions: salty (0.44% w/v Sodium Chloride), sweet (7% w/v Sucrose), sour (0.11% w/v Citric Acid), and bitter (0.11% w/v Caffeine and 0.006% w/v Quinine Hydrochloride). The liking and intensity ratings for taste solutions were measured using the 9-point P & K scale ranging from 1 (super bad/ super weak) to 9 (super good/ super strong). To measure implicit taste evoked emotional responses toward the taste solutions, facial expression analysis was used. Explicit emotional responses, a list of 33 emojis were presented in a check-all-that-apply format.

#### Results:

Participants showed a higher liking towards the sucrose solution, as compared to the remaining 4 solutions, with sucrose being the only basic taste that received a liking rating. Interestingly, no difference in the intensity perception was seen between the 5 taste solutions. A biplot of Principle Coordinate Analysis showed that roughly 61% of the variation in the data could be explained by liked vs disliked taste solutions (Figure 1). Sucrose solution was associated with positive valence emojis, whereas caffeine, quinine, and sodium chloride solutions were more associated with negative valence emojis. Correlation analyses showed that frequencies of selecting thirteen different emojis were significantly correlated with the overall liking ratings for all stimuli. On the other hand, the biplot of Principle Component Analysis of the facial expression data showed differences between facial expressions to the taste stimuli (Figure 2). Sucrose solution was associated with “neutral” expression, quinine with “angry” and “disgusted” expression, and sodium chloride with “surprised” expression. The “disgusted” facial expression was negatively correlated ( $P < 0.001$ ) and “neutral” facial expression was positively correlated ( $P < 0.05$ ) with overall liking scores for all stimuli. The “neutral” facial expression was also positively correlated ( $P < 0.05$ ) with overall intensity scores for all stimuli.

**Conclusions:** Both explicit and implicit emotional responses provided an understanding of liking as well as intensity perception of taste stimuli. The results from this study can be useful in developing interventions directed toward emotional regulation during feeding, to reduce food refusal and increase food acceptability.

#### **405.119 (Poster)** The Association between Sensory Domains in Children with Autism Spectrum Disorder

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#### Background:

Sensory processing refers to how the nervous system takes in stimuli from the environment through sensory organs and then processes this information via higher level cognitive functioning. Atypical sensory processing patterns have only recently received greater attention in children with autism spectrum disorder (ASD). Both hyporeactivity and hyperreactivity to different sensations (touch, sound, light, taste, etc.) can occur in ASD.

#### Objectives:

We collect parent-report data on how children with ASD and typically developing (TD) controls respond behaviorally to various sensory domains, which include sensory seeking and avoiding patterns. We hypothesized that sensory seeking and sensory avoiding behavior would be negatively correlated, and that both sensory seeking and avoiding behaviors would be increased in the ASD group.

#### Methods:

We collected data on children 36-47 months of age using the Sensory Profile 2 (SP2). This parent-report survey includes questions about children's behavior in response to various inputs across multiple sensory modalities. The SP2 then calculates scores relating to seeking and avoiding behavior, using variables from every section in the survey. In our study, we split participants into 2 cohorts during recruitment: Typically Developing (TD, n = 6, 5 males, 1 female) and ASD (n = 13, 12 males, 1 female). Recruitment is still active, so these current numbers will increase in the coming months. A Pearson correlation was used to evaluate the association between the avoiding and seeking domains, while an independent-samples t test (uncorrected for multiple comparisons since this was an exploratory analysis) was used to evaluate statistical significance between ASD and TD in each SP2 domain.

#### Results:

There is a positive linear correlation between the Avoiding and Seeking domains in the SP2 for all children, regardless of ASD status ( $r = 0.832$ ,  $p < 0.01$ ; Figure 1). Figure 2 demonstrates that some domains of the SP2 show a statistically significant difference ( $p < 0.05$ ) between ASD and TD participants.

#### Conclusions:

Rather than seeing a dichotomy in which some individuals with ASD demonstrated primarily sensory seeking behaviors and others demonstrated primarily sensory avoiding behaviors, we found that children with strong sensory seeking tendencies also showed strong sensory avoiding tendencies. Certain domains of the SP2 show a marked difference in scores between ASD and TD individuals, suggesting that some sensory processing patterns might be more affected in response to specific stimuli among children with ASD. These findings not only inform our understanding of sensory phenotypes in ASD, but may also guide future steps in using sensory processing as a model for understanding the biology underlying ASD. Specifically, based on our findings we hypothesize that the paradoxical co-existence of sensory hyperreactivity and hyporeactivity seen in ASD

reflects altered “gain control” in ASD (i.e., a tendency for the nervous system to respond to stimuli in an excessively, all-or-nothing manner, rather than modulating itself to allow for more nuanced, graded responses); our future research will aim to test this hypothesis.

**405.120 (Poster)** Autism in Movement: Influence of Motor Development on Other Aspects of Development in Children with and without Autism Spectrum Disorder in New Zealand

**P. Araya-Herrera**, *School of Psychology, The University of Auckland, Auckland, New Zealand*

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**Background:** Although motor impairments are not a critical diagnostic feature in Autism Spectrum Disorder (ASD), increased clumsiness is typically expected. A gross motor skill (like walking or throwing) is also essential for development. It can evolve into more complex movements that allow the child to engage in other aspects of physical activity and, indeed, to learn by engaging in the world around them. Research has shown that deficits in motor impairments are associated with lower cognitive processing. Motor skills have also been shown to impact social interaction and one's ability to move around their environment, which may influence the child's ability to learn from others and the environment. Furthermore, object exploration supports learning their properties and participating in games with their caregivers. This link facilitates and enriches the experiences of linguistic and social knowledge.

**Objectives:** Increased participation in physical activity has been related to a positive influence on the occurrence of stereotypic behaviour in ASD, social functioning, and health-related outcomes. However, gross motor skills are often necessary to participate in physical activity. Given that people with ASD may be prone to motor deficits, they may also be intensifying their other behavioural excesses and deficiencies. This study aimed to understand how does the gross motor development influence other areas of developmental outcomes in children with and without ASD when controlling mediators such as perinatal health indicators and early sociodemographic in New Zealand.

**Methods:** Sample with and without ASD included 150 participants from the Growing Up in New Zealand project (ASD diagnosis was obtained by parent-report and formal diagnosis at four and a half and eight years), and developmental outcomes were obtained from Data Collection Wave data sets at six weeks, nine months, two years, four and a half years and eight years. Information of prevalence and trajectories was obtained by mother and child questionnaires, child observation and observation instruments to assess motor outcomes of child development. Mediating factors such as ethnicity, maternal education, and socioeconomic status were considered, plus gestational age at birth, body mass index, nutrition, and physical disability. Ethics approval from the Growing Up in New Zealand Data Access Committee (N° IA 21\1014).

**Results:** A decrease in language, cognition and motor alterations were observed in Maori group in children with and without ASD.

**Conclusions:** The lower decrease of motor development in Maori children with and without ASD could be due to protective factors of New Zealand's heritage. Further studies are required in a larger population.

**405.121 (Poster)** Relationships between Motor and Daily Living Skills in Children with Autism Spectrum Disorder (ASD): A SPARK Dataset Analysis

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**Background:** Eighty-seven percent of children with Autism Spectrum Disorder (ASD) from the SPARK study cohort are at risk for motor impairment (Bhat, 2020) and their motor performance correlated with their core social communication impairment, repetitive behavior severity as well as general delays in cognition, language, and functioning (Bhat, 2021). The previous analysis utilized quick parent-report screening tools such as the DCD-Q, SCQ, and RBS-R (Bhat, 2020, 2021).

**Objectives:** This presentation will report new SPARK study data on relations between various domains and subdomains of the Vineland Adaptive Behavioral Scales (VABS-3), a measure of overall and domain-specific adaptive functioning to provide an in-depth examination of adaptive functioning across multiple developmental domains (communication, social, daily living, and motor) and their relations with each other and differences across subgroups based on age, sex, and levels of functioning.

**Methods:** The SPARK study VABS-3 dataset (N=4,257) was examined for associations between multiple developmental domains (social, communication, daily living, and motor) and subdomains (social: play, interpersonal, and coping, communication: receptive, expressive, and written, daily living: community, domestic, and personal, problem behaviors: internalizing, externalizing) of the Vineland Adaptive Behavior Scales, Third Edition (VABS-3). Next, VABS performance for all domains/subdomains will be compared across sex (male, female), age (5-15 years), and functional delay (no delay, some delay, significant delay). Lastly, VABS performance for all domains/subdomains will be compared across domains and whether decline in motor functioning parallels certain other developmental domains.

**Results:** Based on VABS-3 domain scores, 77.9% of children with ASD had low (17.7%) to moderately low (60.2%) motor performance (N=2,644, 4-10 years only). 81.5% of children with ASD between 4 and 16 years had low (34.5%) to moderately low (47.0%) communication performance (N=4,257). 88.1% of children with ASD had low (50.1%) to moderately low (38.0%) social performance (N=4,257). 77.5% of children with ASD had low (35.8%) to moderately low (41.6%) daily living skills performance. In terms of associations between domains, motor VABS standard scores were strongly associated with communication ( $r=0.62$ ), social ( $r=0.61$ ), and daily living ( $r=0.63$ ) standard scores but not the problem behavior domain ( $r=-0.1$ ). Proportion of VABS motor delays across subgroups based on functional delays paralleled proportion of VABS daily living skill delays. Furthermore, age and sex-related differences in VABS performance will be discussed during the presentation.



Conclusions: These findings provide evidence for linkages between motor, social, communication, and daily living skill difficulties in children with ASD. It will be important to facilitate motor exploration in young and older children with ASD to promote cascading effects on other developing systems and to promote functional independence. Taken together, ASD interventions must address not only the social communication and cognitive/behavioral challenges of children with ASD but also their motor function and participation (Kaur & Bhat, 2019; Srinivasan et al., 2015).

## VIRTUAL POSTER SESSION — SENSORY, MOTOR, AND REPETITIVE BEHAVIORS AND INTERESTS

### 505 - Sensory, Motor, and Repetitive Behaviors and Interests --- (V)

#### **505.048** (Virtual Poster) A Comparison of Psychometric and Clinical Properties of Bsiq and ABC-C

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#### Background:

Restricted and repetitive behaviors (RRBs) represent a core diagnostic feature of autism spectrum disorder (ASD) interfering with environmental exploration, development of play skills, and learning and academic performance in children with ASD (Lam & Aman, 2007). There are a number of measures which look at these behaviors including the Social Responsiveness Scale, Second edition (SRS-2, Constantino, 2012), Autism Diagnostic Observation Schedule, Second edition (ADOS-2, Lord et al., 2012) and the Aberrant Behavior Checklist - Community (ABC-C, Marshburn and Aman, 1992). Historically, the trend has been to group many RRB behaviors under one heading. A newer measure, the BSIQ (Hanson et al, 2016), uses a comprehensive listing of individual RRBs.

Previous research explored the correlation between subscales of the ABC-C with Vineland-II (Sparrow et al. 2005) and Child Behavior Checklist (Achenback and Rescorla, 2000, 2001; Kaat et al., 2014). Comparison of psychometric properties of the specific subscales has yet to be explored between BSIQ and ABC-C. ABC-C is a caregiver-filled-out measure of severity of behaviors, with 5 subscales. BSIQ is an investigator-based instrument that uses 13 subscales to assess the type, frequency, and intensity of 74 RRB's.

#### Objectives:

We hypothesize that there is correlation between the RRB subscales of the BSIQ and the ABC-C. We then discuss the relative strengths and potential difficulties with methods of grouping these behaviors.

#### Methods:

Retrospective data on individuals with ASD were used from Boston Children's Hospital Phenotypic and Genetic Factors in ASD study, Autism Consortium, and Simons Variation in Individuals Project. Participants in this study included 108 individuals (75% male) ranging in age between the ages of 28 to 265 months ( $m = 92$ ,  $SD = 55.4$ ). ASD diagnosis was confirmed by cutoff scores on the ADOS-2 and Autism Diagnostic Interview-Revised (Rutter et al., 2003). ABC-C and BSIQ subscales were compared using Spearman's rank correlations test.

#### Results:

Preliminary results suggest the strongest relationship between ABC-C and BSIQ were related to stereotyped behaviors (SB). A relatively strong, positive and significant correlation between ABC-C SB and BSIQ Hand/Finger Mannerisms subscales ( $p=0.66$ ,  $p=7.05 \times 10^{-15}$ ). Similarly, the correlation between ABC-C SB and BSIQ Complex Mannerisms/ was found to be positive and significant ( $p=0.52$ ,  $p=9.61 \times 10^{-9}$ ).

Other relatively strong, positive and significant correlations were found between ABC-C Inappropriate Speech and BSIQ Language-Perseveration ( $p=0.57$ ,  $p=1.79 \times 10^{-10}$ ). Additionally, a positive and significant correlation was found between ABC-C Lethargy/Social Withdrawal and BSIQ Self-Injurious Behavior ( $p=0.42$ ,  $p=4.65 \times 10^{-6}$ ).

#### Conclusions:

This preliminary data analysis supports a plausible relationship between RRB based subsection scores on the BSIQ and ABC-C.

The two measures provide different levels of behavior description. The BSIQ covers a wider breadth of behaviors and provides more comprehensive data, which may have particular merits for use in the research setting. While not as comprehensive for RRBs, the ABC-C provides an overview of a broad range of these and other behaviors, with briefer administration time. This method may increase inaccurate reporting and decrease understanding of the breadth and type of specific behaviors. Future research will focus on parsing out these strengths and concerns.

#### **505.049** (Virtual Poster) A Portrait of the Repetitive Behaviors and Interests of Autistic Children Aged 6 to 12 Years: Parents' Perceptions

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**Background:** Although studies show that repetitive behaviors and intense interests (RBIs) decline through school age in autistic children, very few studies have examined the individual trajectory of these RBIs.

**Objectives:** To document, using a comprehensive list, the nature and frequency/intensity of RBIs in school-age autistic children. To explore if the nature and frequency/intensity of RBIs vary during this period.

**Methods:** Seventy-three french speaking parents of autistic children (6-12 years, 12F: 61M) completed the *Questionnaire on Repetitive Behaviors and Interests School-Aged Autistic Children*, via Lime Survey. The questionnaire included open-ended questions, but here we focused on the frequency/intensity ratings (on a Likert scale) of the 29 themes and objects of interest and the 47 repetitive behaviors included in the questionnaire. Using SPSS software, descriptive analyses were conducted with all the sample and Mann-Whitney U Tests were performed to compare the younger children ( $M = 7.67$  years old,  $SD = 1.00$ , Range 6.08 to 9.92 years) and the older children ( $M = 11.50$  years old,  $SD = 0.88$ , Range = 10.00 to 12.92 years).

**Results:** Four behaviors were observed « very often » by a significant number of parents: *putting object in mouth* (28.77%), *emits vocalizations spontaneously* (28.77%), *repeating words* (26.03%) and *sentences* (24.66%). Interest for three technological tools and one application: *electronic tablet* (46.58%), *YouTube* (41.10%), *video games* (41.10%), *computer* (35.62%) were considered « intense » by the largest number of parents, followed by *listening to music* (17.81%) and *drawing* (16.44%). Mann-Whitney U tests indicated four behaviors that were significantly different in younger and older children: *Facial twitching* was more frequent in older children ( $p < .01$ ), while *putting object in mouth*, *repeating sentences* (echolalia) and *emits sentences spontaneously* were more frequent in younger children (all  $p$ 's  $< .05$ ). None of the interests were reported as significantly more intense in older children, while interests for trains and planes were reported as more intense in younger children (both  $p$ 's  $< .05$ ).

**Conclusions:** Our preliminary results first suggest that technology-oriented interests characterize school-aged children. It will be important to document the properties of the applications that are of interest at this stage of development as well as the developmental trajectory of this common interest in autistic children. Second, our results highlight that the most frequent repetitive behaviors in school age autistic children are mostly related to language, especially in younger children. This latter result needs to be further investigated to better understand the trajectory of these specific repetitive behaviors as well as to better understand the role of language related repetitive behaviors in language development in autism.

#### **505.050 (Virtual Poster) Barriers to an Autistic Identity: How Restricted and Repetitive Behaviors May Contribute to the Underdiagnosis of Females**

**E. L. Cary<sup>1</sup>, A. Rao<sup>2</sup>, E. Matsuba<sup>1</sup>, E. C. Masters<sup>1</sup>, C. MacKenzie<sup>1</sup>, J. Osborne<sup>2</sup> and N. Russo<sup>1</sup>, (1)Department of Psychology, Syracuse University, Syracuse, NY, (2)Syracuse University, Syracuse, NY**

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**Background:**

Autistic females are frequently underdiagnosed, misdiagnosed, and/or diagnosed later in life. Females require more severe autism symptoms and impairment than males to receive an autism diagnosis and are less likely to get an autism diagnosis even when they have the same number of autistic traits on rating scales. Restrictive and Repetitive Behaviors (RRBs) are increasingly critical for diagnosis and yet are commonly rated lower in females. However, it is unclear whether this reflects genuinely lower levels of these traits, or if female-typical restricted and repetitive behaviors have a different phenotypic presentation that may not register on current quantitative measurement tools.

**Objectives:**

We sought to characterize RRBs in females using a mixed-methods analytical approach. Differences in RRBs across genders were assessed from standard quantitative diagnostic tools and examined through a combined quantitative and inductive qualitative approach.

**Methods:**

Twenty-one autistic females and 21 autistic males matched on chronological age ( $M = 14.5$ ) and Full-Scale IQ ( $M = 103.67$ ) participated in the study. Participants completed the Autism Quotient, Sensory Profile, Autism Diagnostic Observation Schedule 2<sup>nd</sup> Edition, and Autism Diagnostic Interview-Revised. T-tests were used to determine group differences by gender for 1) overall autistic traits using the Autism Quotient (AQ), 2) Sensory features on the Sensory Profile (sum score) 3) each RRB subcategory from the DSM-5 (i.e., stereotyped movements or speech, insistence on sameness, restricted interests, sensory differences) measured by the sum of z-scores for relevant ADOS-2 and ADI-R items. Written comments on the ADOS-2 and ADI-R protocols for items pertaining to each of these RRB categories were qualitatively investigated by forming categories and comparing those between genders.

**Results:**

Quantitative comparisons indicated that there were no gender differences on the Sensory Profile nor AQ. When analyzed by RRB category, the only gender differences were that females scored higher on stereotyped movements and speech on the ADI-R ( $T = 2.58$ ,  $p = .02$ ) and were observed to engage in more sensory behaviors during the ADOS-2 ( $T = 2.35$ ,  $p = .02$ ). Qualitative analyses indicated that both females and males were equally likely to engage in stereotypic behavior, but 38% of females engaged in those behaviors when anxious compared to only 10% of males. Furthermore,

females had more tactile exploration than males (90% vs. 67%), especially tactile exploration of themselves (e.g., feeling their hair or touching their arms; 48% vs. 5%), but also tactile exploration of other people (19% vs. 5%) and objects (62% vs. 43%) as well as sensitivity to materials (33% vs 14%).

#### Conclusions:

Findings highlight differences in RRBs in females that may help enhance diagnostic clarity for. Results add to a growing body of research suggesting that females engage in more sensory behaviors, especially in the tactile domain. Based on the results from this study, the inclusion of sensory behaviors has promising implications for increasing diagnostic sensitivity for autistic females.

#### **505.051** (Virtual Poster) Trauma Mediates the Relation between Autistic Traits and Sensory Sensitivity and Avoiding in Adults

**E. L. Cary<sup>1</sup>**, A. Rodrigues<sup>1</sup>, E. C. Masters<sup>1</sup>, E. Matsuba<sup>1</sup>, C. MacKenzie<sup>1</sup>, J. Osborne<sup>2</sup> and N. Russo<sup>1</sup>, (1)Department of Psychology, Syracuse University, Syracuse, NY, (2)Syracuse University, Syracuse, NY

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#### Background:

Autistic individuals are more likely than non-autistic individuals to experience trauma in their lifetimes, and frequently report sensory differences. Both autism and traumatic experiences are independently associated with sensory differences. As such the presentation of sensory features in autism might be influenced by the experience of traumatic events. Here we sought to take a preliminary step by looking at the relationship between autistic traits, sensory features, and traumatic experiences in neurotypical individuals.

#### Objectives:

We first assessed the relationship between traumatic experiences, autistic traits, and sensory features in neurotypical individuals using correlation analyses, and then assessed the role of traumatic experiences as a mediator between autistic traits and sensory features.

#### Methods:

Two hundred forty-two participants (126 females, 116 males) ages 18 to 31 ( $M = 24.60$ ,  $SD = 3.58$ ) participated in this online study. Participants completed the Adolescent/Adult Sensory Profile (AASP), Adult Autism Quotient (AQ), and the Adverse Child Experiences Questionnaire (ACE-Q). Pearson correlation coefficients were conducted between autistic traits, measured by the total AQ, sensory features, measured by the four quadrants of the sensory profile, and type of childhood trauma (i.e., abuse, neglect, and household dysfunction). Mediation analyses were completed using PROCESS v3.4 in SPSS and statistical significance was determined at  $p < .05$  if the 95% bias-corrected percentile bootstrapped confidence interval of the indirect effect did not contain zero. Two mediation analyses assessed whether a history of trauma, measured by the total score on the ACEs, mediates the relation between autistic traits, measured by the total score on the AQ, and the sensory sensitivity and avoiding quadrants of the Sensory Profile.

#### Results:

Autistic traits were strongly and positively correlated with the total number of ACEs, and specifically neglect and abuse, but not household dysfunction. Autistic traits were positively correlated with sensory registration, sensory sensitivity, and sensory avoiding, and negatively correlated with sensory seeking. The total number of ACEs, abuse, and neglect were positively correlated with sensory registration, sensory sensitivity, and sensory avoiding but not sensory seeking. Household dysfunction was only positively correlated with sensory sensitivity and sensory avoiding. The relationship between autistic traits and sensory sensitivity and sensory avoiding were both significantly mediated by trauma ( $B = 0.05$ ,  $SE = 0.02$  (95% bias-corrected bootstrapped CI [0.02, 0.1])). Childhood trauma accounted for 8.3% of the relation between autistic traits and sensory sensitivity and sensory avoiding.

#### Conclusions:

Findings suggest that a portion of the relationship between autistic traits and sensory sensitivity and avoiding can be explained by childhood trauma. Findings provide preliminary support for including trauma histories in the conceptualization of sensory features in autism and suggest that future work should assess these relationships within an autistic population.

#### **505.052** (Virtual Poster) Evidence for Specificity of Involvement in Executive Functioning, Behavioral and Attentional Regulation in Tactile Detection Thresholds.

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**Background:** While commonly exhibited by individuals with autism and now included in the diagnostic criteria for Autism Spectrum Disorder (ASD), sensory differences are not exclusive to ASD and occur in other neurodevelopmental conditions such as Attention Deficit/Hyperactivity Disorder (ADHD). Work from our lab suggests that parent-reported tactile dysfunction in ASD may reflect more global executive (including behavioral and attentional) dysregulation shared by neurodevelopmental conditions. We now seek to establish whether this may be driven by fundamental differences in touch at the perceptual level as these differences are not specific to ASD. Differences in adaptation to tactile thresholds have been linked to altered thalamocortical feedforward inhibition. Understanding whether individuals fall within particular tactile subtypes have different external presentations and executive function performance, independent of clinical diagnosis, could provide important insights into the neurological mechanisms underlying tactile difficulties across disorders.

**Objectives:** To define tactile subtypes based on adaptation to tactile thresholds in typically developing controls (TDC), ASD, and ADHD. We hypothesize that, across diagnoses, those without a typical adaptation response will show more difficulties in behavior, attention and executive functioning with both objective (WISC) and subjective (Conners, BASC) measures.

**Methods:** *Sample:* 413 children aged between 8 to 17 years were recruited. 123 were diagnosed with ASD and 103 were diagnosed with ADHD. The remaining 187 participants were TDC. The following measures were employed to assess attention/behavior regulation and executive function: parent-reported Conners 3<sup>rd</sup> Edition, parent-reported BASC-3, and performance-based WISC-IV/V (working memory, processing speed, full-scale IQ and verbal comprehension indexes). *Psychophysics:* Tactile detection thresholds were measured using a vibrotactile stimulator which delivered stimuli to two fingers. In the static condition, children reported the finger that received a stimulus. In the dynamic condition, children reported the finger which felt a stimulus dynamically increasing from zero amplitude. The difference between static and dynamic thresholds was considered a marker of feedforward inhibition. *Analysis:* Children were grouped into “Typical”, “Neutral” and “Atypical” performance based on their feedforward inhibition thresholds. Participants with changes of more than 25% were considered to have “Typical” performance; those with changes in detection thresholds between -25% and 25% were considered “Neutral”, and those with changes in detection thresholds less than 25% were considered to have “Atypical” performance. One-way ANOVAs (age and sex covaried) were conducted on groups examining attention, behavior and executive function differences.

**Results:** On the BASC-3, participants in the “Atypical” and “Neutral” groups showed more externalizing behaviors and executive function challenges compared to the “Typical” group (both  $p < 0.01$ ), with no differences in internalizing behaviors (both  $p > 0.1$ ). On the Conners 3<sup>rd</sup> Edition, “Atypical” and “Neutral” groups showed more inattention and impulsivity (both  $p < 0.001$ ) compared to the “Typical” group. On WISC-IV/V, “Atypical” and “Neutral” groups showed lowered working memory performance (both  $p < 0.001$ ) compared to the “Typical” group.

**Conclusions:** Our results are consistent with research describing the overlap between attention and sensory dysfunction. Findings suggest that regardless of neurodevelopmental condition, tactile detection differences align with functional measures of executive function, behavioral and attentional regulation.

#### **505.053 (Virtual Poster)** Gender and Age Differences in Sensory Impairments in ASD and ASD+ADHD

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#### **Background:**

Sensory issues are critical features of both ASD and ADHD. Further, gender and age are linked to different presentations of sensory symptoms in both disorders. Research is needed to understand the contribution of co-occurring ADHD symptoms to sensory sensitivities in ASD, as well as gender and developmental differences in these relations.

#### **Objectives:**

To evaluate sex and age differences in severity of sensory impairments in ASD and ASD+ADHD groups.

#### **Methods:**

Participants included ASD individuals ages 6 to 18 years from an NIH-funded study looking at sex differences in ASD. Participants were separated into two groups: the child group included participants  $\leq 11$  years old ( $n=99$ ; ASD=58, 60.3% male); the adolescent group, included participants  $\geq 11$  years ( $n=58$ ; ASD=28, 75% male). All participants met ASD criteria via the ADOS-2 and ADI-R and had an IQ  $\geq 70$  via DAS-II. Co-occurring ADHD symptoms were assessed using the CBCL DSM-oriented subscale for ADHD and the ASD+ADHD group (score  $>63$ ). Parents and participants completed the Sensory Profile (Caregiver and/or Adolescent report). Scores were computed for sensory sensitivity, sensory seeking, and poor registration domains. Lower scores indicated greater sensory impairment. Group differences and gender interactions were analyzed using a series of ANOVAs.

#### **Results:**

In children <11, there was a significant interaction between group and gender ( $F=5.04, p=0.027$ ), such that males with ASD ( $M=36.69, SD=7.5$ ) had greater sensory sensitivity compared to males with ASD+ADHD ( $M=40, SD=9.24$ ) and females with ASD, both with ( $M=39.17, SD=5.94$ ) or without ADHD ( $M=43.74, SD=9.78$ ). There was a significant main effect of gender on poor registration ( $F=4.15, p=0.04$ ), such that males with and without co-occurring ADHD had poorer registration than females with and without ADHD, but no significant interaction or main effect of group. In sensory seeking, there were no significant main or interaction effects.

In Adolescents, there was a main effect of group in sensory sensitivity ( $F=4.64, p=0.036$ ), poor registration ( $F=5.09, p=0.028$ ), and sensory seeking ( $F=14.32, p<0.001$ ). However, there were no significant interactions or main effect by gender.

**Conclusions:** Patterns of the interaction of sex differences and co-occurring ASD+ADHD differed between age groups. Co-occurring ADHD did not exacerbate sensory sensitivities in children with ASD who are younger than 11 years old, but ADHD did affect sensory sensitivities in children with ASD who were older than 11 years old. This difference may reflect the transition from the use of caregiver reports to self-report. However, it may also reflect different

#### **505.054 (Virtual Poster)** Interoceptive Challenges Are Linked to Appetitive and Eating Disorder Traits in Autistic Adults

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**Background:** Eating behaviors in people with ASD are potentially important contributors to poor health outcomes, including both selective eating and eating in the absence of hunger, yet the mechanisms driving these behaviors are poorly understood. Sensory sensitivities are consistently linked to selective eating in ASD (e.g., Zickgraf et al., 2020), still other factors likely play a role not only in selective eating, but also eating in the absence of hunger. One likely culprit is interoception; the perception of senses from inside the body. Interoceptive abilities are vital in regulating essential bodily functions. Nevertheless, studies to date have not examined associations between interoception and eating behaviors in ASD.

**Objectives:** Examined for the first time, links between interoception and eating behavior among younger adults with ASD.

**Methods:** 254 participants (assigned female at birth; 67%) aged 18-42 years ( $M=31.27, SD=5.63$ ) were recruited online via Simons Powering Autism Research and Knowledge (SPARK; SPARK Consortium, 2018) Research Match. Three questionnaires were completed by participants. Confusion of interoceptive bodily states was assessed using the 20-item Interoception Sensory Questionnaire (ISQ). Appetitive traits were assessed using the 35-item Adult Eating Behavior Questionnaire (AEBQ). Symptomatology of Anorexia Nervosa, Bulimia Nervosa, and Binge-Eating Disorder was assessed using the DSM-5 Eating Disorders Diagnostic Scale (EDDS). Hierarchical linear regressions were run to examine associations between interoception and both appetitive traits (AEBQ) and eating disorder traits (EDDS) after controlling for the influence of age and sex assigned at birth.

**Results:** Analyses revealed that interoception significantly predicts several appetitive traits, including enjoyment of food ( $\Delta R^2=.04, p=.002$ ), satiety responsiveness ( $\Delta R^2=.04, p=.001$ ), and food fussiness ( $\Delta R^2=.03, p=.004$ ), as well as global eating disorder traits ( $\Delta R^2=.02, p<.05$ ). Including dietary restrictions as an additional covariate, resulted in the association between interoception and global eating disorder traits becoming non-significant, while the other three findings remained unchanged.

**Conclusions:** Interoception appears to be a contributing factor to atypical eating patterns in adults with ASD though longitudinal study designs are needed to evaluate more causal pathways. If this link is confirmed, it is possible that developing interventions to address interoception challenges in ASD may cascade to positively impact eating behaviors and health outcomes in this group.

#### **505.055 (Virtual Poster)** Investigation of the Postural Control and Gait of Autistic and Neurotypical Preschool Children

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**Background:**

Movement difficulties are common in autistic individuals however motor difficulties are not currently identified as a core criterion or specific in the diagnostic criteria for autism. Previous research suggests that up to 75% of autistic children have motor difficulties and 50.9% of Australian autistic individuals are classified as having a severe mobility restriction. Motor differences in autistic children include but are not limited to reduced postural control and atypical gait. Currently information about gait and postural control is very limited for autistic preschool children, despite this being a critical period for motor development. Understanding motor difficulties at an early age is important because these can impact a child's ability to engage and participate in everyday life.

**Objectives:**

This study aimed to compare the postural control and gait of autistic and neurotypical preschool children.

**Methods:**

A case control design compared the postural control and gait of pre-school autistic and neurotypical children. A total of 33 participants consisting of 13 autistic and 20 neurotypical children aged between three to five years of age participated in the study. Standing postural control was recorded using the AccuGait portable force platform while children watched a cartoon they had selected. The force platform provides a measure of centre of pressure (COP) which reflects postural control as the ability to control the centre of mass over the base of support. Gait temporospatial parameters were measured using the GAITRite Walkway System, which provides spatial parameters including step length, stride length and step width, as well as temporal measures including cadence, gait cycle, velocity, step time, and stance time among others. Postural control and gait were also video-recorded with observations undertaken by blinded assessors.

#### Results:

Autistic children had poorer postural control than neurotypical children with 1.5 times larger anterior-posterior sway, 1.4 times larger medio-lateral sway and 2.4 times larger COP trajectory prediction ellipse area than neurotypical children. Observational analysis of postural data showed that autistic children were more categorised as more 'floppy' than neurotypical children ( $p=0.010$ ) and paid less attention to the cartoon ( $p=0.024$ ). They demonstrated more large ( $p=0.002$ ) and wriggly ( $p=0.024$ ) lower limb movements. During gait, autistic children had a higher adjusted ataxia ratio (measure of stride regularity) than neurotypical children, however, no differences between the autistic and neurotypical children were observed for cadence, stride length, step width, double support, or mean normalised velocity. Observational analysis of gait showed autistic children spent more time looking away from the forward position when walking ( $p=0.010$ ).

#### Conclusions:

Autistic children showed differences in postural control and gait compared to neurotypical children. Static postural stability was poorer and video analysis suggested this is due to a combination of hypotonia and difficulty maintaining attention to a task. Gait parameters were similar to those of neurotypical children however the autistic group demonstrated more stride variability and were more distracted during gait. Reduced attention is the most likely contributor to the increased stride variability. Further research on the effect of hypotonia and attention on motor performance and learning in autistic children is recommended.

#### **505.056** (Virtual Poster) Pupil Reveals Auditory over-Responsivity in Children with Autism Spectrum Disorder

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**Background:** Sensory over-responsivity is highly prevalent in children with autism spectrum disorder (ASD) and is related with maladaptive behaviors and anxiety (Lane et al., 2015). Research in this field typically relies on parental report questionnaires and autobiography of high functioning individuals (Ben-Sasson et al., 2009; Elwin et al., 2012). A few objective physiological measures utilizing electrodermal activity or heart rate in sensory challenge tasks revealed conflict evidence, with the majority showing either hyper or normal responses to sensory stimuli in ASD (Chang et al., 2012; McCormick et al., 2014). Recently, convenient and contactless pupillometry has been introduced to examine the autonomic response to auditory stimuli in ASD. For example, Top et al (2019) found ASD adults had larger baseline pupil diameter and normal peak pupil diameter change to auditory stimuli, suggesting they endure chronically hyper-arousal in daily life. Habituation rate could impact sensory responsivity and maybe is impaired in ASD (Millin et al., 2018).

**Objectives:** The primary aim of the present study was to measure the responsivity to non-social auditory stimuli in ASD children using pupillometry. We also concerned if slower habituation rate underlies the mechanism of atypical auditory response.

**Methods:** Thirty-seven children with ASD and 40 TD children completed a passive listening task adopted from Top et al (2019). Children were asked to look at a fixation cross at the center of the screen during the experiment while a 300 Hz eye-tracker recorded their pupil diameter throughout the task. Following a silent period which recorded the baseline pupil diameter before the experiment, two blocks of sound were presented, which contained a rather mild sound (2000 Hz sinewave tone) and an aversive sound (2000 Hz sawtooth tone) respectively. In each block the sound was presented 10 times and lasted 2 seconds each time. We used pupil area change as an index of phasic auditory responses. The effect of trial on peak pupil area change was used to depict the habituation rate across each block.

**Results:** No significant difference of the baseline pupil diameter was found between ASD and TD children, suggesting typical baseline arousal in ASD children. Temporal course analysis showed pupil area change was similar in the ASD and TD group at all time points when the mild sound present, while ASD demonstrated more pupil area change than TD children between 0.50-1.93 second from stimuli onset when listening to the aversive sound (Figure 1). The results were confirmed as we extracted the peak pupil area change from the time course individually and found that ASD children had normal phasic response to the mild sound, while responded more to the aversive sound than TD (Figure 2). However, ASD children showed normal habituation to the aversive sound.

**Conclusions:** To conclude, we found typical baseline arousal before the experiment and pupillary over-responsivity to the aversive, but not the mild sound in ASD. Reducing exposure to aversive sensory stimuli is needed to avoid overwhelming feeling and anxiety in ASD children in daily life.

#### **505.057** (Virtual Poster) Reduced Connectivity of Cortical-Cerebellar Networks Is Implicated in Precision Motor Deficits in Individuals with Autism Spectrum Disorder

**Background:** Studies of sensorimotor behaviors offer unique promise for characterizing neurodevelopmental mechanisms associated with ASD as they are precisely quantifiable in both spatial and temporal dimensions, and their underlying neural systems have been well-defined. Sensorimotor issues are present in the majority of individuals with ASD and are associated with core symptoms. However, studies are needed to link sensorimotor phenotypes associated with ASD to specific alterations in brain function.

**Objectives:** Using a rapid visually-guided precision gripping task during functional neuroimaging (fMRI), we examined cortical-cerebellar networks associated with visuomotor control in ASD.

**Methods:** Twenty-five individuals with ASD (10-33 years) and 18 typically developing (TD) controls matched on age and IQ completed a test of precision gripping during fMRI. Participants pressed with their right thumb and forefinger on a force transducer while viewing a green FORCE bar that moved upwards with increased force toward a fixed white TARGET bar. Participants maintained the FORCE bar at the level of the TARGET bar for two seconds, alternating with two second rest periods. Two runs were administered in which target force levels were set at 20% or 60% of each participant's maximum voluntary contraction (MVC). Cortical and cerebellar seeds were analyzed for whole brain connectivity (psychophysiological interaction; PPI) based on previous studies of precision motor tasks.

**Results:** Mean force output was reduced in ASD across both force levels. Relative to controls, individuals with ASD showed more variable initial force output at 60% MVC and less variable initial force output at 20% MVC. Connectivity was similar between groups at 20% MVC. At 60% MVC, individuals with ASD demonstrated decreased force-dependent connectivity between left anterior intraparietal lobule (LaIPL) and right anterior and lateral cerebellum and increased connectivity between LaIPL and right thalamus; the opposite pattern was observed in controls. Force-dependent connectivity of primary motor cortex (M1) and dorsal anterior cingulate cortex (dACC) also was decreased in ASD, but increased in controls. Reduced functional connectivity of LaIPL-right cerebellum was associated with increased symptom severity in ASD participants (Autism Diagnostic Observation Schedule Calibrated Severity Score; ADOS CSS). Dimensional associations between task performance and functional brain activation in visuomotor network regions that showed significant activation during task vs. rest also will be reported.

**Conclusions:** Atypical control of initial force output in ASD suggests reduced integrity of internal action representations that are consolidated and stored within cerebellum and is consistent with previous reports of structural and functional cerebellar abnormalities in ASD. Reduced cerebellar-parietal connectivity in ASD suggests deficits in integrating multimodal sensory feedback may underlie frequently observed deficits in precision motor control in ASD; associations between reduced cerebellar-parietal connectivity and increased symptom severity suggest reduced sensorimotor control may be central to the pathophysiology of ASD. Reduced force-dependent connectivity between M1 and dACC in ASD suggests reduced reliance on error-monitoring processes during visuomotor output, while increased thalamocortical connectivity in ASD suggests individuals may be using alternate strategies (e.g., power grip) for generating precision force. These findings collectively suggest cortical-cerebellar dysfunctions may contribute to precision sensorimotor issues and core clinical symptoms of ASD.

#### **505.058 (Virtual Poster) Sensory Features of the Classroom Affect Task-Behaviour Especially for Autistic Children**

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**Background:**

The ability to pay attention and engage in a task is fundamental for learning and participation in the classroom. Typical school classrooms are busy multi-sensory environments in which children must filter out and ignore various sensory inputs (e.g. noise from peers, visual displays on walls) in order to engage and learn. Some children find this very difficult, especially autistic children, many of whom experience significant sensory differences compared to neurotypical children (NT) (Jones et al., 2020).

**Objectives:**

In the current study, the impact of classroom sensory inputs on task behaviour was investigated in children with and without autism. The sensory inputs of interest were classroom noise and classroom visual displays. It was hypothesised that both classroom noise and visual displays would lead to increased off-task behaviour for all children, but to a greater extent for autistic children.

**Methods:**

Twenty-six autistic children (mean age 9.62 years) and 22 NT children (mean age 8.35 years), matched on verbal mental age (using the Wechsler Abbreviated Scale of Intelligence 2), completed reading comprehension tasks in a bespoke mini-classroom. It was possible to manipulate sensory features of the mini-classroom. Participants completed 4 reading comprehension tasks, under different sensory conditions: baseline (no visual/auditory input); auditory (classroom noise played in background); visual (visual displays on walls); and auditory and visual together. The order of conditions was counterbalanced between participants. Using video recordings, behaviour was coded as on or off-task (with sub-categories for fine-grained analyses).

**Results:**

Autistic children spent a significantly greater percentage of time off-task compared to NT peers. However, the pattern of off-task behaviour was the same for the groups in terms of impact of condition – it was greatest for both groups in the visual and auditory-visual conditions, and significantly more off-task behaviour was found in these compared to auditory and baseline conditions. (See Figure 1). Greater off-task behaviour in the visual and auditory-visual conditions was driven by the physical environment, meaning looking at/engaging with visual displays.

#### Conclusions:

This study shows how classroom visual displays can lead to greater off-task behaviour for all children, but particularly for autistic children. Over behaviour measures may not be best suited to understanding the impact of noise on classroom learning and engagement. This study has implications for understanding attention in action for learning in the classroom, as well as classroom design.

#### **505.059** (Virtual Poster) Sensory Profiles in Children with Autism Spectrum Disorder: A Descriptive Study Using the Italian Version of the Sensory Processing Measure-2 (SPM-2)

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**Background:** An increasing body of evidence suggests that subjects with Autism Spectrum Disorders (ASD) exhibit atypical sensory profiles. However, the detailed characteristics of this atypical sensory functioning have not been fully explained. Although unusual sensory features in children with ASD have been reported since Kanner's early descriptions, subsequent literature has not always reached universal conclusions, and large-scale clinical trials are still lacking. Some authors argue that children with ASD show problems at the level of sensory processing but also that the presence of a true disorder would concern only a part of them. The discordant data in the literature may be due to the diversity assessment methods used.

**Objectives:** The main aim is to investigate, through the Sensory Processing Measure-2, the sensory profiles in school-aged children with ASD. To date, the SPM-2 is the only tool adapted with normative data for the Italian population.

**Methods:** The total sample included 86 subjects with ASD aged between 6 and 12 years (mean age = 9.01 years; SD = 2.07; Range: 6-14). All subjects with ASD were native Italian speakers. All children were evaluated through a multi-informant perspective on data collection by using professional observation or interview (ADOS-2; Wechsler Scales and Vineland-II) and parent reports including CBCL 6-18 and the Sensory Processing Measure-2 (SPM-2). Sensory Processing Measure-2 (SPM-2) requires just 15 to 20 minutes; the Home Form (adopted for this study) yield eight parallel standard scores: social participation, vision, hearing, touch, body awareness (proprioception), balance and motion (vestibular function), planning and ideas (praxis), and total sensory systems. Scores for each scale fall into one of three interpretive ranges: typical, some problems or definite dysfunction.

**Results:** A two sensory phenotypes were described: (1) low-functioning (LF) and (2) high-functioning (HF). In subjects with LF, compared to those with HF, there were found significant correlation between SPM-2 (Total and sub-domains scores) and Restricted and Repetitive Behaviours (RRBs) severity score of ADOS-2. Age, adaptive behaviour, internalizing and externalizing problems were not found to differ significantly across the two phenotypes (LF vs HF).

**Conclusions:** Our preliminary study shows a very close link between sensory difficulties and severity in the area of restricted and repetitive behaviors in children with LF. In children with high-functioning ASD, this correlation with RRBs was not found. This finding could be indicative of a high degree of heterogeneity of sensory difficulties in ASD. Creating sensory phenotypes might be a more effective way to analyze the large internal variability. The creation of phenotypes may aid in the development of effective interventions for these difficulties. The sensory difficulties of different phenotypes could be traced to different neurophysiological circuits.

#### **505.060** (Virtual Poster) Slow Updating with Adequate Benefits from Temporal Regularities

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**Background:** Mixed results in benefits from temporal regularities and rate of sensorimotor responses led to disputes regarding the nature of difficulties of people with autism in performing such tasks. Breska & Ivry (PNAS, 2018) found reduced benefit in using a single predicted interval. By contrast, administering the same paradigm to adult individuals with a basal-ganglia impairment (Parkinson's disease) they found reduced benefit from a predictive rhythm.

**Objectives:** Given reports of both atypical basal ganglia and cerebellum connectivity in ASD, we now asked whether people with autism manifest similar behavioral difficulties. In addition, by administering a paradigm developed by Breska & Ivry with two conditions we now separated between sensorimotor benefits from different types of temporal regularities, and the updating abilities that have been required in these tasks (verification of target presentation before response)

**Methods:** We recruited 48 participants (24 in each group, age: mean  $\pm$  SEM (years): ASD:  $26.4 \pm 1.4$ , Neurotypical:  $26.5 \pm 0.8$ . Mann-Whitney:  $U=529$ ,  $p=0.33$ . Male/female: 22/2, 16/8, respectively. Matched for spatial reasoning skills). The participants were asked to respond to a visual target (a green square) presented on a screen (by pressing a key) as fast as they can. Each trial consists of two or three red squares, that appear one after



another, followed by a white square and then the target. There were three different block types: 1. “Rhythmic”: the target is presented after a sequence of squares with fixed intervals. 2. “Single-interval”: the interval between the first two squares denotes the interval between the white square and the target. 3. “Random”: the intervals preceding the target are randomly chosen (with the same mean).

We introduced two conditions. In one, every trial ended with a green target (100%), guaranteeing participants' reduced response time as long as they can benefit from the temporal regularity (measured relative to the random condition). In the second, 25% of the trials ended without any target. This condition requires a participant confirmation for the presence of target before pressing, and therefore requires an additional updating with the visual information.

**Results:** Both groups benefitted from the temporal regularities in both conditions, and as expected benefitted more in the 100% condition (Wilcoxon test: ASD:  $p=0.002$ , Neurotypicals:  $p<0.001$ ). The benefit from the two types of regularities was highly correlated in both groups (spearman: ASD:  $0.5112$  ( $p=0.011$ ), control:  $0.667$  ( $p=0.001$ )). We, therefore, averaged, for each participant, the benefit from the two regularity types. In the 100% condition – the groups did not differ, indicating that people with ASD benefit adequately from temporal predictions. However, in the 75% condition, the ASD group showed reduced benefits (mean: ASD-0.14, Neurotypicals-0.17  $p=0.025$ ), indicating that their target present/absent updating was slower than the neurotypicals.

**Conclusions:** our study suggests a specific difficulty in online updating abilities, in line with the “slow updating” hypothesis (Lieder et al., 2019; Vishne et al., 2021), with adequate use of temporal intervals per-se. These findings explain some of the disputes regarding the use of temporal regularities in ASD.

#### **505.061 (Virtual Poster)** Synesthesia Is Consistently Positively Associated with Attention to Detail – a Twin Study

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**Background:** Synesthesia is a sensory phenomenon where inputs such as noises, letters or weekdays lead automatically to vivid, additional sensations such as color or shape. The phenomenon occurs in ~4% of the population, but is more prevalent in individuals with autism spectrum condition Neufeld et al., 2013, Baron-Cohen et al., 2023). Further, both binary defined synesthesia, the amount of different synesthesia types and the degree of synesthetic consistency are associated with elevated autistic traits (Ward et al. 2017, Burghoorn et al., 2019). Recently, we demonstrated this association for the first time in a twin sample, where familial (genetic and environmental) factors are implicitly controlled for (Neufeld et al., accepted in *Cortex*). More specifically, twins with higher autistic traits in specifically the domain of attention to detail showed a higher synesthetic consistency. However, the sample was small ( $n=65$ ) and consisted preliminary of non-synesthetes with or without neurodevelopmental diagnoses.

**Objectives:** In this study, we aimed to replicate and extend the previous within-pair findings on the link between synaesthesia and autistic traits in an independent, larger twin sample where 23% fulfilled criteria for synesthesia.

**Methods:** The twins completed a standard consistency test assessing color synaesthesia for letter and numbers (grapheme-color synesthesia, GCS) and questionnaires online. Dimensional GCS was defined as the degree of synesthetic color consistency reflected by the test score and binary GCS (fulfilling criteria for being a synesthete) was defined as scoring within the synesthetic range and additionally self-reporting GCS. Autistic traits were assessed using the Autism Spectrum Quotient (AQ), and divided into the two sub-scores “attention to detail” and AQ-other (containing social and communication domains) as suggested by previous research (Hoekstra et al., 2008). 75 individuals were excluded because they failed to follow task instructions correctly or due to missing data. The final sample consisted of  $n=155$  twins (75% female) aged 19 or 20 years, including 39 complete pairs of which 46% were MZ and 12 were discordant for binary synesthesia (= only one twin fulfils criteria for synesthesia).

**Results:** Twins with higher autistic traits in the attention to detail domain showed more consistent grapheme-color associations (= lower scores;  $\beta=-.22$ ,  $SE=.09$ ,  $p=.018$ ) while controlling additionally for touch screen device usage (since touch screen users were overall less consistent in their color choices:  $t=-2.92$ ,  $df=49.12$ ,  $p=.005$ ). In contrast, binary defined GCS was negatively associated with the AQ-other domain ( $\beta=-.15$ ,  $SE=.06$ ,  $p=.010$ ).

**Conclusions:** The results confirm previous findings of a positive association between dimensional synesthesia with specifically the attention to detail domain of autistic traits. In addition, they indicate that higher social/communication-related autistic traits might decrease the likelihood of being identified as a synesthete when controlling for genetic and environmental factors shared by twins and touch screen usage. These latter findings need to be interpreted with caution, due to the small amount of complete synesthesia-discordant pairs. However, they indicate that familial factors might have contributed to the inconsistent findings of previous studies, sometimes indicating a link with the social domain of autistic traits and sometimes not.

#### **505.062 (Virtual Poster)** Differences between ASD and TD in Social and Non-Social Joint Action Performance and Its Predictors

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Background:

Joint action (JA) is the accomplishment of a shared goal by coordinating a motoric movement with social and non-social partners in time and space, that mandates the successful operation of social-motor capabilities. Though the manifestation of social-motoric difficulties in cognitively able (IQ > 70) youngsters with autism spectrum disorder (CAASD) is common, the differences in JA performance with social and non-social partners between TD and CAASD along development, and the contribution of motor and theory of mind (ToM) abilities to social and non-social JA succession, are underexplored in CAASD.

#### Objectives:

This study examined task (social-JA with a peer / non-social-JA with a computer), group (ASD/TD), and age (early-childhood 6-8, pre-adolescence 8-12, and adolescence 12-16) differences in JA for youngsters with CAASD compared to age-matched controls with typical development (TD). We also examined the prediction of social and non-social JA performance by motor and ToM abilities. Understanding these differences and the effect motor and social-cognition impairments have on JA performance may open future intervention paths focusing on social-motor coordination in youngsters with CAASD.

#### Methods:

Study participants included 84 children and adolescents ages 6-16yrs with CAASD ( $M = 11.11$ yrs,  $IQ = 103.88$ ) and 64 with TD ( $M = 10.73$ yrs,  $IQ = 114.53$ ) in three age-groups. Group differences on age and IQ were non-significant. To evaluate social JA, participants performed four dyadic JA tasks with their peer. Two social JA-mirroring tasks (side-by-side walking, face-to-face movement) and two JA-completion tasks (virtual-football kick-and-catch, walk in a corridor). Dyads were paired by gender, IQ, and chronological age. Participants also performed two non-social JA tasks interacting with a computer: A mirroring task (following a moving triangle with a finger) and a completion task (virtual ping-pong play). JA performance was coded via *Interact* micro-analyses coding system, providing six major coordinated movement scores for each task. In addition, we evaluated the participants motor and ToM abilities via the Individual Motoric Observation Scale (IMOS) and Theory of Mind Inventory (TOMI) parents' questionnaire (Hutchins et al., 2012).

#### Results:

A Generalized Estimating Equations (GEE) analyses yielded significant main effects of task (non-social > social) group (CAASD < TD) and age (early-adolescence and pre-adolescence > early-childhood). The significant Task X Age interaction indicated better JA in the older age-groups in comparison with the youngest age-group in the social mirroring tasks and that adolescents outperformed younger participants in the non-social mirroring task. The significant Task X Group interaction highlighted the advantage of TD participants over ASD participants in the social completion tasks, though not in non-social completion task.

A linear regression analyses indicated the prediction of better JA performance with better motor abilities in social and non-social tasks and with better ToM abilities only in social tasks (see table 1).

#### Conclusions:

Study findings are discussed in light of the connection between social-cognition and motor difficulties in youngsters with CAASD and its possible impact over their peer engagement. Our understanding of the role motor and ToM abilities play in JA, support the development of intervention program to elicit JA abilities in children with CAASD.

#### **505.063** (Virtual Poster) What Is the Developmental Trajectory of Repetitive Behaviors in Autistic Children Aged 6 to 12 Years? - a Parental Perspective

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**Background:** Repetitive behaviors are central in the diagnosis of autism spectrum and are expressed through a wide range of behaviors, from motor stereotypies to an insistence on sameness (American Psychiatric Association, 2013). Several studies have shown that, overall, repetitive behaviors decrease with age (Esbensen et al., 2009). However, some behaviors present at a young age may develop into more complex behaviors over the course of development and current knowledge does not provide information about how these behaviors change in autistic children over time.

**Objectives:** To document the developmental trajectory of repetitive behaviors in autistic children aged 6 to 12 years using a parental perspective and to identify the most prevalent repetitive behaviors in this age range.

**Methods:** 73 parents of autistic children aged between 6.1 to 12.9 years (60 boys: 13 girls) completed the french version of the *Questionnaire on Repetitive Behaviors and Interests in School-Aged Autistic Children* through LimeSurvey. The questionnaire includes a comprehensive list of 47 different repetitive behaviors chosen following an iterative process with expert clinicians. Parents were asked to identify and qualify the repetitive behaviors of their child by answering to multiple-choice and open-ended questions on the frequency and intensity of these behaviors. Descriptive

analyses were conducted to identify the nature and frequency of repetitive behaviors and changes over time in these behaviors were identified through thematic and qualitative analyses.

**Results:** Thirty-nine percent of parents ( $n = 28$ ) reported that their child's behaviors had changed over time. Among these parents, 4 major patterns of change were identified from the thematic analysis: 64% mentioned that the behaviors have evolved over time, either by **becoming more complex** (72%) or by **transforming into other behaviors** (28%). Finally, 29% of parents said that the behaviors had **increased**, while 21% said that they had **decreased** in frequency. Furthermore, the behaviors most frequently reported by these parents were hopping (50%), putting objects in mouth (46%), holding objects in hands (43%), hand flapping, producing vocalizations, words or sentences spontaneously (all reported 39%), repeating words and sentences (echolalia), grouping objects by their perceptual properties, clapping hands and pacing or running (all reported 36%), as well as facial twitching, smelling objects and lining up objects (all reported 32%).

**Conclusions:** Parents' answers suggest that the manifestation of repetitive behaviors evolve with age in autistic children and that there is variability in the developmental trajectory of these behaviors. Clarifying the developmental trajectory of repetitive behaviors may help professionals and clinicians make better prognosis about the evolution of repetitive behaviors. In addition, it may allow the development of assessments based on a better understanding of the transformation of pathognomonic signs in autism. In future research, the understanding of these behaviors and their evolution over time will need to be refined through the addition of direct observation tools with the child.

#### **505.064 (Virtual Poster)** A Multi-Level Investigation of Sensory Sensitivity and Responsivity in Adults with Autism

**L. A. Sapéy-Triomphe<sup>1,2</sup>, J. Dierckx<sup>1</sup>, J. Van Overwalle<sup>1,2</sup>, S. Vettori<sup>3</sup> and J. Wagemans<sup>1,2</sup>, (1)Department of Brain and Cognition, Leuven Brain Institute, KU Leuven, Leuven, Belgium, (2)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium, (3)Institut des Sciences Cognitives - Marc Jeannerod UMR5229, Centre National de la Recherche Scientifique (CNRS) & Université Claude Bernard Lyon 1, Lyon, France**

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**Background:** Atypical sensory processing is a core symptom of Autism Spectrum Disorder (ASD). Yet, measurements of sensory sensitivity tend to lack of consistency in ASD, which may be due to the (sometimes) unclear notion of sensitivity. Here, we refer to sensory sensitivity as the ability to detect a sensory stimulus, and to sensory responsivity as the intensity of an observable response to a sensory stimulus.

**Objectives:** This study aimed at better characterizing visual sensitivity and responsivity in ASD at three levels: self-reported, behavioral and neural. We also aimed at investigating the relationships between these three levels, and at exploring how atypical sensory processing may contribute to an increased intolerance of uncertainty and anxiety, as these factors were found to account for half of the variance in sensory sensitivity in ASD.

**Methods:** This study involved 25 neurotypical (NT) and 24 autistic adults. The two groups were matched in age, sex ratio and intelligence quotient. At the self-reported level, participants completed questionnaires measuring sensory sensitivity (visual items of the Sensory Perception Quotient – SPQ), sensory responsivity (Sensory OverResponsivity scale – SOR) or both (Glasgow Sensory Questionnaire – GSQ). At the behavioral level, participants took part in a series of tasks measuring sensory sensitivity (i.e., detection thresholds in contrast and spatial frequency of gratings) and responsivity (i.e., contrast, spatial and temporal frequency thresholds at which participants felt uncomfortable). At the neural level, we used Fast Periodic Visual Stimulation (FPVS) and a 64-electrode electroencephalogram (EEG) system as an implicit and objective way to assess detection thresholds in contrast and spatial frequency. Finally, participants completed the short Intolerance of Uncertainty scale (IU) and the State-Trait Anxiety Inventory (STAI).

**Results:** At the self-reported level, the ASD group scored higher than NT on the GSQ and SOR ( $p < .001$ ), while the group difference was marginal on the SPQ ( $p = .057$ ). At the behavioral level, measures of sensory sensitivity and responsivity in contrast and temporal frequency showed no group differences. Yet, the ASD group had higher detection thresholds than NT in spatial frequency ( $p < .01$ ), as well as higher thresholds at which they reported feeling uncomfortable when seeing the grating ( $p < .05$ ). The SOR was correlated with behavioral measures of sensory responsivity, and the GSQ with behavioral measures of sensory sensitivity and responsivity. Contrary to NT, in the ASD group, self-reported and behavioral measures of sensory sensitivity and responsivity were correlated with the IU and STAI, so that higher sensory sensitivity and responsivity were associated with a higher intolerance of uncertainty and more anxiety.

**Conclusions:** In autistic adults, visual sensitivity and responsivity were higher at the self-reported level, and typical or higher, depending on the visual feature, at the behavioral level. Future EEG analyses will determine whether sensory sensitivity is also increased at the neural level in ASD. This multi-level approach sheds light on the mechanisms that underlie sensory issues in ASD, ranging from their difficulties in their daily-lives to peculiarities at the neural level, and to co-occurring issues such as anxiety.

#### **505.065 (Virtual Poster)** Estimating the Relative Prevalence of Early Interest in Written Material in Autism in a Representative Population

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#### **Background:**

Although the scientific community has not come to an agreement on the defining criteria for hyperlexia, it is commonly described as an **intense and precocious interest in written material** and a **discrepancy in reading skills between advanced decoding and weaker comprehension**. A strong link between autism and hyperlexia has been demonstrated (Ostrolenk et al., 2017), but there are no recent studies assessing the frequency and development of hyperlexic features in a large population of autistic children.

## Objectives:

Our study focuses on the most precocious and specific sign of hyperlexia, early interest in written material. We **documented its frequency and the history of its emergence** in a representative population referred for an autism diagnosis assessment and **compared the results between autistic and non-autistic individuals**. A secondary objective was to collect qualitative and quantitative information on other manifestations of hyperlexia and the parallel development of oral language.

## Methods:

The study participants comprised all children under 7 years of age referred for an autism diagnosis assessment at our autism evaluation clinic from a defined geographic area in northern Montreal. The families were enrolled in two complimentary projects:

- The parents of children assessed at the clinic in 2019 and 2020 who consented to participate in person answered a 45-minute phone questionnaire (PQ) which was developed based on a literature review, a previous pilot questionnaire, and clinicians' opinions. It includes questions about the child's interest in letters and numbers, related behaviours and skills, oral language level, parental attitude regarding written material, and relevant qualitative information. All the parents were contacted shortly after the assessment. The parents of 146 children, of which 84 subsequently received an autism diagnosis, answered the questionnaire ( $M_{age}=55.64$  months;  $SD=12.80$ ; range=29-83). An additional neurotypical control group is currently being recruited for this project.
- The medical files (MF; psychiatrist and psychologist reports) of all the eligible children who were assessed during the same period were anonymously examined using a rating grid investigating the child's interest in letters and numbers, for a total of 446 children, of which 253 received an autism diagnosis. Although the information gathered from MF was less detailed than in the PQ, it allowed us to assess the entire population and to ensure the representativity of our sub-sample.

## Results:

The children's interest in written material was rated using 4 categories (*None < Moderate < Intense < Exclusive*) and yielded similar results in both the direct (PQ) and indirect (MF) investigation: the autistic group showed a superior level of interest than the negative diagnosis group ( $p<0.005$ ). Significantly more autistic children had an *intense* or *exclusive* interest in written material (PQ: 40.48% vs. 20.97%; MF: 23.71% vs. 3.63%). Moreover, the higher the interest, the earlier was its onset.

## Conclusions:

These results indicate that a large proportion of autistic children have an intense interest in written material at the age of diagnosis, confirming the need for more research on hyperlexia and the factors involved in its emergence, as well as its possible uses during diagnostic assessment and intervention.

**505.066** (*Virtual Poster*) Investigating the Relationships between Perceptual Alterations, Sensory Reactivity, Intolerance of Uncertainty and Anxiety in Autistic Children

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## Background:

Sensory differences and anxiety disorders are common in autism. Previous studies suggest that sensory hyper-reactivity may be associated with anxiety and intolerance of uncertainty (IU) in autistic children. However, those studies predominantly assessed sensory reactivity using questionnaires (i.e., clinical reports), which are often subjective and do not differentiate between sensory difficulties at behavioural and perceptual levels. Psychophysical approaches allow for an objective, quantitative measure of sensory differences at the perceptual level. Determining whether perceptual differences contribute to the manifestation of anxiety, and how this relates to IU, would provide further insight into the nature and impact of sensory difficulties in autism.

## Objectives:

We aimed to: 1) replicate the findings from a previous study (MacLennan et al. 2021), who showed that IU fully mediated the association between sensory reactivity and anxiety, and anxiety fully mediated the association between sensory reactivity and IU; and 2) to investigate how alterations in sensory perception contribute to sensory reactivity, IU and anxiety.

## Methods:

41 autistic children (33 male, 30 with ADHD) were included. Sensory reactivity was assessed using the Sensory Processing Measure (SPM) and a battery of vibrotactile tasks, using a Cortical Metrics stimulator (Figure 1A). Anxiety and IU were assessed using parent-report measures from the

Screen for Child Anxiety Related Disorders (SCARED) and Intolerance of Uncertainty Scale for Children (IUSC), respectively. Pearson's correlations were run between SPM scores, SCARED score, IUSC score, and vibrotactile thresholds. Mediation analyses using bootstrapping were run in R.

#### Results:

Significant positive correlations were found between SPM Touch Score and IU, and between IU and anxiety ( $p \leq 0.04$ ), but not between SPM Touch Score and anxiety ( $p = 0.08$ ). Neither SPM Total Score, nor any other sensory modality, significantly correlated with IU or anxiety (all  $p$ -values  $> 0.05$ ). Of the vibrotactile tasks, only simultaneous frequency discrimination (SFD) threshold (Figure 1B) significantly correlated with SPM Touch Score after Bonferroni's correction ( $p < 0.01$ ; Figure 1C). However, no significant associations were found between SFD threshold and IU or anxiety ( $p \geq 0.10$ ). Mediation analyses showed full mediation between SPM Touch Score and IU through anxiety (Figure 1D;  $p = 0.04$ ). Mediation analysis between SPM Touch Score and anxiety through IU did not meet significance set at 0.05 (Figure 1E;  $p = 0.06$ ), but was similar to findings by MacLennan et al. 2021. No mediation was found between SFD threshold and anxiety through IU (Figure 1F), or between SFD threshold and IU through anxiety ( $p \geq 0.21$ ).

#### Conclusions:

We contribute to previous findings showing full mediation between SPM Touch Score and IU through anxiety, and an association suggestive of mediation between SPM Touch Score and anxiety through IU. While larger samples are needed, our findings suggest that touch processing problems (rather than global sensory reactivity) contribute to the development and maintenance of anxiety and IU. Our findings imply that perceptual alterations contribute to the clinical manifestations of sensory reactivity but are not directly associated with anxiety or IU. This highlights the importance of differentiating sensory difficulties at behavioural and perceptual levels.

#### **505.067** (Virtual Poster) Oromotor Skills in Autism Spectrum Disorder: A Scoping Review

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#### Background:

The factors that influence language outcomes in autism spectrum disorder (ASD) are not fully understood. A substantive body of research has revealed gross and fine motor impairments among individuals with ASD. These studies have provided compelling evidence for causal linkages between motor disruptions and deficits in expressive language. The vast majority of this work has, however, been focused on general motor skills and not oromotor skills, which are critical to expressive language development. Research on oromotor skills among individuals with ASD has been limited by methodological constraints, contradictory findings, and a relatively small number of studies.

#### Objectives:

The purposes of this scoping review are to summarize and disseminate research findings regarding oromotor skills in ASD and to identify gaps in the existing body of literature. The research questions are: (1) What methods have been used to investigate oromotor functioning among individuals with ASD?, (2) What behaviors have been investigated?, and (3) What do the findings tell us about this topic?

#### Methods:

This scoping review follows the framework outlined by Arksey and O'Malley (2005). After identifying the research questions, we identified studies based on specific criteria (Table 1) via a comprehensive search of relevant databases (Table 2). Two authors independently conducted a title/abstract review of 2,246 manuscripts, dissertations, and book chapters. 396 studies were chosen for full-text review and 74 studies were chosen for final inclusion. Data regarding targeted behaviors, assessment tools, outcome measures, and findings were extracted and analyzed using descriptive statistics.

#### Results:

Analysis approaches included perceptual (73% of studies), instrumental (36%), report/questionnaire (4%), and medical record review (1%), with 15% of studies incorporating multiple approaches. 50% of studies used a published assessment tool. Oromotor functioning was examined in the context of speech abilities (87%), non-speech oromotor abilities (23%), and feeding skills (11%). 86% of studies reported an oromotor abnormality based on comparison to a non-ASD group or the use of standardized norms. Among speech-related oromotor findings, the most common level of analysis was phoneme (52% of speech studies), followed by syllable (40%), word/nonword repetition (37%), and connected/spontaneous speech (20%). While the majority of speech studies examined accuracy (58%), others examined duration (16%), phoneme inventory (13%), rate (13%), and intelligibility (6%). Nonspeech and feeding studies demonstrated a similar variety in methodology, behaviors analyzed, and reported results.

#### Conclusions:

A variety of oromotor abnormalities are present among individuals with ASD, although generalization to the population is limited by methodological constraints of existing literature. The reliance on observational analysis of oromotor and speech behavior, while ecologically valid, exposes studies to rater bias and reliability issues. The variety of assessment paradigms limits cross-study comparisons, as does the reporting of composite scores rather than detailed oromotor characteristics. Small sample sizes and selection bias further complicate generalization. The summarized literature, in conjunction with known associations between oromotor functioning and expressive language skills, motivates future research with implications regarding the efficacy of motor-based therapy approaches, addressing ongoing clinical and scientific issues such as the early detection of ASD, and identifying neurobiological mechanisms influencing communication development.

**505.068 (Virtual Poster)** Sensory and Behavioral Subtypes of Children with Autism Spectrum Disorder

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**Background:** Sensory processing characteristics are exhibited in children with Autism Spectrum Disorder (ASD), and it has been reported to be variable among children with ASD. To understand the patterns of variability in sensory processing characteristics, subtypes based on sensory processing have been reported. These studies suggest that sensory subtypes are formed by sensory severity, sensory modalities, and responsiveness to sensory stimuli. However, information regarding daily difficulties and mental health problems faced by each subtype is lacking.

**Objectives:** The aim of this study was to identify subtypes of sensory processing and behavioral characteristics in children with autism spectrum disorder. We thought that cluster analysis, including mental health and behavioral issues, would help identify sensory subtypes that would be more useful for clinical practices.

**Methods:** Caregivers of children aged 5 to 10 years ( $n = 136$ , 71.3% males, mean = 7.35, SD = 1.93) with ASD participated in this study. All participants were recruited from day-service centers of LITALICO inc. in Japan. All children included in this study were diagnosed with ASD by medical facilities. Sixty-three participants (46.3%) were diagnosed with intellectual disability. The Japanese version of the Short Sensory Profile (SSP-J) and the Strength and Difficulties Questionnaire (SDQ) were used to collect data. Latent profile analysis was used to identify sensory and behavioral subtypes based on z-scores of SSP-J and SDQ. To determine meaningful phenotypes, the Bayesian Information Criteria was used to compare models.

**Results:** Our analyses revealed five distinct subtypes of sensory and behavioral features as follows; (a) typical sensory without behavioral issues (TSB,  $n = 31$ ), (b) moderate hypersensitive taste/smell and conduct problems (MTSC,  $n = 35$ ), (c) mild sensory and social issues (MSS,  $n = 36$ ), (d) severe generalized sensory and severe behavioral issues (GSSB,  $n = 26$ ), and (e) severe sensory seeking and hyperactivity (SSH,  $n = 8$ ). There were no age differences between subtypes ( $F(4,131) = 1.27$ ,  $p = 0.29$ ). Results demonstrated a discrepancy of severity for each component in terms of ASD characteristics; MTSC showed the highest conduct problems (e.g., theft, lies, physical violence), and SSH showed the highest hyperactivity/inattention, even though GSSB had the most severe sensory problems.

**Conclusions:** We concluded that sensory and behavioral features of children with autism spectrum disorder could be classified as five different subtypes. These phenotypes partially replicate previous studies of sensory subtypes and describe their behavioral characteristics. We also found that there are subtypes in which specific sensory and behavioral characteristics co-occur even though sensory and behavioral issues are not strongly correlated in ASD children as a whole (e.g., conduct problems or hyperactivity/inattention). Our study suggests that sensory and behavioral clustering may be helpful to consider individualized approaches for children with ASD.

**505.069 (Virtual Poster)** The Association between Rrbs and Adaptive Functioning

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**Background:** Studies examining the relationship between autism symptomatology and adaptive functioning show that IQ, age and social-communication symptoms tend to associate with adaptive functioning (Tillman et al, 2019; Frost et al., 2017). In contrast, the relationship between RRBs and adaptive functioning remains unclear, with some research indicating no association, and other work finding a negative correlation between these two constructs (McDonald et al., 2017; Tryob et al., 2016).

The majority of studies examining the association between RRBs and adaptive functioning have used the ADOS or ADI-R to measure RRBs, which provide little nuance regarding the variability in symptom expression. In the current study, we utilized the parent-report Repetitive Behavior Scale-Revised (RBS-R; Bodfish et al., 1999), which divides RRBs into 6 subcategories: stereotypic behavior (SB), self-injurious behavior (SIB), compulsive behavior (CB), ritualistic behavior (RB), sameness behavior (SAB) and restricted behavior (RI).

**Objectives:** To obtain a more nuanced understanding of the relationship between specific subcategories of RRBs and adaptive functioning.

**Methods:** We collected these data within the context of a larger study examining family accommodation among children with autism (Feldman et al., 2019). Participants were 170 children (125 males) at time of diagnosis, who received a gold-standard evaluation including developmental/cognitive

(Mullen, WPPSI, WISC) and autism-specific (ADOS-2) assessments, in addition to the RBS-R and the Vineland Adaptive Behavior Scales 2 (VABS-II; Sparrow et al., 2005). We stratified the sample by age and compared participants age 3-5.11 (N=83) with those age 6-12 (N=87).

Results: A stepwise regression model was used to predict adaptive functioning, as measured by the overall Adaptive Behavior Composite Standard score (ABCS) of the VABS-II, with the six subcategories of the RRBs, as measures by the RBS-R, as predicting variables.

For children 3-5.11 years old, all RRB subcategories significantly and negatively correlated with adaptive functioning ( $p < .01$ ) and the model explaining the most variance in ABCS included IQ, RB, SB and CB as significant predictors. Together they explained 59.23% of variance in ABCS ( $p < .01$ ), such that higher levels of RB, SB and CB predict worse adaptive functioning and higher IQ predicted higher adaptive functioning. For children 6-12 years old, with the exception of RI, all RRB subcategories correlated significantly and negatively with adaptive functioning ( $p < .05$ ). The model explaining the most variance in ABCS included only SIB as a significant predictor, while RI, RB, CB, and SAB were not significant predictors. SIB explained 17.85% of variance in ABCS ( $p < 0.01$ ), such that individuals with higher levels of SIB exhibited decreased adaptive functioning.

Conclusions: This study provides evidence that there is a significant negative relationship between subcategories of RRBs and adaptive behavior, while revealing that certain types of RRBs, specifically RB, SB, CB, and SIB, contribute to the ability to predict adaptive behavior in this population. Results point to differences in the relationship between these variables and age. Future work should focus on possible mediating variables, such as IQ and gender, and should examine these findings in a longitudinal context.

**505.070 (Virtual Poster)** The Shortening of Achilles' Tendon Length in Moderate/High Severity Toe Walkers Is Already Present at a Young Age and Increase with the Age?

**G. Valagussa**<sup>1,2</sup>, **E. Grossi**<sup>2</sup>, **V. Balatti**<sup>2</sup>, **D. Piscitelli**<sup>1,3</sup>, **F. Cantarelli**<sup>4</sup>, **L. Mascetti**<sup>5</sup>, **E. Montrasio**<sup>5</sup>, **M. Mazzucchelli**<sup>6</sup> and **C. Perin**<sup>1</sup>, (1)Program in Physical Therapy, University of Milano-Bicocca, School of Medicine and Surgery, Monza, Italy, (2)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy, (3)School of Physical and Occupational Therapy, McGill University, Montreal, QC, Canada, (4)Istituto La Casa del Sole, Mantova, Italy, (5)Fondazione Renato Piatti, Milano, Italy, (6)School of Medicine and Surgery, University of Milan-Bicocca, Milano, Italy

Background:

Toe-walking is a phenomenon present in 20-30% of ASD subjects. Using a qualitative structured assessment, we previously described three mutually exclusive clinical functional classes of tip toe behavior (TTB) of increasing severity: during running (TTB1); during walking and running (TTB2); during standing, walking and running (TTB3). In another study, we found a positive relationship between the presence and severity of TTB and the Achilles' tendon shortening. It is not clear if ASD subjects who present TTB manifest the Achilles' tendon shortening at a young age and if this deficit is related to the age of onset.

Objectives:

This cross-sectional study aimed to evaluate: 1) if ASD subjects who present moderate-high TTB severity manifest a deficit in gastrocnemius and soleus muscles (GM and SM) length values (the two muscles that coalesce into Achilles' tendon) at a young age (i.e., before 8 years); 2) if the SM and GM length values decrease with age in moderate-high TTB severity subgroup.

Methods:

The study group consisted in 106 subjects (mean age: 11.27 years – 4.95 SD; 83 males) with autism diagnosed according DSM-5 or ICD-10 criteria. A therapist assessed the presence of TTB during standing, walking, and running using direct observation and an interview of the main caregiver living with the children<sup>2</sup>. Two therapists assessed both the SM and GM length values using a manual goniometer following the methodology previously described<sup>3</sup>. We considered moderate-high severity TTB subjects those belonging to TTB2 and TTB3 subgroups. Therefore, to assess the presence of muscle length deficit at a young age (0-8 years), we compared the GM and SM length values between NON-TTB (n=28) and TTB2+TTB3 (n=9) subgroups using a Mann-Whitney test. To assess if the SM and GM length values decrease with age in moderate-high TTB severity subgroup we performed a Spearman correlation test between age and GM and SM length values in the TTB2+TTB3 subgroup (n=25).

Results: At age of 0-8 years, the mean length value of the **left GM** of NON-TTB subgroup (n = 28) was 18.61° (6.37°SD) vs a value of 9.22° (4.09°SD) TTB2+TTB3 subgroup (n = 9) ( $p < 0.001$ ). The mean length value of the **right GM** of NON-TTB subgroup was 18.32° (4.97°SD) vs a value of 11.33° (4.36°SD) TTB2+TTB3 subgroup ( $p < 0.001$ ). The mean length value of the **left SM** of NON-TTB subgroup was 27.39° (7.57°SD) vs a value of 15.56° (4.5° SD) TTB2+TTB3 subgroup ( $p < 0.001$ ). The mean length value of the **right SM** of NON-TTB subgroup was 26.39° (5.83°SD) vs a value of 18° (2.97° SD) TTB2+TTB3 subgroup ( $p < 0.001$ ). Moreover, we found a significative inverse correlation between age and left GM ( $r = -0.702$ ;  $p < 0.001$ ), right GM ( $r = -0.623$ ;  $p = 0.001$ ), and right SM ( $r = -0.412$ ;  $p = 0.04$ ) of the TTB2+TTB3 subgroup. We found a not significative correlation between age and left SM ( $r = -0.253$ ;  $p = 0.221$ ).

Conclusions: ASD subjects who present moderate-high TTB severity manifest a significant decrease of Achilles' tendon length values at a young age (i.e., before 8 years). We also found the existence of a significative inverse relationship between age and the Achilles' tendon length values.

**505.071 (Virtual Poster)** Visual and Proprioceptive Feedback Mechanisms of Fine and Gross Motor Control in ASD

**Background:** Deficits in sensorimotor integration are highly prevalent in persons with Autism Spectrum Disorders (ASD). Our prior precision gripping studies demonstrate over-reliance on visual feedback for motor control in ASD. Studies of other motor behaviors, including postural control, indicate over-reliance on proprioceptive feedback. These findings suggest that sensorimotor deficits in ASD are not specific to one sensory domain but may reflect deficits integrating multiple sources of feedback during motor control resulting in behavior specific sensory bias.

**Objectives:** Understanding sensory and motor control processes in ASD is important for identifying physiological mechanisms and determining new targets for interventions. To clarify multisensory mechanisms of motor deficits in ASD, we characterized precision force and postural control during conditions of altered visual and proprioceptive feedback.

**Methods:** Participants with ASD (N=19, 9F) and age- (11-25 years) and non-verbal IQ- (ASD: 102±19.6, TD: 112±14.5) matched controls (N=14, 7F) completed precision gripping and postural control tests. For gripping, participants pressed on force sensors with their index finger and thumb to control a moving bar so it reached and stayed stable at the level of a target bar. The spatial resolution of visual feedback was manipulated (low/medium/high). To manipulate proprioceptive feedback of finger posture, 80Hz (ON) or 0Hz (OFF) tendon vibration (TV) was applied at the wrist. For posture, participants stood still on a force platform with feet shoulder width apart for 45s. Visual feedback (lights ON/OFF) was manipulated. TV was applied (ON/OFF) to the Achilles tendons to manipulate the proprioception of ankle posture. Grip force output and postural center of pressure (COP) were analyzed for variability (standard deviation) and regularity (sample entropy and detrended fluctuation analysis, respectively).

**Results:** Force variability was increased in controls with the TV ON relative to OFF, especially at younger ages and was not affected by TV in ASD ( $R^2_{\text{GROUP} \times \text{TV} \times \text{AGE}} = .008$ ,  $t_{151.8} = 2.43$ ,  $p = .016$ ). Force regularity was decreased with the TV ON relative to OFF in ASD only ( $R^2_{\text{GROUP} \times \text{TV}} = .008$ ,  $t_{151.4} = 3.16$ ,  $p = .002$ ). During posture, anterior-posterior COP variability was elevated in both groups with TV ON compared to OFF but trended higher in ASD ( $R^2_{\text{GROUP} \times \text{TV}} = .012$ ,  $t_{65.5} = 1.80$ ,  $p = .077$ ). Medial-lateral COP variability was higher in ASD than controls across conditions ( $R^2_{\text{GROUP}} = .131$ ,  $t_{33.6} = 2.50$ ,  $p = .017$ ). Medial-lateral COP regularity trended lower during TV ON compared to OFF for both groups and decreased with increased age in controls during TV OFF only ( $R^2_{\text{GROUP} \times \text{TV} \times \text{AGE}} = .016$ ,  $t_{68.9} = 1.71$ ,  $p = .091$ ). No other group or group by sensory feedback effects were found.

**Conclusions:** For gripping, disrupting proprioceptive feedback resulted in greater force variability in controls, especially at younger ages, and reduced force regularity in ASD with no effect on variability. For posture, disrupting proprioception led to greater postural variability, especially in ASD, and reduced postural regularity, especially in controls. These findings indicate that controls use multiple sensory inputs to maintain spatial precision of ongoing movements, which improve with age. Persons with ASD show reduced multisensory feedback processing, relying predominantly on vision for gripping and proprioception for posture across age. Our findings help clarify sensory integration deficits that contribute to motor issues in ASD and implicate atypical neurodevelopmental mechanisms.

## Service Delivery/Systems of Care

### PANEL — SERVICE DELIVERY/SYSTEMS OF CARE

#### 201 - How Do We Meet the Challenges to the Delivery of Childhood Autism Diagnostic Services Internationally?

**Panel Chair:** Ian Male, Mid Sussex Child Development Team, Sussex Community NHS Trust, Haywards Heath, United Kingdom

**Discussant:** Kristin Sohl, ECHO Autism Communities, Child Health, Columbia, MO

**201.001 (Panel)** How Can We Improve the Delivery of Childhood Autism Diagnostic Services: Emerging Lessons from Clinician Interviews from Teams Meeting the UK Nice Autism Quality Standard

**I. A. Male<sup>1</sup>, W. Farr<sup>2</sup>, P. M. Wilson<sup>3</sup>, V. J. Abrahamson<sup>4</sup>, S. Wigham<sup>5</sup>, H. Terrell<sup>6</sup>, A. Allard<sup>7</sup>, V. Grahame<sup>8</sup>, L. Kenny<sup>9</sup>, V. Reddy<sup>10</sup> and J. R. Parr<sup>5</sup>**, (1)Mid Sussex Child Development Centre, Sussex Community NHS Trust, Haywards Heath, United Kingdom, (2)Sussex Community NHS Trust, Haywards Heath, United Kingdom, (3)Centre for Health Service Studies, University of Kent, Canterbury, United Kingdom, (4)University of Kent, Canterbury, United Kingdom, (5)Population Health Sciences Institute, Newcastle University, Newcastle upon Tyne, United Kingdom, (6)Research and Development, Sussex Community NHS Foundation Trust, Haywards Heath, United Kingdom, (7)Council for Disabled Children, London, United Kingdom, (8)Cumbria, Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (9)NHS England, London, United Kingdom, (10)Cambridge and Peterborough NHS Foundation Trust, Peterborough, United Kingdom

**Background:** Diagnostic services for children with possible autism are struggling to meet rapidly growing demand across the world where resources are being stretched regardless of setting. The Realist Evaluation of Autism Service Delivery (RE-ASCeD) study was designed to identify and research models that deliver timely, high quality autism diagnostic services (NHS England Long Term Plan (2019)).

**Objectives:**



- To investigate which existing models of Autism diagnostic service delivery offer the timely, cost-effective, high quality and child and family friendly solutions.
- In line with realist thinking, to understand the contexts and mechanisms that underpin their success, or failure.

#### Methods:

6 diagnostic services (2 paediatric, 2 CAMHS, 2 integrated CAMHS / Paediatric) were identified from our national survey completed by 128 services, as being the most compliant with the NICE Quality Standard for autism service delivery, based on self-report, and willingness to participate as a case study site. The sites had all scored well on Care Quality Commission reviews, and reported compliance with NICE quality standard recommendations e.g., ability to consider the child's physical and mental health; offering a personalised plan as part of diagnosis working with family; access to a key worker; and discussion and signposting for psychosocial interventions. We adapted the sampling frame, with input from our Expert Advisory and Parent Groups, from one looking at specific innovative approaches to focus on the broad service delivery types in the UK.

Members of each clinical team, commissioners and referrers (12 at each site) and parents and young people, have, or will be interviewed to explore how the service developed, its strengths and weaknesses, and the factors that have either facilitated or blocked their ability to deliver a high-quality service.

#### Results:

13 professional interviews have been conducted across 4 of the sites. Emerging themes from interviews include:

- **What works well:** use of parent and educational setting questionnaires at referral to inform approach to assessment / early redirection to alternative services; pathway coordinator; skill mix e.g. psychology assistants; tiered assessment responsive to diagnostic complexity, although concern was expressed that "abbreviated" approaches may give insufficient assessment; access to family support from early in pathway, especially with lengthening waiting times; diagnostic reports and future interventions shared with parents, reflecting the child's strengths as well as weaknesses.
- **Challenges:** increasing demand "*the service was developed to see 60 children a year, its about trebled...we see 2 children a week, and get 8 referrals.*" Need to adapt screening and diagnostic tools to better detect girls with autism. Working with multicultural population.
- **Facilitators:** good relationships between team members in non-hierarchical teams; respect for each other's roles; training; access to multidisciplinary team and regular MDT meetings.
- **Blockers:** persuading commissioners of need for greater resourcing; reduction of input from other relevant services.

Conclusions: Emerging data from interviews of professionals delivering or referring to autism diagnostic services point to a number of strategies that can improve quality and timely access. Despite this, it is also evident that significant uplifts in funding and staffing are required to address the consistent increases in demand.

#### 201.002 (Panel) Accuracy of Consultant General Pediatrician Autism Diagnosis Compared to a Multi-Disciplinary Team

**M. Penner<sup>1</sup>, L. Senman<sup>2</sup>, L. Andoni<sup>3</sup>, A. Dupuis<sup>4</sup>, E. Agagnostou<sup>5</sup>, M. Shouldice<sup>6</sup>, S. Kao<sup>7</sup> and J. A. Brian<sup>1</sup>,** (1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Autism, Bloorview Research Institute, Toronto, ON, Canada, (3)University of Massachusetts, Boston, MA, (4)Biostatistics, University of Toronto, Dalla Lana School of Public Health, Toronto, ON, Canada, (5)Autism Research Centre, Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (6)Hospital for Sick Children, Toronto, ON, Canada, (7)Paediatric Alliance of Ontario, Toronto, ON, Canada

Background: Many existing ASD diagnostic guidelines require that the assessment be conducted by a multi-disciplinary team (MDT), who are often in short supply, leading to lengthy wait times for diagnostic assessment. One potential solution to expand diagnostic capacity is for consultant general pediatricians to perform ASD diagnostic assessments; however, the accuracy of these assessors is not yet known.

Objectives: To determine the accuracy of ASD diagnostic assessments conducted by consultant general pediatricians compared to a MDT.

Methods: This was a prospective cross-sectional study. Pediatricians were eligible if they had not completed subspecialty training in developmental pediatrics. Their patients were eligible if they were less than 5.5 years of age, had been referred with a developmental concern, and did not have an existing ASD diagnosis. The pediatrician and the MDT (a developmental pediatrician, psychologist, and psychometrist) each conducted blinded assessments for the child within two weeks of each other. The MDT assessment included the Autism Diagnostic Interview – Revised (ADI-R), the Autism Diagnostic Observation Scale, 2<sup>nd</sup> edition (ADOS-2) and the Mullen Scales of Early Learning. Patient participants were randomized to either undergo the pediatrician or the MDT assessment first, followed by the other assessment. Both the MDT and the pediatrician recorded a forced decision about whether the child was autistic, as well as their level of certainty on a 5-point Likert scale. Accuracy was measured by calculating sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV).

Results: Seventeen pediatricians (12 women) participated in the study and referred a total of 106 children. Participating pediatricians had been in practice an average of 13 years (range: 1-32). Patient participants (79 boys) had a mean age of 41.9 months (SD 13.3). Fifty-six participants (52.8%) were of non-white race/ethnicity. Seventy-two participants (67.9%) were diagnosed as autistic by the MDT. Sensitivity and specificity of the pediatrician assessments compared to MDT were 0.75 and 0.79, respectively. PPV of the pediatrician assessments was 0.89 and NPV was 0.6. When the MDT and pediatrician agreed the child was autistic, pediatricians indicated feeling Certain/Completely Certain in 80% and the MDT in 96.3% of cases. Among cases with agreement that the child was not autistic, feeling certain occurred in 55.6% of cases for the pediatrician and for the MDT.

When the pediatrician indicated ASD and the MDT did not, the pediatrician and MDT each felt certain in only 28.6% of cases. Finally, among cases in which the MDT indicated ASD and the pediatrician did not, the pediatrician felt certain in 44.4% of cases, whereas the MDT felt certain in 83.3%.

**Conclusions:** Our results show strong agreement between pediatricians who indicate a child has an ASD diagnosis and a subspecialist MDT, with accompanying high feelings of certainty. Agreement was much lower when pediatricians did not feel the child was autistic, which was accompanied by lower feelings of certainty among pediatricians. Our results suggest that consultant general pediatricians can be encouraged to diagnose ASD when they feel certain, and that further education is needed for caution when 'ruling out' ASD.

**201.003 (Panel)** Combination of New Remote Assessment Tool and Echo Autism Program Accelerates Access to Autism Assessment and Diagnosis in Latin America Despite Global Pandemic

**V. Nanclares-Nogues<sup>1</sup>, N. E. Granana<sup>2</sup>, A. Richaudeau<sup>3</sup>, F. Astorino<sup>4</sup> and K. Sohl<sup>5</sup>,** (1)*ECHO Autism Communities, University of Missouri, Columbia, MO, (2)Servicio de Neurología Infantil, Hospital Durand, CABA, Argentina, (3)Hospital Universitario Austral, Buenos Aires, Argentina, (4)Pediatric neurology, Hospital Alassia, Santa FE, Argentina, (5)ECHO Autism Communities, Child Health, Columbia, MO*

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**Background:** The diagnosis of autism spectrum disorder (ASD) can be difficult, as we rely on developmental history and observable behavior to diagnose. There are great barriers in access to best-practice evaluations for ASD in low-resource countries, ranging from lack of training to few specialists. These barriers were only exacerbated during the COVID-19 pandemic. A group of researchers in Argentina and Chile conducted a pilot study within the validation study of the Brief Observation of Symptoms of Autism (BOSA) instrument developed during the months of confinement due to the pandemic (Lord et al., 2020), piloting the use of the Spanish version of the BOSA for Latin American participants.

**Objectives:** The main objectives were to determine the feasibility of an assessment while maintaining social distance protocols, pilot the use of the Spanish version of the BOSA with a Latin-American population, and, in turn, improve accessibility to diagnosis. In addition, the project sought to train professionals remotely in best-practice care and establish a multicenter network for diagnosis and referral. .

**Methods:** The professionals who participated in the study were part of the ECHO Autism PROTECTEA network. ECHO Autism PROTECTEA "Programa de Orientación Temprana y Concientización en Trastornos del neurodesarrollo y en el Espectro Autista" (Program for Early Detection and Conscientization on Development and Autism Spectrum Disorders) is a network of professionals who work in primary care settings and hospitals that assess individuals with neurodevelopmental differences. These providers participated in the ECHO Autism PROTECTEA teleECHO sessions throughout the 2020 year. Only professionals who met strict criteria were allowed to take part in the pilot study. In addition, all professionals completed the UCLA training on the BOSA, presented at least two BOSA cases during the ECHO Autism: BOSA Supervision teleECHO sessions, and demonstrated reliable administration and coding procedures. The ECHO Autism: BOSA Supervision teleECHO sessions consisted of 6 clinics designed to ensure all professionals involved in the study achieved reliable administration and coding practices prior to the collection of data. The assessment protocol consisted of the BOSA, cognitive assessment (when possible due to COVID restrictions), adaptive behavior assessment, and sociodemographic evaluations.

**Results:** 201 patient cases, 153 males and 48 females, with a median age of 6.3 years. Of the 201 patients, 163 were given the diagnosis of ASD according to BOSA. Cognitive abilities were found to be in the average range for 52% of participants, mild/moderate range in 39%, and 9% of patient cases fell in the severe deficit range. 55% of participants belonged to low and very low socio-economic status, according to the Graffar-Méndez Castellano Scale (Méndez-Castellano, 1986).

**Conclusions:** The study showed that early detection and diagnosis of ASD are feasible in underserved areas, even during a global pandemic. Telehealth technology and social distance protocols were implemented, enabling clinicians to overcome the barriers imposed by the pandemic. Training and supervision of professionals was achieved remotely, with high reliability in use of the BOSA instrument. A multicenter network was created, improving access to diagnosis and early referral to treatment.

**201.004 (Panel)** Validation of the Spanish Version of the Autism Mental Status Exam (AMSE) in Argentina

**S. H. Cukier<sup>1</sup>, A. L. Maglio<sup>2</sup>, J. P. Berman<sup>3</sup>, N. Barrios<sup>4</sup> and D. Grodberg<sup>5</sup>,** (1)*PANAACEA, Buenos Aires, Argentina, (2)Universidad de Buenos Aires, Buenos Aires, Argentina, (3)PANAACEA, Programa Argentino para Niños, Adolescentes y Adultos con Condiciones del Espectro Autista, Buenos Aires, Argentina, (4)Fleni, Capital Federal, ARGENTINA, (5)Mount Sinai School of Medicine, New York, NY*

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**Background:** Standardized diagnosis of autism spectrum disorders (ASD) is inaccessible to many people in Argentina and other countries in the region. Numerous families, particularly those who live outside the main cities, must travel a great distance (frequently over 100 kilometers) for a diagnostic assessment because there are no standardized assessment tools to support clinical impression in their area of residence. The autism mental status exam (AMSE) is a brief, free-access, clinician-completed instrument that structures the observation and documentation of social, communicative and behavioral signs and symptoms of ASD. AMSE, in its original version in English language, has previously shown high accuracy in identifying autism spectrum disorder (ASD) compared to the autism diagnostic observation schedule (ADOS) in a non-stratified population of high-risk patients suspected of having ASD, and in a sample of high-risk verbally fluent adults using DSM-5 criteria for ASD

**Objectives:** This protocol investigates the sensitivity and specificity of a version of AMSE in the Spanish language in an Argentinian sample of 315 subjects, against DSM-V clinical consensus diagnosis as primary outcome.

**Methods:** The cutoff values were calculated using the ROC (receiver operating characteristic) curve, identifying the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV). The homogeneity of the items of the version in Spanish of AMSE was determined using Cronbach's alpha.

Results: Findings indicate an optimized sensitivity of 90.71% and a specificity of 92.17% for this sample of 315 patients that consulted spontaneously in seven different psychiatric clinics in five different cities in Argentina. AMSE exhibited fair internal consistency (alpha coefficient of 0.75) and high Inter-rater reliability (96.99%).

Conclusions: AMSE showed to be a reliable diagnostic assessment tool that can support clinical diagnosis of ASD in children and adolescents at risk in Argentina. Because of its high clinical utility, it holds promise as an instrument to be useful in other regions in Latin America, where access to the training and use of main standardized diagnostic tools might be limited.

## PANEL — SERVICE DELIVERY/SYSTEMS OF CARE

### 209 - Novel Models for Improving Healthcare Transition and Adult Healthcare Provision in Individuals with Autism and Related Neurodevelopmental Disabilities (NDD).

**Panel Chair:** Sarah Spence, *Autism Spectrum Center, Department of Neurology, Boston Children's Hospital, Boston, MA*

**209.001 (Panel)** Massachusetts Initiative to Improve Transition to Adult Healthcare for Individuals with Autism and Related Neurodevelopmental Disabilities (NDD)

**S. J. Spence<sup>1</sup>, S. Shanske<sup>2</sup>, L. S. Hunt<sup>3</sup> and J. Polzin<sup>4</sup>,** (1)*Autism Spectrum Center, Department of Neurology, Boston Children's Hospital, Boston, MA,* (2)*Bridges Young Adult Program Department of Social Work, Boston Children's Hospital, Boston, MA,* (3)*Center for Primary Care, Harvard Medical School, Boston, MA,* (4)*Division of Developmental Medicine, Boston Children's Hospital, Boston, MA*

**Background:** Youth with autism and neurodevelopmental disabilities (NDD) face unique challenges with healthcare transition. They may lack access to care and experience poorer health outcomes. Therefore special attention must be paid to this vulnerable population.

**Objectives:** The overall aim of the initiative was to improve the quality of healthcare transition for individuals with autism and related neurodevelopmental disabilities by ensuring that patients have a comprehensive integration from pediatric to adult health care.

**Methods:** A diverse group of stakeholders was recruited to examine drivers for improvement and engage in solution-oriented collaboration. An inter-professional steering committee was established with representation from health care facilities across the state (urban and rural, academic and community based), state agencies, patient and family advocacy groups and payers. Task forces were convened to work on 4 main themes including workforce development, optimizing clinical care, practice management and clinical infrastructure and financing the solution. With the help of a quality improvement consultant, each task force spent a year gathering best practice resources and brainstorming additional recommendations, concluding with a statewide summit in November 2020 with three primary objectives:

1. Identify models for best practice in pediatric to adult care transition for individuals with NDD in Massachusetts.
2. Describe quality improvement strategies to implement changes in practice.
3. Engage in solution-focused collaboration with stakeholders across Massachusetts.

**Results:** Each task force provided deliverables that were made available to the nearly 200 people from across the state who participated in the summit. The summit included: key note addresses (one academic overview and an opening panel with patients, families and providers), task force work overviews, interactive small groups to work on the drivers and change ideas, a number of sessions taking a deeper dive into the task force deliverables and concluding with an exchange of ideas that participants could take back to their own clinical settings.

100% of respondents (n=65) stated that all objectives of the summit were met. 95% rated the summit overall as very good or excellent; 80% reported that the summit was helpful or very helpful in setting transition related goals.

Initiative members, including steering committee and task forces, rated their experience of participation. All respondents (n=27) were neutral to very satisfied and all indicated they felt neutral to very good about the use of their time. 26 out of 27 respondents said that they felt they contributed to overall initiative objectives and 24 of 26 wanted to hear about continued opportunities for engagement.

**Conclusions:** Engaging stakeholders across Massachusetts in efforts to improve transition to adult healthcare for the vulnerable population of people with autism and related NDD yielded positive momentum and a sense of community. We are now engaged in Phase 2 utilizing an innovation collaborative approach from QI methodology, with teams of pediatric providers, adult providers and patient/family partners working together to test change ideas developed in the initiative.

**209.002 (Panel)** Training Neurology Residents to Care for Adults with Autism and Related Neuro Developmental Disabilities

**J. Frueh<sup>1</sup>, S. J. Spence<sup>2</sup>, D. K. Urion<sup>3</sup>, D. Z. Press<sup>4</sup> and J. S. Sanders<sup>4</sup>,** (1)*Department of Neurology, Boston Children's Hospital, Boston, MA,* (2)*Autism Spectrum Center, Department of Neurology, Boston Children's Hospital, Boston, MA,* (3)*Cognitive Neurology Unit, Department of Neurology, Beth Israel Deaconess Hospital, Boston, MA,* (4)*Department of Neurology, University of Colorado, Denver, CO*

**Background:** Many patients with Autism Spectrum Disorder (ASD) and their families feel uncomfortable transitioning from pediatric to adult care settings. Similarly, many neurologists feel uncomfortable caring for this patient population. Insufficient exposure to adults with ASD and other neurodevelopmental disabilities (NDD) during training contributes to provider discomfort in caring for this population, and in turn poses a barrier to

patients receiving optimal care in adulthood. We describe a novel approach to providing care to adults with NDD through a teaching clinic within an adult medical center staffed by trainees and faculty from both pediatric and adult neurology programs.

#### Objectives:

1. Describe the patient population cared for in a resident-developed adult neurodevelopmental disabilities clinic within an adult medical center.
2. Describe an innovative approach to training adult and pediatric neurology residents to care for adults with autism and other neurodevelopmental disabilities.

**Methods:** The adult NDD clinic was created by a neurodevelopmental pediatrics resident in 2018. Working with the cognitive neurology group in an adult academic medical center, the pediatric trainee initially worked with the adult cognitive neurology attendings seeing patients with ASD and related NDD. In 2021, the clinic expanded to include adult neurology residents rotating in cognitive neurology. The adult neurology residents in the adult NDD clinic have supervision from pediatric behavioral neurology attendings who have specific expertise working with this cohort. Data were obtained through retrospective chart review of patients seen in the adult NDD clinic between 2018 and 2021, and of residents rotating through this clinic in 2021.

**Results:** A total of 33 patients were seen by residents in the adult neurodevelopmental disabilities clinic over the observed time course. Mean age of patients was 41.7 years (range 21-73 years). The most common reasons for referral were behavioral concerns (39%), followed by requests for updated diagnostic evaluations (15%). Most frequent diagnoses were intellectual disability (46%), autism spectrum disorder (27%), Trisomy 21 (12%), cerebral palsy (15%) and genetic syndromes (9%). Genetic testing was recommended to 27% of patients, neuropsychological testing to 24%, metabolic testing to 18%, and neuroimaging to 15%. EEG and other studies were ordered in 6%. Sixty-six percent of patients were counseled on lifestyle modifications including behavioral and social strategies as part of their management. About one-third of patients were referred to behavioral or other therapy services, and 21% were referred for community services. A total of 9 trainees (5 child neurology residents, 4 adult neurology residents) were scheduled for half-day rotations in the adult NDD clinic by the end of 2021.

**Conclusions:** This unique clinic model offers an opportunity for both child and adult neurology residents to receive training in the care for adults with autism and related NDDs. The innovative cross training between adult and pediatric neurology providers with expertise in behavioral health is successfully improving access to age-appropriate specialty care for this vulnerable population of patients. Future studies should investigate how this experiential training improve comfort levels of the trainees, and how that can translate to better care for adults with NDD in the future.

**209.003 (Panel) A New Adult Neurodevelopmental Disabilities Clinic: Description of Population and Yield of Genetic Testing in the First Year**  
**J. S. Sanders<sup>1</sup> and M. Mabry<sup>2</sup>,** (1)Department of Neurology, University of Colorado, Denver, CO, (2)University of Colorado School of Medicine, Aurora, CO

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#### Background:

As patients with NDD transition from pediatric to adult healthcare systems, they often have difficulty finding providers who address their NDD-related needs, including revisiting the etiologic workup of their NDD. In response to this care, a new consultation clinic was established in an adult neurology department to address neurodevelopmental concerns of these adult patients and provide etiologic workup, including genetic testing.

#### Objectives:

1. Characterize the patient population seen in the first year of a newly developed Adult Neurodevelopmental Disabilities (NDD) Clinic.
2. Demonstrate yield of genetic testing in adults with neurodevelopmental disabilities (NDD).

#### Methods:

Data was obtained by a retrospective chart review of all 79 patients seen in the adult Neurodevelopmental Disabilities (NDD) clinic from September 2020 through September 2021.

#### Results:

The average age was 35 years (median 28 years), ranging from 18 to 80 years. Developmental diagnoses included but were not limited to autism spectrum disorder (47%), intellectual disability (44%), Down syndrome (15%), cerebral palsy (8%) and other genetic disorders (27%). Comorbidities addressed included anxiety (in 27% of patients), behavioral concern (22%), seizures (18%), and depression (11%). 21 patients (27%) had previous genetic testing that included Chromosomal Microarray (CMA), Autism Spectrum Disorder/Intellectual Disability Panel (ASD/ID Panel), or Whole Exome/Whole Genome Sequencing (WES/WGS), before the new clinic. New genetic testing was completed in 17 patients (21.5% of the overall cohort). A pathological variant was identified in 6/17 (35%). Diagnoses were established by CMA in 3/11 (27%), ASD/ID panel in 2/5 (40%), and WES in 1/1 (100%).

#### Conclusions:

Our study characterized the diversity of developmental disabilities and comorbidities addressed in a new specialty Adult NDD clinic. Our data also revealed the high yield, and importance of, revisiting etiologic diagnoses in adults with NDDs, as many patients seen in this clinic were provided with genetic diagnoses for the first time as adults.

**209.004 (Panel) Project Echo Autism Adult Healthcare: A Novel Learning Community for Primary Care Providers**

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**Background:**

Autistic adults have complex healthcare needs, yet they experience poor healthcare access, experiences and outcomes. This is due in part to shortages of healthcare providers with knowledge and expertise in caring for this population. The Project Extension for Community Healthcare Outcomes (Project ECHO) Autism framework is a novel approach to address this service need. Project ECHO Autism uses secure videoconferencing technology to create a learning community by connecting primary care providers (PCPs) in local communities (“spokes”) to an interdisciplinary team of experts (“hub”). Learning is anchored in the person-family centered model and facilitated through brief evidence-based didactics, case-based learning (during which PCPs present their own cases for discussion and co-management), collaborative mentorship, and guided practice.

**Objectives:**

The objectives are to develop, and pilot test a novel PCP training program using the Project ECHO Autism framework with the goal of increasing high-quality community-based healthcare for adults on the autism spectrum

**Methods:**

Between November 2020 and April 2021, we conducted 12 ECHO Autism sessions (two a month for six months). Each session lasted one hour and consisted of a case presentation and discussion, and a didactic presentation. Before and after each ECHO, the hub team met to discuss elements of the session to maximize participant learning. Three ECHO sessions were randomly chosen to monitor fidelity and were reviewed by an investigator independent of the Hub Team.

ECHO participants completed a series of surveys before and after the 12 sessions, including related to satisfaction and changes they planned to make to their practice.

**Results:**

Of 20 participants entering the ECHO, five were Asian, two were Black, and the remainder White. There were 16 women and 4 men. Average age was 46.5 years. Nine were physicians and eleven were advanced practice providers. Most providers (80%) attended at least 50% of the sessions.

Our “Hub” Team consisted of 8 members (four men and four women), including two neurologists, one of which also had expertise in sleep medicine and was a parent, a psychologist, a psychiatrist, an internal medicine/pediatrics physician, a parent advocate/family navigator, and two self-advocates.

Fidelity was 100% for two sessions and 99% for one session.

Community providers stated a variety of changes they planned to make to their practice, including tools to address the transfer process, using visual tools in their clinic, compiling lists of resources in their area, and identifying specialists experienced with caring for autistic patients. They also stated they would be more aware of patient needs, and implement strategies to help prevent problem behaviors, such as providing headphones to reduce sensory overload.

Providers expressed a high level of satisfaction with the program, including learning best-practice care, connecting with colleagues, and increasing knowledge through case-based learning and didactic presentations.

**Conclusions:**

We developed and piloted a Project ECHO focused on Autism Adult Healthcare, with favorable PCP recruitment and retention, and excellent fidelity. PCP satisfaction was high, and PCPs identified several areas for making changes in their practice.

**ORAL SESSION - 4B — SERVICE DELIVERY/SYSTEMS OF CARE**

**310 - Service Delivery / Systems of Care**

**310.001 (Oral) Diagnostic Accuracy within a Statewide System of ASD Evaluation**

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**Background:** The significant gap between the emergence of autism spectrum disorder (ASD) symptoms and diagnosis means that young children are missing opportunities for intervention at the time of optimal impact. Diagnostic delays are exacerbated for children from diverse racial, ethnic, socioeconomic, and geographic groups. As such, developing and testing streamlined community-based methods of ASD diagnosis has been identified as a priority.

**Objectives:** To determine the diagnostic accuracy of a statewide system for early ASD diagnosis in the primary care setting. Specifically, we sought to 1) determine ASD diagnostic agreement between primary care providers (PCP) trained to conduct standardized ASD evaluations and an expert team specializing in early ASD diagnosis, and 2) identify differences in the phenotypic presentation of children accurately and inaccurately diagnosed in the community primary care setting.

**Methods:** Early Autism Evaluation (EAE) Hubs have been established in primary care practices across Indiana. Primary care providers in the EAE Hubs were trained on a standard clinical pathway for ASD evaluation. Since 2012, nearly 4000 toddlers, ages 18-48 months, have been evaluated in the EAE Hubs. In the current study, EAE Hubs refer children for follow-up comprehensive evaluation [including Mullen Scales of Early Learning (MSEL), Vineland Adaptive Behavior Scales (Vineland-3), Autism Diagnostic Observation Schedule (ADOS-2), caregiver DSM-5 ASD interview, and Child Behavior Checklist (CBCL)] by a team specializing in early ASD diagnosis.

**Results:** To date, 55 children (M=2.6 years; SD=0.6; 80% male; 69% White; 18% Latinx) have been evaluated. In 45 cases (82%), there was diagnostic agreement between the EAE Hub PCP and ASD specialist ( $k: 0.61; p < 0.01$ ) indicating a substantial level of agreement. Thirty-one cases were true positives (56% TP; diagnosed by both EAE Hub PCP and ASD expert with ASD), 14 cases were true negatives (26% TN; diagnosed by both EAE Hub PCP and ASD expert with non-ASD) and 10 cases were false negatives (18% FN; EAE Hub PCP diagnosed non-ASD and ASD expert diagnosed ASD). Fifty percent of false negative cases were flagged by the EAE Hub PCP for referral for follow-up specialized ASD evaluation. No false positive cases were identified. Compared to TP cases, FN cases had significantly higher non-verbal (MSEL Visual Reception T Score), expressive language (MSEL Expressive T score), and adaptive abilities (VABS-3 Communication and Daily Living Skills standard scores), and internalizing behaviors (CBCL Internalizing T score); all  $p < 0.05$ .

**Conclusions:** Community-based PCPs trained as part of a statewide system are able to make accurate ASD diagnoses in young children in a significant majority of cases. All diagnostic disagreements to date have been false negative cases. False negative cases appear to have a different phenotypic presentation including higher cognitive, language, and adaptive functioning and increased internalizing behaviors. Findings have implications for further training of PCPs conducting ASD evaluation, specifically with regard to identification of cases requiring referral for specialized evaluation at an ASD diagnostic center. Community-based models of ASD evaluation are a promising method for improving localized, equitable access to diagnostic services, potentially allowing for streamlined entry into interventions.

### **310.002 (Oral) Echo Autism: Mental Health: An Approach to Improved Mental Health Care for Individuals on the Autism Spectrum**

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**Background:** Autistic individuals struggle with mental health issues, such as anxiety and depression, at alarmingly high rates. Despite the prevalence, mental health concerns are often inadequately addressed or treated in individuals with autism, leading to challenges with social, mental, and physical wellbeing. Modified cognitive-behavioral therapy (CBT), delivered as a component of comprehensive mental healthcare, can reduce anxiety and depression in people with autism, though few clinicians are trained to deliver the care.

**Objectives:** The primary objective of the study is to evaluate the feasibility, acceptability, and efficacy of ECHO Autism: Mental Health with mental health clinicians working with clients on the autism spectrum. Through the program, we hope to advance mental health care for autistic individuals.

**Methods:** ECHO Autism: Mental Health is a virtual learning community that allows a "hub team" of experts to mentor and coach "spoke participants" through videoconferencing technology. This model includes case-based learning, high-yield didactic presentations, and building a network of clinicians who feel confident to serve this vulnerable population. ECHO sessions took place every other week for 1.5 hours per session, across 16 sessions. Participants completed pre/post program surveys asking about demographics, self-efficacy, and perceived barriers to providing care, and semi-structured interviews for open-ended feedback. The interview questions asked about the components of ECHO Autism: Mental Health, barriers to participation, and changes in practice and perception because of the program. All interviews were audio-recorded and transcribed for analysis. We conducted a thematic analysis, a rigorous, systematic approach identify themes from the data.

**Results:** Sixteen mental health clinicians completed the pre/post surveys, and 13 clinicians completed the interviews. Survey results showed statistically significant self-efficacy improvements in all assessed categories ( $p < 0.05$ ). Qualitative findings highlighted positive general feedback, and supported case presentations with hub team recommendations as the most useful component of the program, with many participants utilizing the hub team's recommendations. The supportive interdisciplinary hub team with a family advocate was central to the participants' comfort and learning. One participant stated about ECHO Autism: Mental Health that they "really appreciate the opportunity and the fact that this was done in such a positive professional way. It's one of those things where there was no stupid questions and everyone seemed to feel very free to just, be open to

communicate and provide each other feedback.” All participants stated the program increased their knowledge and/or confidence in treating autistic individuals.

**Conclusions:** Mental health issues, which affect outcomes of physical and social health, are often a challenge for autistic individuals. This study aimed to assess the ECHO Autism model to train more mental health clinicians in CBT techniques specific to autistic individuals. Preliminary results suggest that ECHO Autism: Mental Health is a useful program to increase mental health clinicians’ knowledge and confidence in working with people on the autism spectrum. The study helps to guide revisions for future ECHO Autism: Mental Health cohorts and provide a framework for improving mental health care for autistic individuals.

**310.003** (Oral) Understanding and Improving Education Systems for Children with Autism Spectrum Disorder in South Africa

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**Background:**

The prevalence of autism spectrum disorder (ASD) in South Africa is unknown and there is little information on the educational service needs of children with ASD in the country. There are no standardized procedures for identification, diagnosis and management of these children. The Western Cape is one of the better resourced provinces in the country in terms of ASD services yet educational opportunities for children with ASD are limited. We therefore used the Western Cape as a case study to understand education systems for children with ASD in South Africa by examining the ‘hardware’ elements (finances, infrastructure, and resources) and ‘software’ element (ideas and interests, relationships and power, values, and norms) in order to gain whole-systems understanding.

**Objectives:**

The objectives of the study were a) to perform a situational analysis of the needs and resources for children with ASD and their families and b) to examine stakeholder views, perspectives and proposed solutions to meet the educational needs of children with ASD in order to generate contextually appropriate guidelines for improved ASD educational service delivery.

**Methods:**

An exploratory mixed-methods approach was used across two phases. In the first quantitative phase, provincial educational data were used to describe the profile of children with ASD in the formal education system as well as those waiting for educational services. The second qualitative phase used focus groups and interviews to examine the perspectives and recommendations of caregiver, service provider and government stakeholder about ASD services.

**Results:**

The systematic database search for children with ASD in the provincial educational system (serving more than 1 million children), combined with the provincial ‘waiting list’ of those waiting for school placement found very low rates of ASD (<0.1%). The majority of children with ASD (89%) were in special educational placements, and only 10% of children with ASD were in mainstream schools. All children waiting for school placement, were waiting for a place at a special school. Thirty six percent (36%) of the children waiting were of compulsory school-going age and 48% of those waiting received no other ASD intervention while waiting. The key perspective that emerged from the caregiver focus groups was “we wait and we wait”. Here, caregivers expressed their frustrations with current ASD services. Service providers acknowledged the limitations in their capacity to provide services for children with ASD and their families under a theme “we are doing the best we can to bridge the gap” and government stakeholders felt that ASD services were not prioritised due to competing societal demands on government resources under a theme “we are doing damage control”. Synthesis of the findings across the different phases of the study identified six key actions for service improvements.

**Conclusions:**

Findings from this study highlight the urgent need for multi-stakeholder collaboration to develop and implement contextually relevant plans and policies for ASD services for children in South Africa. Better systems for identification of children with ASD, designated early intervention programmes and better inclusion of children with ASD in the education system is recommended.

**310.004** (Oral) Racial Disparities in Autism Service Persist throughout the Pandemic-Induced Transition to Telehealth

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**Background:** Late cancellations, i.e. cancellations within 24 hours of scheduled appointments including no-shows, stress clinical resources and infrastructure, limit optimal care capabilities, and impact patients’ needed care. Previous analysis of a high-throughput metropolitan autism clinic’s

data highlighted several demographic factors associated with increased rates of late cancellations: Black or American Indian race, Medicaid, positive ASD diagnosis, and middle-school age<sup>1</sup>. In March 2020, many in-person appointments transitioned to telehealth due to the COVID-19 pandemic. Although this transition may have represented an opportunity<sup>2</sup> to reduce the disparities in appointments and late cancellations, its impact is yet poorly understood.

**Objectives:** To examine how demographic factors (focused on race/ethnicity) relate to the frequency of telehealth and in-person appointments before and during the COVID-19 pandemic and the likelihood of late cancellations for in-person and telehealth appointments.

**Methods:** Data were obtained from 74,718 scheduled appointments in a high-throughput metropolitan autism clinic between January 2018 and May 2021. “Pre-COVID” is defined as before March 2020 (n=48,526); “during-COVID” is defined as March 2020 onward (n=26,192). Odds ratios were used to examine frequency of visits pre- and during-COVID and frequency of in-person and telehealth visits during-COVID. A generalized linear model was run to explore the probability of encounter-level late cancellations based on race/ethnicity controlling for age, sex, language-other-than-English, ASD/non-ASD diagnosis, new/return visit, and Medicaid insurance usage for three divisions of scheduled appointments: pre-COVID in-person, during-COVID in-person, and during-COVID telehealth. We did not include pre-COVID telehealth appointments in our analyses due to their infrequency.

**Results:** During the pandemic, relative to White families, scheduled appointments increased in frequency for families belonging to more than one race, remained the same for Black families, and decreased for families of all other races (Table 1a). Regardless of race, all telehealth appointments sharply increased in frequency beginning March 2020. Except for Native American families, all non-White families less frequently scheduled telehealth visits compared to White families (Table 1b). Pre-COVID, all non-White families except Asian families late cancelled more frequently than White families (Table 2a). During COVID, in-person visits for all non-white families were late cancelled at comparable rates to White families. However, for telehealth visits, Black, Hispanic, and families of more than one race late cancelled at higher rates compared to White families.

**Conclusions:** Pre-pandemic it was often hypothesized that telehealth could overcome barriers-to-access such as lack of transportation. The converse was observed. Pre-pandemic racial disparities in autism services attainment have persisted through COVID and seem linked to multi-level systemic difficulties in telehealth access involving decreased adoption and increased cancellation of telehealth appointments largely by non-White families. We note that the finding of decreased late cancellations in in-person appointments by minorities during COVID may suggest that increasing the proportion of appointments offered virtually perversely drives minorities to higher fidelity of making in-person visits. It is critical that we continue to explore barriers to appointments for families that late cancel.

## References

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## POSTER SESSION — SERVICE DELIVERY/SYSTEMS OF CARE

### 426 - Service Delivery/Systems of Care

**426.098 (Poster)** A Social Network Analysis of Team Coordination to Support Children with ASD in an Inclusive School Setting  
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**Background:** Schools are complex socio-political structures with formal and informal social networks. Evidence-based intervention and resource coordination models frequently target school social networks to improve student outcomes, educational equity, and inclusion. Group collaboration and coordination are crucial to school intervention teams. Special education (SPED) teachers are key players in successful school-based interventions for children with autism (ASD), acting as the primary contact for students, caregivers, and other staff.

**Objectives:** The purpose of this study is to examine the role of teachers in the coordination network of an urban inclusive elementary school and the influence of student support needs on coordination-related group clustering. We hypothesized that (1) SPED teachers would be centrally located in the coordination network and (2) inclusion for students with ASD and higher support needs, indicated by the student’s classroom placement, requires more staff coordination than students needing less support.

**Methods:** A social network survey (Social Dynamics of Intervention; SoDI) was administered to parents of children with ASD (n=17) and school staff (n=32) at three-time points, at Aspire, an inclusive (i.e., all students with ASD were mainstreamed for part of the school day) low-income school. Coordination network data from time point two were analyzed. Participants were asked to identify the individuals they coordinated with for each student’s interventions. Network measures were calculated, and qualitative interview (n=2 teachers) analyses were conducted.



**Results: Network Analysis.** Examination of egocentric (node-level) network centrality indicated that SPED administrators, service coordination staff, and elective teachers had the highest centrality (Figure 1). Parents, general, and SPED teachers were not intermediaries for coordination and had low betweenness scores (Figure 2).

Network-level indicators showed that the network was dense, with 82% of all possible ties present. The network was cohesive with an average path length of 1.91, transitivity of .37, with no isolates and one component. A CONCOR (CONvergence of iterated CORrelations) analysis segmented the coordination network into eight groups with the most influential (Group 1) consisting of two paraprofessionals, and four parents of children with higher-support needs, and SPED administrators, the social worker, and elective teachers as key coordinators in the inclusion of students with ASD (Table 1 and Figure 3). Lesser influential groups, containing the bulk of the teachers, showed low modularity or social mobility.

**Qualitative Interviews.** Teachers reported frequent coordination with other teachers, particularly between general and SPED teachers, and highlighted the benefits and barriers to home-school coordination.

**Conclusions:** Hypothesis 1: Despite evidence supporting the role of teachers as key players in the implementation of school-wide inclusion and intervention initiatives, teachers were absent from the top node-level centrality rankings. The interview results and frequency of teacher connections with one another indicate that coordination among teachers played an important role in interventions and inclusion. The peripheral location of SPED teachers in the network suggests that hierarchical coordination structures informed inclusion processes.

Hypothesis 2: The data confirm coordination of elective teachers, parents, and paraprofessionals supporting students with ASD with higher support needs, suggesting that student characteristics can shape network structure.

**426.099 (Poster) Longitudinal Analysis of Impact of COVID-19 on the Service Patterns and Child/Parent/Family Mental Health in Families Affected By Autism Spectrum Disorder (ASD)**

*A. N. Bhat, Department of Physical Therapy, University of Delaware, Newark, DE*

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**Background:** Children with ASD receive a multitude of educational, medical, and therapeutic services. At the onset of the COVID-19 pandemic, all of these services came to a complete halt following strict lockdowns. Many services have resumed in a hybrid format using face to face and virtual modes of delivery.

**Objectives:** The present study examines longitudinal data collected in the SPARK study families (N=6,393) on the impact of COVID-19 on service patterns, child/parent/family mental health, and the benefits of online/virtual services (clinic or school-based).

**Methods:** Caregivers of children and adolescents with ASD between 19 months and 18 years completed an online survey inquiring about the impact of COVID-19 pandemic on access to services, parent concerns about the same, impact on child's ASD-related behaviors, child/parent/family mental health, and the benefits/potential benefits of online/future online services. These surveys have been completed across 4-6 time points depending on questions.

**Results:** Preliminary analysis of data from the early part of the pandemic from Spring 2020 revealed that certain demographic (age, income/SES) and child-related factors (repetitive behaviors, language, functional, cognitive, and motor impairments, and child's understanding), as well as parent's past mental health were associated with and predicted service disruptions ( $r=0.15-0.26$ ,  $p<0.001$ ), ASD-related behaviors ( $r=0.16$ ,  $p<0.001$ ), and negative impact on parent mental health ( $r=0.17$ ,  $p<0.001$ ).

**Conclusions:** In conclusion, younger children, children from low-income families, and children with greater impairment severity (more severe repetitive behaviors, language, cognitive, function, language, and motor impairments) were more negatively impacted by the pandemic through service disruptions, increased ASD-related behaviors, negative parent health/family impact, and found online interactions to be less beneficial. A further analysis of child, parent, and demographic factors and their longitudinal impact on service disruptions and other aforementioned issues will be reported during the presentation.

**426.100 (Poster) Academic Performance of College Students with Autism Spectrum Disorder or Attention Deficit Hyperactivity Disorder**

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**Background:** There is currently extremely limited research on academic progression or academic performance in college students with autism spectrum disorder (ASD), with research on this topic largely limited to self-reported and parent-reported participation and graduation rates (Wei et al., 2014).

**Objectives:** To examine and compare academic progression and academic performance of college students with ASD to college students with Attention Deficit Hyperactivity Disorder (ADHD) and college students from the General Population (GP).

**Methods:** Academic Grade Point Averages (GPAs) of college students with ASD ( $n=46$ ) and individually matched groups of students with ADHD ( $n=46$ ) and students from the GP ( $n=46$ ) were extracted from historical academic records of a small, Catholic university in the greater Philadelphia region. All students were admitted to the University based on standard admissions criteria, with no special consideration. Furthermore, students in the

ADHD and GP groups were matched to the students with ASD individually and at the group level on biological sex, a socioeconomic status indicator (eligibility for federal Pell grant funding), incoming academic year cohort, and school of their major. Finally, all students with ASD or ADHD designated and officially registered their clinical diagnoses with one of the University's official support programs for students with disabilities. Statistical models which included student group (ASD, ADHD, GP) as a between-subjects factor and semester (1 through 8) as a within-subjects factor were conducted to test the hypothesis that students with ASD and/or students with ADHD would exhibit GPAs which differed from GP students at different points in their college academic progression.

**Results:** Results indicate that the mean grade point averages of students with autism (2.91) were statistically indistinguishable from students from either those with ADHD (2.89) or those from the general population (3.09), overall. However, mean grade point averages did differ for both students with ASD and students with ADHD compared with GP students during the first 4 of 8 semesters (ASD=2.845, ADHD=2.875, GP=3.175).

**Conclusions:** These findings indicate that individuals with ASD and those with ADHD who enroll in college are capable of academic achievement equal to the GP, but that the first 2 years of college are significantly more academically challenging for both students with ASD and students with ADHD.

**426.101 (Poster) Autistic Women Evaluate Their Therapies Received**  
*M. L. Bezemer and E. M. Blijd-Hoogewys, INTER-PSY, Groningen, Netherlands*

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### **Background:**

Autism has for long be missed in many women (Hiller et al., 2014). For, the diagnostic of more camouflaged autism requires additional expertise. The female autism phenotype has been characterized as having higher social motivation, better nonverbal communication, more gender-stereotypical interests, more sensory problems, and higher vulnerability to emotional problems and social camouflage (Bargiela et al., 2016). These are crucial elements to consider not only during diagnostics but also in therapy. Do we therapists do that?

### **Objectives:**

Gaining insight into what kind of therapy is being offered to autistic women and what they claim to benefit from.

### **Methods:**

The Female Autism Network of the Netherlands approached Dutch autistic women through social media and asked them to fill-in a survey on all therapies received, focusing on form of therapies, therapy satisfaction, and adjustment recommendations. All participants ( $N = 150$ ) reported being diagnosed in adulthood ( $M_{\text{age of diagnose}} = 35.82$ ,  $SD = 10.51$ ). Some were mental health care professionals themselves ( $n = 8$ ).

### **Results:**

Of the total group, 90 women (60%) received therapy directly after receiving the ASD diagnosis; 53 women (35%) did not receive direct therapy, though some reported having received some psychoeducation. Reasons for not receiving therapy were no suitable therapy offer, therapy waiting lists, professionals lacking expertise in ASD women, professionals who regarded problems as too mild or expected a more well-defined therapy request.

Almost half ( $n = 70$ ) experienced ill matching therapy offers, often due to a lack of expertise in autistic women. Most autistic women wanted more elaborate and more in-depth psychoeducation, not to simplistic or "that classic ASD story". They mentioned to have learned a lot from reading books and articles, and from peer support. They stated that a therapist needs to be aware of camouflaging behavior, also in therapy session, and should make camouflaging a therapy focus, in combination with attention to self-esteem and identity. Some therapies (e.g., mindfulness and psychotherapy) were experienced as too abstract. Autistic women stressed the need for more concrete language, in-depth questioning and in many cases more practical support. They cautioned for overestimation of their abilities and not to be taken seriously. For more details see Table 1 and 2.

### **Conclusions:**

Except for therapies focusing on energy management, the top-5 of therapies received was not equal to the ones being most valued by autistic women. We advise therapists to pay more attention to sensory management, relaxation strategies, improving social network and peer support. Psychoeducation fell outside the top-5 most valued therapies; autistic women urge psychoeducation to be implemented more individualized.

Autistic women did not seem to profit from emotion-regulation therapies. Possibly, these therapies are not well fitted to them, focusing mainly on behavior strategies and less on recognizing and understanding emotions. Autistic women urge therapist to get more training in the female autism phenotype, matching their communication style and looking further than the mask.

There is no one-size-fits-all conclusion for individual therapies. We had no insight into the quality and content of the therapies supplied. Further research is needed.

**426.102 (Poster)** Building on the Strengths of Autistic Scholars By Addressing Systemic Barriers to Autistic Success in Academia: Year One SIG Results

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**Background:**

Although an increasingly large research literature investigates barriers facing autistic people in undergraduate education, little attention – and no published qualitative or quantitative research studies – have explored the accessibility for autistic people of post-graduate education, academia, and research. However, autistic academics report many barriers and challenges in these domains (Botha, 2021; Dwyer et al., 2021; Jones, 2021). This emphasizes the importance of investigating these barriers, developing theoretical frameworks to describe them, and directing efforts to promote autistic representation, success, and thriving in academia.

**Objectives:**

This submission presents findings from the first of a three-year qualitative study, conducted as an INSAR Special Interest Group, exploring the lived experiences of autistic graduate students in their transition into graduate school, their experiences while in graduate school and their post-graduate experiences after completion of their degrees. The aim of this study is to generate a theory on supports and barriers for autistic researchers as they applied, entered and sought to adjust to their first year of graduate school.

**Methods:**

Stakeholders in the field of autism were invited to participate in one of six (2 groups for autistic researchers, 1 group for faculty who teach autistics, and 3 groups for non-autistic students and postdocs) simultaneously occurring, semi-structured focus group interviews during the 2020 International Society for Autism Research Conference. Focus groups were conducted via Zoom and the main topics of discussion were challenges in post-undergraduate university applications, diagnosis disclosure, activities of daily living during higher education, and supports during college. Data were analyzed using a grounded theory approach and triangulation was applied to synthesize information from the different stakeholders.

**Results:**

A total of 14 autistic researchers, 19 non-autistic students and post-docs, and 4 non-autistic faculty participated in our virtual focus groups. Preliminary coding generated a total of 150 codes that were reduced to 60 focused codes. Our preliminary analyses indicate that autistics have a strong desire to learn in higher education. However, ableist processes built into the college systems such as social requirements, poorly designed classrooms that are often overwhelming for the sensory system of autistics, a lack of external support, and a lack of supportive higher education systems makes the process of obtaining a higher education degree difficult for autistics. In the presentation, we will present finalized analyses and the generated theory.

**Conclusions:**

Based on our findings, ableism presents a clear barrier to autistic people's inclusion in academia and higher education. The culture, expectations, and practices of academia give rise to serious barriers, such as requirements for high degrees of social interaction and lack of clarity in rules. Poorly designed and inaccessible environments also represent a serious challenge to many autistic researchers, as do mental health challenges. Unfortunately, respondents described a dearth of support from programs and institutions. Moreover, the small numbers of openly autistic people in higher education today can prevent autistic colleagues from being an informal source of support or mentorship, exacerbating the challenges faced by autistic people in post-graduate education and academia. Directions for future research will be discussed.

**426.103 (Poster)** COVID-19 Pandemic Influence on Vaccinations and Autism Myth Discussions

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**Background:** Since the declaration of the COVID-19 pandemic in March 2020, extensive efforts have been made to develop and control the infectious virus via the development of vaccinations. As the Covid -19 pandemic began, we began to see a revival in conspiracy theories that have been influencing the beliefs of individuals and instilling a fear based notion in regards to vaccines and their relation to autism. Since the Covid-19 pandemic has been an unpredicted time of uncertainty, discussions have been circulating within social and traditional media as individuals have been falling to conspiracy theories to find some sort of explanation for uncertain times. Importantly, research conducted in the US revealed that vaccination rates dropped initially during the pandemic, as a result of the imposed restrictions, healthcare personnel workload and the concern of exposure to COVID-19 while outside.

**Objectives:**

In order to examine the influence that the COVID-19 pandemic had on current trends in publications, we analyzed semantic networks of vaccine information from formal publications and usage of search engines. In order to decipher the influence of COVID-19 pandemic on public interest we compared publications and search keywords between the years 2019 and 2020.

Even before the first publications of clinical trials with COVID-19 immunizations it was clear to the medical community that vaccine hesitancy may contribute to suboptimal vaccination coverage. Inaction to vaccinate poses a significant risk to the continuation of the pandemic as the public would be unable to acquire herd immunity. All medical associations worldwide initiated campaigns to influence public opinion on vaccine safety, even before the COVID-19 vaccine was distributed.

#### Methods:

Our present study focused on trends in formal publications during a two year period (before and during Corona pandemic) and on search trends made by the general public in various geographic zones.

We constructed semantic networks of vaccine information from Google Scholar engines, searching for articles with keywords “vaccines”, “autism” and the link between the terms. We analyzed trends over two years according to months and geography.

Results: media search of vaccination and autism terms was significantly impacted and followed the different waves of the pandemic. Global trends will be presented according to timeline and location.

Conclusions: The COVID-19 pandemic changed the way vaccine information has been communicated through media which has prompted the medical community to become more active resulting in improved vaccine acceptance

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#### **426.104 (Poster) Challenges and Opportunities in Building Interdisciplinary Programs Around Autism** **E. Rotheram-Fuller, M. Dixon and N. Scherer, Arizona State University, Tempe, AZ**

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Background: Children with Autism Spectrum Disorders (ASD) with high-intensity needs often require supports from a range of professionals with unique expertise, but few training programs have opportunities for students to experience and practice cross-disciplinary collaboration.

Objectives: Examine the challenges and opportunities in creating an interdisciplinary program model between autism specialist (AS) and speech and language pathology (SLP) students at the masters level.

Methods: AS and SLP programs worked together to develop an interdisciplinary training model between two colleges and three faculty members. The goal was to incorporate perspectives from two key professional disciplines in the training process around ASD. Four collaborative courses and three semester-long seminars were developed that focused on topics around interdisciplinary collaboration and case consultation. The program development process was documented and barriers in design were addressed.

Results: Over the course of four meetings with three faculty members, the coursework and course sequencing were adapted in both programs to make collaborative activities work for both sets of students. Programs were able to integrate interdisciplinary coursework and seminars without significantly altering their existing course sequence or impacting credentialing competencies. All collaborative activities were moved online to facilitate collaboration, and approvals were needed on program activities from the program faculty and deans of each college. The model developed allows for training of other related professions (e.g., occupational therapy) to be included in the future, to create a truly interdisciplinary model of autism training. Faculty buy-in and program flexibility were key to ensure that interdisciplinary competencies could be incorporated.

Conclusions: Key identified interdisciplinary competencies around children with ASD with high-intensity needs, as well as unique methods to integrate program activities will be discussed. It is feasible to adapt existing programs to include interdisciplinary competencies, however, there must be engagement at the faculty and administration level to ensure prioritization of these competencies and effective coordination.

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#### **426.105 (Poster) Changes in the Organizational Context of Autism Community-Based Organizations: Effectiveness of a Multi-Faceted Implementation Strategy**

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#### Background:

Evidence-based practices (EBPs) for Autism Spectrum Disorder (ASD) lead to improvements in core ASD domains, co-occurring challenges, and quality of life (Steinbrenner et al., 2020). However, within community-based organizations providing services to autistic individuals (ASD-CBOs), EBPs are utilized inconsistently and with low intensity (Brookman-Frazee et al., 2012). Implementation science aims to promote the uptake of EBPs in routine practice and increase understanding of how organizational context may contribute to variable EBP use (Bauer et al., 2015). Organizational capacity to support practice change depends in part on contextual factors such as culture, formal and informal leadership, measurement practices, and available resources (Helfrich et al., 2009). To improve the implementation of EBPs within ASD-CBOs, Drahota and colleagues developed and pilot-tested the ACT SMART Implementation Toolkit, a multi-faceted implementation strategy to guide organizations through EBP adoption and implementation as well as increase organizations' capacity to support practice change (Drahota, Meza, & Martinez, 2014).

#### Objectives:

Assess changes in organizational context within ASD-CBOs following use of the ACT SMART Implementation Toolkit.

## Methods:

Six ASD-CBOs located in Southern California met eligibility criteria and participated in the pilot study. ASD-CBOs provided: Applied Behavior Analysis (ABA;  $n=4$ ), ABA and mental health ( $n=1$ ), and Speech and Language Pathology ( $n=1$ ) services. Supervisors and direct providers at each participating agency (See Table 1) completed an agency assessment, including an adapted version of the Organizational Readiness to Change Assessment, Context Scale (ORCA; Helfrich et al., 2009) at pre- and post-pilot (13 months after pre-pilot assessment). The ORCA Context Scale measures the quality of organizational context to support practice change and includes sub-scales measuring leadership culture, staff culture, leadership behavior, leadership measurement, readiness for change, and organizational resources.

## Results:

Due to the limited sample size of a pilot study, we calculated effect sizes to achieve a more accurate estimate of the magnitude of the effect of the ACT SMART Implementation Toolkit on ORCA Context Scale ratings (Ferguson, 2009). Small to medium effect sizes (Hedge's  $g$ ) were found for both supervisor and direct provider ratings on the ORCA Context Scale and underlying sub-scales. Only the mean for supervisor ratings of organizational resources did not increase from pre-toolkit to post-toolkit (Table 2).

## Conclusions:

Overall, effect sizes indicate that both supervisors and direct providers at ASD-CBOs perceived an increase in organizational leadership culture, staff culture, leadership behavior, leadership measurement, and readiness for change after use of the ACT SMART Implementation Toolkit. These preliminary findings suggest that the toolkit may be an effective strategy for improving ASD-CBOs' organizational capacity to adopt and implement EBPs for youth on the autism spectrum (Moullin et al., 2019). However, supervisors perceived a decrease in organizational resources whereas direct providers perceived an increase in organizational resources after use of the toolkit. This suggests important differences in supervisor and direct provider perspectives and a potential need to further evaluate and adapt the ACT SMART Implementation Toolkit to address resource related barriers to implementing EBPs for autistic individuals.

### **426.106 (Poster)** Childhood Opportunity and Access to Telehealth during the COVID19 Pandemic

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Background: Models of care to increase equitable access to autism services in under-resourced communities are needed. The COVID-19 pandemic forced an increase in telehealth, which has great potential for addressing these inequities in autism care; however little to date is known regarding the sociodemographic or environmental factors enhancing or impeding access to telehealth for autism. We examined the impact of neighborhood level resources and conditions on access to autism services.

Objectives: (1) To compare sociodemographic characteristics among families accessing telehealth at a multidisciplinary child development clinic before and during the pandemic. (2) To examine whether any child neighborhood opportunity profiles predicted better access to telehealth using the Childhood Opportunity Index 2.0 (ChOI 2.0).

Methods: We examined medical records of children seen between January 2018- September 2021. For aim 1, children were stratified by telehealth; over 90% of telehealth visits were conducted after February 2020. Binary regression analyses were used to identify associations between sociodemographic profiles of children accessing telehealth. Next, using geoid coding we calculated Childhood Opportunity Index scores for each child. The ChOI is a publicly available surveillance tool that incorporates traditional and novel attributes of neighborhood conditions (education, health/environment, social/economic). Secondary regression analyses examined whether ChOI levels (Very Low, Low, Moderate, High, Very High) predicted accessing telehealth throughout the study period. Post-hoc analyses examined the effect of ChOI levels on differences in age of referral and autism diagnosis across the study sample.

Results: We included 3,500 unique children (1,030 female; 2,469 male) from 12,077 visits. Among all children 1,745 were seen before and 1,755 during the pandemic (See Table 1). Results of the binary logistic regression indicated that there was a significant association between geography (urban and rural), language (English speaking), and insurance type (Commercial), and telehealth access ( $\chi^2(5) = 23.56$ ,  $p < .00$ ). Secondary analyses (See Chart 1 ) further indicated that *Very Low* childhood opportunity levels of education and health and environment predicted increased telehealth access ( $\chi^2(8) = 18.20$ ,  $p < .02$ ). Post-hoc univariate analyses of the ChOI suggested that families in areas with *Very Low* Childhood Opportunity were referred at older ages  $F(8,4039) = 2.2$ ,  $p = .0251$  and less likely to receive an autism diagnosis  $F(4,.149) = 2.94$ ,  $p = .019$ .

Conclusions: Our results suggest that telehealth for autism has strong potential to increase access to care for English speaking families in urban and rural areas and those with commercial type insurance. However, considerations for models of care should be taken for non-English speaking families and those in designated Frontier communities. We also found that while telehealth availability increased access for families in lower opportunity neighborhoods, children in these communities are referred and subsequently diagnosed later. This study is the first to report neighborhood level resources and conditions on access to telehealth autism services. Autism centers should continue to incorporate telehealth models into their existing systems of care and evaluate equitable access using tools such as the ChOI.

### **426.107 (Poster)** Comparing Rates of Health Care Transition across Youth with ASD, Shcn, and Youth with Typical Development

**Background:** Access to health care transition (HCT) services have been included in national surveys for 20 years. Many studies assessing HCT in the National Survey of Children with Special Health Care Needs and the revised National Survey of Children's Health (NSCH) have shown disparities in access to HCT services for youth with autism spectrum disorder (YASD) but these estimates are often varied and don't reflect the needs described by individuals on the spectrum and their caregivers.

**Objectives:** This study aimed to develop and validate a holistic measure of HCT services within the NSCH and utilized this measure to examine access to HCT services among YASD, youth with other special health care needs (YSCHN), and typically developing youth (non-YSHCN).

**Methods:**

*Measurement Development and Psychometric Testing:* We utilized four-years of NSCH data (2016-19, n = 54,434) to examine the model fit of nine HCT questions. The new measure's psychometric properties were assessed by comparing it to theoretically similar and divergent variables including System of Care indicators, unmet needs, youth employment, and access to mental health services, dental treatment, and mentorship.

*Assessing the relationship between condition status and HCT service provision:* We utilized the newly validated dichotomous HCT measure as the dependent variable in a logistic regression model. Using this model, we examined the relationship between the HCT measure and youth's condition status while controlling for demographic and family-related variables.

**Results:**

*Measurement Development and Psychometric Testing:* An exploratory factor analysis and item culling yielded eight items addressing three subscales. A dichotomous and continuous scale was created with subscales including Guidance Toward Independence, Adequate Clinic Visit, and Continuity of Care Discussions. Model fit was excellent with an Eigenvalue of 1.01 and 79% variance explained. Examination of initial reliability and content and criterion validity indicated high reliability and validity for the scale and subscales.

*Assessing the relationship between condition status and HCT service provision:* YASD had the lowest access to HCT services. YSCHN had significantly higher rates of HCT service provision with 27%, followed by non-YSHCN (19%), and YASD (18%, Table 1). Logistic regression analyses indicated that being older, identifying as female, being white or non-Hispanic black, having private insurance, and having a household income at or above 400% of the federal poverty level were strong predictors of HCT service provision.

**Conclusions:** Less than one in five YASD receive HCT services, indicating a significant disparity in access to HCT services. This was the first study to identify this disparity utilizing a validated measure of HCT service provision. This caregiver-report HCT measure assessed providers' use of care plans, promotion of independence, clinic visit quality, and transfer assistance. The low rates of HCT service provision for YASD is a clear indication that the health care system is not assisting YASD, and families move to an adult model of care or helping YASD learn to manage their own health care needs and gain independence.

#### **426.108 (Poster) Content Analysis of the Recommendations from Project Echo Ontario Autism.**

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**Background:** The rising prevalence of autism spectrum disorder (ASD) diagnoses in recent decades has caused an increased number of community practitioners to care for this population. However, community practitioners report a lack of knowledge and confidence in treating autistic children, resulting in unmet healthcare needs. The Extension of Community Healthcare Outcomes (ECHO) Autism model aims to address this through case-based and didactic learning to help guide community practitioners in providing comprehensive, best-practice care for ASD screening, diagnosis, and management of co-occurring conditions. Each ECHO session involves a case presentation followed by a list of recommendations generated by community participants and an interdisciplinary 'hub' team. While ECHO Autism has shown to improve physician's abilities to care for children with ASD in their practices, recommendations stemming from ECHO cases have yet to be characterized and may help guide the future care of autistic children.

**Objectives:** To quantify and characterize the common categories within ECHO Autism Ontario case recommendations.

**Methods:** We conducted a content analysis of 422 recommendations stemming from 61 ECHO cases to identify categories of recommendations and their frequencies. Three researchers independently coded recommendations from five ECHO cases, after which an original coding guide was developed. The researchers then independently coded the remaining cases using the coding guide and met regularly with the ECHO lead to modify and consolidate the codes and coding guide. From there, we identified categories and sub-categories from the various codes. Finally, the frequencies of each code and category were calculated.

Results: Fifty-seven codes were included in the final coding guide and were grouped into 8 broad categories. Categories include: 1) diagnosis; 2) concurrent mental and physical health conditions; 3) referrals to allied health providers and other specialists; 4) accessing community resources, such as parent and sibling support groups; 5) providing education and guidance to physicians, patients, and families; 6) management strategies such as nutrition, physical activity, and social skills; and 7) patient and family-centered care. A Covid-19 category was also added as many of the later recommendations were adapted to online service delivery. An analysis of the frequency of codes found that the 1,384 total in-text codes were relatively spread out amongst the various categories. The three highest frequencies of categories were as follows: providing general guidance and education (22%), accessing resources (16%), and referrals (15%).

Conclusions: This is the first time recommendations from ECHO Autism have been characterized and quantified. Our results, particularly the most common category of providing general guidance and education about ASD, show that there is still important work to do with educating clinicians and families about aspects of ASD. Furthermore, findings from this study should inform Pediatrics residency programs about real-world knowledge gaps in ASD care, and may help create more tailored ASD training programs and educational materials for medical trainees and practicing physicians.

**426.109 (Poster)** Developmental-Behavior Extenders Reach Military Families Worldwide

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Background: The prevalence of Autism Spectrum Disorder ASD has been steadily rising over the last 20 years. While treatment services for such children have been expanding, challenges in generating an efficient approach to the timely identification and evaluation of children at risk for ASD. Military Treatment Facility data suggests that primary care clinics on average annually refer ten children out of every 500 children they serve to a sub-specialty clinic to rule out ASD. The time from suspicions of ASD to diagnostic evaluation is often longer than 9-12 months. When combined with the highly mobile nature of this patient population, prolonged wait times for diagnosis often becomes the critical limiting factor in access to services.

Objectives: To evaluate the benefits of the Developmental Extender certification program, a manning-neutral program designed to empower the Patient-Centered Medical Home model to facilitate diagnostic evaluations and connect families to comprehensive therapeutic interventions for children ages 2-5 with autism.

Methods: This program design trains a medical team to diagnose and manage ASD with the hub and spoke Developmental-Behavioral Pediatric Oversight to strategically embedded in clinics with limited access to Developmental Pediatrics services. The PCP team is integrated with and supported by a Regional Developmental Specialist through use of telehealth/telementoring, and site visits.

Results: Since conception, seven military bases with PCP teams function as Developmental Extenders and have performed over 100 evaluations for autism. The average age of diagnosis has been reduced to a current average of is 32 months, 15 months earlier than the national average. The reduction of time to diagnosis went from 28 weeks to 4 weeks. Developmental Extender training has also increased provider confidence in diagnosing and treating autism resulting in a 25% decrease in referrals to specialty evaluations for developmental concerns. The model is being considered for expansion to overseas and other regional hub and spoke sites.

Conclusions: The Developmental Extender model is a promising novel approach to ASD screening, evaluation, and diagnosis that has proven to advance early detection and intervention. A targeted expansion could significantly improve time to service access for young military dependents with special needs.

**426.110 (Poster)** Disparities in Autism Diagnosis and Classroom Placement in Black Students

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Background: Racial disparities in autism diagnosis and educational placement exist, with black children being less likely to receive an autism diagnosis than white children (Mandell et. al., 2009). Black children with disabilities are also more likely to be placed in a separate educational placement regardless of income (Grindal et al., 2019).

Objectives: The objectives of this study were to examine the representation of black students compared to white students served under autism eligibility in public school special education and to explore how the combination of income and race affect educational placement for students with developmental disabilities.

Methods: The data presented uses administrative data from a large southern California school district from the 2018-2019 academic year. Participants included students served under autism, specific learning disability (SLD), intellectual disability (ID), and emotional disturbance (ED) eligibility. Student free or reduced lunch (FRL) eligibility was used as an indicator for household income. Inclusion status (special day class [SDC], general education [GE]) reflected the educational placement where a student spent greater than 50% of their time during the school day. Proportions of black and white students by FRL eligibility and educational placement were tabulated. Black and white students were compared using proportionality measures which were calculated using risk ratios and confidence intervals.

Results: Black students were underrepresented in the autism category compared to white students. Black students made up 8.4% of the district population and 10.5% of students served under autism eligibility and 11.4% of students served under ID eligibility. In contrast, white students made up 10.7% of the district population and 16.2% of students served under autism eligibility and 8% of students served under ID eligibility.

Black students served under autism eligibility, regardless of income, had a significantly higher risk of being in SDC compared to white students. Among students without FRL, black students had a higher risk of being in SDC across all eligibility groups. For students on FRL, black students served under ED, SLD, and autism all also had a higher risk of being in SDC. Additionally among students who received FRL, white students served under SLD eligibility had a higher risk of being in SDC.

Conclusions: Larger proportions of black students served under autism eligibility in special education are not due to differences in income, and exist despite black students making up a smaller percentage of students served under autism eligibility.

**426.111 (Poster)** Examining Perceived Barriers to Engagement and Adaptation of Treatment Delivery for Families of Diverse Racial and Sociocultural Backgrounds Undergoing Participation in an Evidence-Based Parent-Mediated Intervention

**A. Rudrabhatla<sup>1</sup>, N. Brane<sup>2</sup>, E. Greenfield<sup>3</sup>, K. Guerra<sup>2</sup>, N. M. Hendrix<sup>1</sup> and K. Pickard<sup>4</sup>,** (1)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (2)Marcus Autism Center, Atlanta, GA, (3)Marcus Autism Center, Emory University School of Medicine, Atlanta, GA, (4)Emory University School of Medicine, Marcus Autism Center, Atlanta, GA

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**Background:**

Recent meta-analyses have demonstrated the efficacy of parent-mediated interventions (PMIs) for fostering social-communication skills in children with Autism Spectrum Disorder (ASD), and parent responsivity and empowerment (Nevill et al.,2018). Parent engagement is integral to the success of PMIs (Pellecchia et al.,2018;Trembath et al.,2019). However, there remain barriers to parent engagement when PMIs are implemented within historically underserved community settings (Kasari et al.,2015). To date, limited research has examined the structural barriers experienced by families of diverse sociocultural and racially marginalized backgrounds when attempting to engage in PMIs. Further, issues of caregiver engagement may reflect a lack of fit between PMIs and the needs of diverse caregivers and families. Although previous research suggests evidence-based interventions high in sociocultural relevance increase client participation (Castro et al.,2014), it is unclear how PMIs for ASD are adapted during delivery to increase their sociocultural relevance and responsivity.

**Objectives:**

To examine (1) whether perceived barriers to participation differ in families of diverse racial backgrounds, (2) how clinicians deliver and adapt an evidence-based PMI, Project ImPACT, in response to families of diverse racial/sociocultural backgrounds, and (3) the extent to which intervention adaptation predicts perceived therapeutic alliance and program satisfaction for families of diverse racial/sociocultural backgrounds.

**Methods:**

Participants included 16 caregivers of a child with ASD (12-40 months) identifying as African American (n=8), White (n=7) and Biracial/Multiracial (n=1). Following a diagnostic evaluation, children were referred to an outpatient Project ImPACT program at a children's hospital in a major metropolitan area. Participating clinicians included speech language pathologists (n=2) and psychologists (n=2). Prior to participation, caregivers completed questionnaires on sociodemographic information and perceived barriers to treatment participation (Barriers to Treatment Participation Scale (BTPS)). Following treatment, caregivers completed a measure of therapeutic responsivity (Measure of Process of Care-20 (MPOC-20)) and a satisfaction survey. Clinicians delivering Project ImPACT participated in a semi-structured interview. Qualitative data collection employed rapid qualitative methods and thematic analysis. Independent t-tests examined whether perceived barriers differed by racial background.

**Results:**

Data collection is ongoing. However, preliminary data from 16 caregivers and 4 clinicians is reported. African American and White families did not significantly differ in perceived barriers to treatment participation ( $p=.487$ ). Qualitative interviews suggest that clinicians adapt Project ImPACT for socioculturally diverse families to accommodate the language preferences of bilingual families, target goals of priority to families, involve extended family members, and validate family concerns about psychosocial stressors including barriers to accessing care and discrimination/bias. The importance of using collaborative goal-setting to assess family values overall was also highlighted. Overall, clinicians shared that cultural adaptations helped to build rapport and alliance with families.

**Conclusions:**

Preliminary analyses showed no differences in perceived barriers to treatment based on racial background. However, interviews suggest that clinicians adapt Project ImPACT for diverse families to promote family engagement by increasing responsivity to sociocultural values and psychosocial stressors. As data collection is ongoing, future analyses involving a larger sample of diverse participants will examine these trends more closely and whether these adaptations yield positive outcomes for therapeutic alliance and program satisfaction.

**426.112 (Poster)** Social Justice Orientation Moderates the Link between Teacher Attention-Related Concerns and Inclusion Attitudes in Parents of Typically-Developing Children

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**Background:**



Federal policy recommendations stipulate that all children with disabilities should have access to inclusive high-quality early childhood education programs (HHS, 2015, 2017). Inclusion programs yield benefits for all children and also allow for increased access to educational environments that support social-communicative skills in children with autism spectrum disorder (ASD; Stahmer et al., 2011). Wide-scale access to inclusion can only become a reality when parents of typically-developing (TD) children value the benefit of such experiences for their children and for society, and eventually select inclusive over non-inclusive alternatives when making decisions about preschool enrollment. While a range of parental concerns (e.g., teachers' ability to divide attention among all children) and values (e.g., social justice attitudes, SJA) have been considered, factors that contribute to the formation of attitudes about inclusion among parents of TD children are poorly understood.

#### Objectives:

To examine factors that predict attitudes about inclusion among parents of TD children, including specific parental concerns and values. Specifically, we predict that parental values (i.e., SJA) moderate the relation between certain parental concerns and attitudes about inclusion.

#### Methods:

Parents of TD children (no Individualized Education Plan, history of early intervention services, developmental concerns) enrolled in Georgia's publicly-funded Pre-K program for 4-year-olds were invited to participate in an online survey. Georgia Pre-K offers two classroom formats: standard (2 teachers, 22 children per class) and inclusion (3 teachers, 18 children per class, incl. 6 children with disability). Surveys were completed by 117 parents. While most parents reported no preference for either classroom format, 14 parents stated that they intentionally sought out an inclusion classroom. Surveys were completed at the beginning of the school year and included measures of inclusion attitudes with a focus on ASD (Attitude Survey toward Inclusive Education-Parent, ASIE-P; Boer et al., 2012), concerns about inclusion (Impact of Inclusion on Typically-Developing Children, IITDC [Risk Subscale], Rafferty & Griffin, 2001; Parental Attitudes Toward Mainstreaming, PATMS [Academics/Teacher Attention Subscale], Green & Stoneman, 1989), and generalized social justice-related values (Social Justice [Attitudes Subscale], SJA; Torres-Harding et al., 2012).

#### Results:

Preliminary analyses comparing parents who intentionally sought out an inclusion class (N=14) and parents who did not (N=103) revealed no significant group differences on any measure ( $p > .05$ ). Pearson correlations between all survey measures are reported in Table 1 and indicate that parental attitudes about inclusion were significantly correlated with general concerns about inclusion ( $r = -.680, p < .001$ ) and teacher attention-related concerns ( $r = .683, p < .001$ ). Finally, we used multiple regression models to test the prediction that SJA moderates the relation between parents' concerns about inclusion (IITDC, PATMS) and attitudes about inclusion (ASIE-P). Results revealed that SJA significantly moderated the relation between PATMS and ASIE-P ( $\beta = .162, p = .026$ , see Figure 1), but not between IITDC and ASIE-P ( $\beta = .002, p = .975$ ).

#### Conclusions:

Analyses highlight the importance of considering both parental concerns about inclusion (particularly concerns about teachers' ability to divide attention among all children) and parental values about social justice (SJA) when aiming to promote positive parental attitudes about inclusion, to address a larger goal of increasing access to inclusion for children with ASD.

#### 426.113 (Poster) Exploring Seasonal Trajectories in Intensity of Intervention Use for Children on the Autism Spectrum

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**Background:** Autistic individuals have a lifelong need for services across the lifespan (Turcotte et al., 2016), but studies over the last two decades have revealed gaps in service coverage (McIntyre et al., 2017) exacerbated by inequitable access based on race, ethnicity, and socioeconomic status (Smith et al., 2020). Despite this emerging literature, our understanding of intervention use over time is limited by the mostly cross-sectional study designs employed thus far. Studies beginning to examine this question (Siller et al., 2013 & Yingling et al., 2019) have employed geographically restricted samples of parents undergoing advocacy training programs and thus may suffer from limited representativeness.

**Objectives:** (1) To identify mean trajectories in intensity of intervention use for autistic children and (2) to examine the association between said trajectories and child demographic factors (age, race/ethnicity, intellectual ability, autism symptoms, family income, and parental education)

**Methods:** As part of their participation in a multisite longitudinal biomarker study, parents reported the number of hours of intervention their children (N=253, Age(years): M=8.54, SD=1.65) received during a series of five consecutive six-week intervals. The data were log-transformed to correct for skewness and clustered via a longitudinal k-means algorithm. The cluster partition with the lowest Bayesian Information Criteria (BIC) was selected. Variability in seasonal participation was coded by a categorical label describing which seasons were encompassed in the data collection period (e.g. spring-winter-fall). Seasonal trends were further quantified by computing the monthly average change in intervention hours per individual. Per Objective 2, associations between cluster membership with demographic information and clinical characterization are forthcoming.

**Results:** Implementation of k-means clustering yielded a six-cluster solution (Fig.1, BIC= 1371.66, Global Posterior Probability = 0.942): a Moderate-EarlyDip cluster (red, 26.48% of trajectories), Moderate-Stable cluster (yellow, 24.90%), High-Stable cluster (green, 24.11%), Low-Stable cluster (light blue, 11.46%), Moderate-LateDip cluster (dark blue, 10.67%), and a small RapidRise cluster (pink, 2.37%). Observed counts in the seasonal trajectory label per cluster differed from expected counts ( $\chi^2=65.784$ ,  $df=35$ ,  $p=0.001246$ ), with the Moderate-EarlyDip cluster having a higher number of summer-fall trajectories (standardized residual(stdres)=4.01); High-Stable cluster being enriched in fall-winter-spring trajectories (stdres=3.09); and the Moderate-LateDip cluster being enriched in spring-summer (stdres=2.07), and spring-summer-fall (stdres=2.82) trajectories. Monthly changes in intervention hours display a sharp decrease in intervention use during the summer months – particularly June (Fig.2,  $t=-2.98$ ,  $p=0.0038$ ).

**Conclusions:** Clustering the longitudinal trajectories in intensity of intervention use for autistic children yields trends that not only reflect differences in absolute intensity of services received (High, Moderate, Low), but also temporal instability associated with seasonal change (Stable, LateDip, EarlyDip). The decrease in intervention hours during the summer is most likely attributable to an interruption in the school year, and the consequent lapse in school-based service delivery. Since racial differences have been found in reliance on school-based and public services (Siller et al., 2013), our planned exploration of associations between demographics and cluster membership may elucidate differential impacts of this provision lapse. Further research is needed to ascertain the impact of short-term interruptions on behavioral change and educational progress measures.

**426.114 (Poster)** Exploring the Effects of Virtual Mathematics Instructional Tools on the Word Problem Solving Performance of Autistic Elementary School Students

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**Background:** Due to the COVID-19 pandemic, many K-12 students in the United States attended school virtually, requiring teachers to alter their teaching methods to virtual formats. Although the use of video modeling (VM) and other behavioral support strategies (e.g., graphic organizers, manipulatives, guided practice) to teach mathematics skills to autistic students is well-supported by the literature, these strategies have not typically been studied in remote, virtual settings.

**Objectives:** The goal of this study was to explore the effects of virtual mathematics instruction and strategies on the word problem-solving performance of three autistic elementary school students.

**Methods:** This exploratory A-B design case study included three autistic students, ages 8-11 years old. Participants included two male students, one of whom also had a secondary diagnosis of ADHD, and one female student, with secondary diagnoses of ADHD, language disorder, and specific learning disability in mathematics. Participating students and their parents attended study sessions virtually, on Zoom. The instructional materials included VM, virtual manipulatives or visual representations, a graphic organizer, guided practice, and corrective feedback. Although parents were present to provide behavioral prompting or technology support, parents did not provide computational help. All students worked on word problem solving on different skills, including multiplication and division, addition and subtraction of mixed fractions, and addition and subtraction with regrouping. Students were evaluated on their independent accuracy of solving word problems, and the number of problem-solving steps that they completed independently per problem. We visually examined data for trend and variability within and between phases.

**Results:** All students demonstrated improved word problem-solving performance from baseline (A) to intervention (B) with the virtual instruction, although to varying extents. Namely, students demonstrated variability in their independent accuracy (calculating the correct final solution), but demonstrated high levels of independent completion of the task analysis steps for the problem-solving process, indicating that additional guidance may be needed for certain steps of the process to result in improved overall independent accuracy. For one student, the use of VM with visual representations, a graphic organizer, three guided practice sessions, and corrective feedback was effective in improving her independent accuracy (mean change= 48%). For the other two students, use of these strategies corresponded with high rates of independent completion of the task analysis steps for problem-solving, but not independent accuracy. Therefore, the VM was replaced with additional opportunities for guided practice to provide explicit instruction on particular steps of the problem-solving process. The use of additional guided practice, coupled with the graphic organizer and corrective feedback, was associated with higher independent accuracy scores (mean change= 58%, 25%).

**Conclusions:** This presentation discusses the findings of one of the early studies that explored the effects of online teaching techniques on autistic students' mathematics accuracy and independent task completion. Each student required different variations of the instructional strategies to improve their independent accuracy of problem-solving based on their individual learning needs. These findings offer implications for future research and practice on individualized mathematics instruction for autistic students in virtual learning environments.

**426.115 (Poster)** Exploring the Impact of Autism-Specific Medicaid Home and Community-Based Waivers: A Scoping Review

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**Background:** Medicaid is intended to provide a broad range of medical and long-term care services to autistic children and adults to support them to live in their homes and communities, rather than institutions. These are also known as home and community-based services (HCBS). Medicaid HCBS waivers are the largest, and often the only, provider of long-term services and supports for people with intellectual and developmental disabilities, including autistic individuals, in the United States. Over the past two decades, many states have developed waivers specifically targeted at supporting autistic children and adults, and their families. Emerging research tests the impact of these autism-specific HCBS waivers on outcomes for autistic individuals and their families; however, this body of work has yet to be synthesized.

**Objectives:** We conducted a scoping review to synthesize what is known about the impact of autism-specific Medicaid HCBS waivers on the lives of autistic people.

**Methods:** In contrast to a systematic review, the intent of a scoping review is to broadly review the literature to examine the extent, range, and nature of research activities and to identify gaps. We systematically searched relevant databases with the guidance of a reference librarian. We comprehensively searched key terms related to autism spectrum disorder, Medicaid, and home and community-based services. These key terms were truncated and broadened to enable comprehensive coverage per guidelines of scoping review methodologies as well as to account for changes in autism spectrum diagnosis language. Studies were included in our review if they: (1) included autistic participants and/or their families; (2) focused on Medicaid HCBS policy; (3) quantitatively tested an aspect of an autism-specific Medicaid HCBS waiver policy on a given outcome.

**Results:** We identified 764 unique studies, of which 6 were eligible for inclusion. All six studies examined the effect of autism-specific HCBS waivers on outcomes for autistic individuals and their families. Three of the studies looked at state-specific autism waivers and their impacts on outcomes for autistic individuals and their families within their state. The remaining three studies used national level data to compare outcomes across states and counties with HCBS waivers targeted at improving outcomes for autistic individuals and their families. No studies utilized causal modeling. Findings indicate that HCBS waivers may improve quality of life for autistic individuals and their families, reduce unmet healthcare needs for autistic people, increase the likelihood that parents will be able to continue working while addressing the care-needs of their autistic children, and reduce racial disparities in access to care.

**Conclusions:** Research on the economic and social impact of HCBS waivers targeted at improving outcomes for autistic individuals is emerging, yet more research is needed to determine causal mechanisms. Key findings of the six studies in this review demonstrate that state-level Medicaid HCBS programs are improving the lives of autistic people and their families. Research that examines the differences between state autism-specific HCBS waivers is now needed to determine which aspects of these programs are working most efficiently and effectively.

**426.116 (Poster)** Exploring the Intersection of Race and Autism in Young Adults: Do Provider Adverse Childhood Experience (ACE) Inquiries Differ Based on Patient Race?

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**Background:** Autistic individuals are more likely to experience adverse childhood experiences (ACEs, e.g., physical and emotional abuse, income insufficiency, divorce) than neurotypical peers (Hoover & Kaufman, 2018). ACEs can have cumulative lifelong effects for autistic individuals (Dodds, 2021), such as worsening autism symptoms (Fuld, 2018), delayed diagnoses, and service access (Berg et al., 2018). Recent research has underscored the importance of explicitly investigating ACE experiences for autistic people to reduce health disparities (Berg et al., 2016; Karpur et al. 2019). Compounding these issues, major racial disparities exist in service access for autistic individuals (Angell et al., 2018). While a recent survey of community-based providers identified patient race as a predictor of trauma-related treatment (Kerns et al., 2020), little research has investigated provider-specific variability in addressing ACEs when serving different racial communities. Even less work has addressed ACEs in autistic young adults, who face risks and challenges in this transition from adolescents to adulthood (Taylor & Gotham, 2016; van Schalkwyk & Volkmar, 2016).

**Objectives:** This study explored variability in ASD provider inquiries of eight individual ACEs based on primary racial group served. We hypothesized that providers primarily serving marginalized racial groups would be more likely to inquire about any of the ACEs than those primarily serving non-marginalized groups.

**Methods:** 148 community-based ASD providers primarily working with young adults completed the Usual Care of Autism Study (UCAS; Wainer et al., 2007). Providers were asked to report primary racial groups served and frequency of ACE inquiries (Table 1). Multivariate regressions analyzed the effect of providers primarily serving different racial groups on likelihood of inquiring about ACEs.

**Results:** Providers who primarily served White autistic young adults reported inquiring less about food scarcity, those who reported primarily serving Asians inquired less about physical or emotional neglect (Figure 1), and those who reported primarily serving Hawaiian or Pacific Islanders inquired less about domestic violence, than those who did not report primarily serving these populations (all  $p < .05$ ; Table 1). Conversely, those who reported primarily serving Black autistic young adults inquired more about physical or emotional neglect, those who reported primarily serving Hispanics inquired more about parent mental illness, and those who reported primarily serving Native Americans inquired more about domestic violence than those who did not serve these populations (all  $p < .05$ ; Table 1).

**Conclusions:** These results suggest provider variability in ACE inquiries based on racial groups of young autistic adults. Autistic individuals face many unique challenges associated with transitioning into adulthood (Taylor & Gotham, 2016) and providers-biases in ACE inquiry (i.e., failing to inquire about ACEs in certain populations) might lead to individuals missing out on services to help address associated mental health concerns. Future work should more directly investigate why these differences may be occurring, determine whether these differences in inquiry are a result of racial biases, and provide more explicit training and education on ACEs in autistic individuals to improve the quality of services.

**426.117 (Poster)** Forward Translation of Who's Caregiver Skills Training (WHO-CST) during COVID-19 Pandemic: A Field Experience from Malaysia

**Background:** Prolonged Malaysia's Movement Control Order mandate benefits children an extra time with primary caregivers from staying at home. With the continuous postponement of hospital appointments, implementing WHO-CST, a program that focuses on training parents to deliver intervention may ensure continuous skills development for autistic children. The Malay language differs from the English language in phonology, grammar, morphology and semantics. Thus, conducting a translation study before implementing the program on a local scale is crucial, considering the significant difference in linguistic and cultural diversity. Besides, in light of the COVID-19, all discussions were conducted virtually.

**Objectives:** To explore challenges in translating the original English module to the local Malay language and solving barriers to implementation.

**Methods:** A group of bilingual interdisciplinary teams (n=65; 82% female; Age<sub>ave</sub> = 31) from the national autism early intervention centre inclusive of occupational therapists, speech therapists, special education teachers and early childhood educators with ≥ 3 years working experience were recruited to translate 623 pages of WHO-CST module to local language. Additional experts (n=10) from medicine, psychology and education with ≥ 10 years working experience in their respective fields were appointed as supervisors. All discussions were made virtually with interactive day workshop and focus group discussion conducted using breakout room and digital workspace apps MURAL.co. The discussion included a linguistic validation comparing Malay translation with the original English by assessing conceptual and content equivalence.

**Results:** As the results of qualitative analysis, three major concerns were raised mainly on (i) translation taxonomy strategies, (ii) cultural filtering and (iii) syntactic problems. All groups reported they were unsure about the words order and grammatical relations. About 6 out of 8 translator groups agree that most illustrations require cultural adaptation and proper characters' names. Furthermore, 3 out of 8 translator groups reported that they had faced challenges when local languages did not have equivalent scientific and technical vocabularies. With in-field experience consulting parents with autism, suggestions were made to use creative translation compared to verbatim, ensuring appropriate adaptation for target users, while language error was suggested to further validate by a language expert. For overall online experience measured using 5-points Likert's scale, out of 32 responses obtained from translators, 50% indicate they were satisfied and find it comfortable navigating online, while 18% feel neutral with the experience.

**Conclusions:** Although the input from the bilingual in-field experts was gained in line with WHO's translation suggestion, there is a need to involve language experts due to the intricacies present in both languages. In the next phase, this research will also gather stakeholders (e.g., the Ministry of Health, Education and the lead advocacy organization) and parents of autistic children to the refined measurement of adaptation outcomes.

#### **426.118 (Poster) Healthcare Disparities Among Autistic, Sexual and Gender Minority Individuals**

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**Background:**

Longstanding disparities exist in healthcare access and utilization for lesbian, gay, bisexual, transgender, or queer (LGBTQ+) populations. LGBTQ+ individuals often experience healthcare-related barriers due to discrimination and prejudice from practitioners. Similar disparities exist for individuals with disabilities; however, less is known about the healthcare experiences of individuals with these dual identities. The field of autism research increasingly recognizes that disparities exist for groups of autistic individuals, and research has identified disparities for racial and ethnic minorities, females, individuals in rural areas, and individuals with a lower socioeconomic status (for review see Bishop-Fitzpatrick & Kind, 2017). While more autistic individuals identify as LGBTQ+ compared to the general population (De Winter et al., 2017); limited data exist on the health disparities and experiences of autistic individuals identifying with non-binary conceptualizations of sex or gender identity.

**Objectives:**

The objective of this study is to examine the extent to which unmet healthcare needs and health status differ between autistic, LGBTQ+ and autistic, straight, cisgender individuals.

**Methods:**

We conducted a descriptive study with data drawn from the administration of the National Survey on Health and Disability (NSHD) conducted between October 1, 2019 through January 31, 2020. The purpose of the NSHD was to understand the healthcare access and experiences of individuals with disabilities, which yielded a sample of 2,175 individuals, aged 18-64 with a wide variety of disabilities. Our study included participants who reported autism spectrum disorder (ASD) as their primary diagnosis on the NSHD survey, which resulted in a sub-sample of 113 participants. Of the 113 participants, 62 identified as LGBTQ+ and 51 identified as cisgender. We used a MANCOVA to examine group differences in unmet healthcare needs (i.e., physician, prescription drugs, mental health, specialty care, preventative care, dental), refusal of care by these providers, physical health status, mental health status, and the total number of co-occurring disabilities.

**Results:**

Results suggested significant differences between the LGBTQ+ and cisgender group after controlling for gender ( $F(4, 84) = 3.44, p = 0.01$ , Pillai's Trace = 0.14, partial  $\eta^2 = 0.14$ ). Univariate follow-up analyses revealed significant group differences with the LGBTQ+ group reporting significantly more days of poorer physical ( $F(1, 87) = 4.92, p = 0.03$ , partial  $\eta^2 = 0.05$ ) and mental health ( $F(1, 87) = 6.91, p = 0.01$ , partial  $\eta^2 = 0.07$ ), as well as more unmet healthcare needs ( $F(1, 87) = 6.24, p = 0.01$ , partial  $\eta^2 = 0.07$ ). However, there were no significant group differences for the number of occasions healthcare providers refused care ( $F(1, 87) = 0.001, p = 0.98$ , partial  $\eta^2 = 0.00$ ) or the total number of co-occurring diagnoses ( $F(1, 87) = 1.69, p = 0.20$ , partial  $\eta^2 = 0.02$ ).

#### Conclusions:

Novel findings from this study suggest dual identities of LGBTQ+ and autism result in greater disparities in physical and mental health as well as unmet healthcare needs. Since our study compared the health status and healthcare needs of both cisgender autistic individuals and autistic, LGBTQ+ individuals, this means the additive effect of an LGBTQ+ identity magnified these disparities.

#### 426.119 (Poster) Identifying Autism Intervention Components Deliverable By Non-Specialists in Low- and Middle-Income Countries: A Systematic Review

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**Background:** The past decade has seen key advances in developing, evaluating and implementing early intervention programs for autistic children. However, most of these efforts were within the context of high-income countries (HIC). The impact on low- and middle-income countries (LMIC) has been minimal. The care gap seen within these countries remains close to 100%. A key challenge in addressing the care gap concerns the paucity of available specialists to deliver services within LMIC contexts. Task-sharing provides an important potential solution, however globally, the vast majority of the evidence for intervention feasibility, acceptability and effectiveness is based on delivery by specialists. Therefore, making evidence-informed decisions around interventions that are suitable for scaled-up delivery in low-resource settings by non-specialist workers becomes difficult.

**Objectives:** The aim of this paper was to conduct a systematic literature review to identify studies which report intervention delivery by non-specialists within LMIC. With these papers, the process described by Chorpita et al (2005) helped identify common components and shared characteristics that are evidence of a successful delivery by non-specialists in LMIC.

**Methods:** Systematic literature search conducted within four databases (Cochrane Database, APA PsychInfo, Ovid Medline, Embase). Articles included if studies were: (a) in LMIC; (b) of autistic children (age <10); (c) about psycho-social interventions delivered by non-specialists; (d) on child outcomes; and (e) English peer-reviewed full-texts. Our definition of non-specialist centered on the kinds of workers available within LMIC settings (e.g., community health workers, parent champions). Initial search generated 2535 articles. Removing duplicates left 1721 articles. Titles and abstracts were then screened, with 10% double-rated to ensure reliability. Two independent raters screened 50 potential full-text articles. Finally, using Chorpita's model of distillation and matching which is codified within the @Practicewise framework (Chorpita et al. (2009)), elements and techniques were mapped within the identified interventions.

**Results:** Two studies met the inclusion criteria. Rahman et al. (2016), pilot randomized controlled trial (RCT) of a parent-mediated communication-focused intervention (PASS) with autistic children aged 2-9 years, delivered by non-specialist health workers in Rawalpindi (Pakistan) and Goa (India). Divan et al. (2019), pilot RCT of PASS Plus (PASS therapy with additional modules for common comorbidities) delivered to parents of autistic children aged 2-9 years by non-specialists in Kolhapur, India. Using the adapted and expanded @Practicewise framework, we identified eight intervention elements across the two publications: accessibility promotion, activity selection, social communication, language expansion, family engagement, narrative, parent-mediated, problem-solving and play therapy. Additionally, we identified nine common techniques: goal-setting for caregivers, home-work for caregivers, review of homework, record diary, caregiver's praise, psychoeducation, relationship/rapport building, therapist's praise and video-feedback.

**Conclusions:** Our study reveals the acute lack of empirical evidence emphasizing a need for further clinical research in LMIC to provide evidence for task-sharing through non-specialist delivery of autism interventions. Despite the small number of studies, several intervention elements and techniques are highlighted, which non-specialists can be trained in to deliver with good fidelity and acceptability, resulting in positive outcomes. This focus is critical to reduce inequity and achieve universal health coverage within resource-constraint health systems.

#### 426.120 (Poster) Implementation of Telepsychiatry Services in Autism Spectrum Disorder Specialty Clinics: A Nationwide Survey Shows Rapid Implementation to Sustain Access to Mental Health Services during COVID-19 Lockdown

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#### Background:

Traditional clinical service models, in which patients visit centralized clinical sites for routine care, can decrease access to care if travel to the clinic site is difficult for patients and their families to manage. In addition to possible financial and time-related challenges of travelling to clinics, a special concern for patients diagnosed with autism spectrum disorder (ASD) is the inherent stress of traveling to a new location that may trigger severe

behaviors. Telepsychiatry, in which psychiatric care is provided by videoconference, has been utilized for decades to address these concerns, but in a limited fashion due to state and institutional regulations. In early 2020, however, there was a nationwide shift to telepsychiatry in the wake of the Coronavirus Disease 2019 (COVID-19) pandemic and lockdowns to prevent the spread of SARS-CoV-2.

#### Objectives:

To assess the rate of in-person versus telepsychiatry appointment attendance pre- and post-COVID-19 lockdown.

#### Methods:

We conducted a national, multi-site survey of completed appointments in 2020 compared to a similar time period in 2019. Five outpatient child psychiatry clinics that specialize in the treatment of patients with ASD and/or DD (ASD/DD clinics) provided numbers of scheduled and completed visits for the time period spanning December to June in 2019 and 2020. Visits totals were provided in aggregate for each clinic site, and were approved or exempted by IRB at each institution.

#### Results:

In 2019-2020, only 2 of the sites were performing telepsychiatry visits in the 3 months prior to the COVID-19 lockdown, making up only 1.2% of completed visits at those sites. After the lockdown commenced in March 2020, this rate was immediately inverted, such that telepsychiatry accounted for 99.6% of all completed visits in April 2020, with only a handful of visits completed in person. Outpatient ASD/DD clinics continued this level of telepsychiatry visits thereafter (**Figure 1A**), with an average telepsychiatry completion rate of 87.8% across all clinic sites (**Figure 1B**). Total completed telepsychiatry visits in April – June 2020 surpassed the number of in-person visits completed for the same period in 2019 (3119 in 2019 vs 3218 in 2020).

#### Conclusions:

The COVID-19 lockdown forced the immediate implementation of remote care delivery, and providers and patients have found many advantages to telepsychiatry that support the continued funding of this care model. We now have a wealth of information and experience to better hone telepsychiatry as a model of care. We will discuss the substantial benefits physicians, patients and families have found in using telepsychiatry, as well as concerning factors that must be addressed to improve access to care for this patient population.

**426.121 (Poster)** Incorporating Telehealth Visits in an Interdisciplinary Team Evaluation Approach for Assessing Autism Spectrum Disorder in School-Age Children

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**Background:** In 2018, the Seattle Children's Autism Center (SCAC) transitioned to an interdisciplinary team evaluation model for assessing autism spectrum disorder (ASD), in which two providers of different disciplines complete an ASD-focused evaluation in one day (Standard team; Gerdtz et al., 2018). An additional evaluation track (Autism Psych team) was later created to account for a subset of patients (10-18%; Gerdtz et al., 2018, 2019), aged 6 years and older, who are unable to complete their evaluation in the Standard model due to complicating factors. Due to the COVID-19 pandemic, SCAC modified its evaluation models in 2020 to include telehealth visits within the format of these diagnostic tracks.

**Objectives:** To describe outcomes of hybrid (telehealth/in-person) ASD evaluations for children, aged 6-21 years, following the modification in SCAC's evaluation procedures due to the pandemic.

**Methods:** Figures 1 and 2 summarize the evaluation models and referral flow following intake. Data from either chart review or brief provider questionnaire were available for 438 patients who completed a diagnostic intake after SCAC's diagnostic services were resumed. Most patients completed their intake via telehealth (98.2%). Patients ranged in age from 6-21 years ( $M = 10.9$ ,  $SD = 3.5$ ; 62.8% male) and 33.2% reported a non-White racial identity. Fifty-eight percent of patients had Medicaid or did not have insurance, and 5.5% needed an interpreter.

**Results:** Of the 407 patients referred on for team evaluation after intake, 85.7% were referred for a Standard hybrid team (SHT) evaluation, and 14.3% were referred for an Autism Psych hybrid team (PHT) (due to significant psychosocial history, psychiatric/medical comorbidity, and/or complicating intellectual functioning). Diagnostic outcome data could be determined from 292 completed evaluations out of 407 referred. SHTs were able to make a diagnostic decision (yes/no ASD) in 89% of cases; the remaining 11% required additional time to come to a diagnostic conclusion. Reasons included the need for additional testing or records and complex history or symptom presentation. Approximately 74% of patients received an ASD or provisional ASD diagnosis across both tracks. Thirteen patients were asked to return to clinic in 6-12 months for re-evaluation. Patient age was a borderline significant predictor of diagnostic outcome ( $p = .051$ ), in that increased age was associated with a decreased likelihood of ASD diagnosis. Patient sex, race, ethnicity, use of interpreter, and insurance type did not predict diagnostic outcome.

**Conclusions:** Diagnostic evaluations that include telehealth visit(s) appear successful in ruling in/out ASD. Rates of patients needing additional time to make a diagnostic decision are comparable to pre-pandemic levels. Preliminary provider satisfaction data indicate that most SCAC evaluation providers (66.7%) prefer a model that includes a telehealth component. Further study is needed to examine patient family perspectives on the acceptability of this delivery model. Having the option to refer directly to a diagnostically complex team may be helpful in optimizing the length of evaluations to best accommodate those most in need of more in-depth evaluations. Future research will seek to characterize the diagnostically

complex group to help predict complicating factors and improve triage at intake.

**426.122 (Poster)** Optimizing Access to Tailored Autism Integrated Care (ATTAIN) in a Federally Qualified Health Center

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**Background:** School-aged children with autism spectrum disorder (ASD) experience high rates of co-occurring mental health (MH) needs (referred to as ASD+). However, this population faces challenges accessing and engaging in specialty MH services (Maddox et al., 2021). To address these challenges, we co-created Access to Tailored Autism Integrated Care (ATTAIN), a customizable model to enhance MH screening and linkage to services for children with ASD at-risk for co-occurring MH conditions. ATTAIN was piloted in two healthcare systems in Southern California (Stadnick et al, under review); providers reported that ATTAIN was feasible and acceptable and shared actionable recommendations for further enhancements. These recommendations were integrated into a refined ATTAIN model that was examined in an optimization pilot in a federally qualified health center (FQHC).

**Objectives:** To examine implementation outcomes and provider perceptions of the adapted ATTAIN model in a 6-week optimization pilot at one FQHC near the US/Mexico border.

**Methods:** To optimize ATTAIN for the FQHC, original implementation strategies were modified to include: (1) a multidisciplinary team of clinic champions, (2) weekly periodic reflections with champion team, (3) virtual training, (4) weekly personalized outreach to provide workflow reminders and technical assistance, and (5) automation of workflow procedures into the electronic health record. Participants in the optimization pilot included 11 providers (4 primary care providers, 6 medical assistants, and 1 care coordinator). Most providers were female (82%) and Latino (64%). ATTAIN adoption rate and post-pilot provider ratings of implementation experiences were analyzed using descriptive statistics. Paired sample t-tests were conducted to examine changes in providers' knowledge and confidence treating children with ASD+ as well as changes in providers' comfort with MH screening, referral, and linkage practices for ASD+ from baseline to post-pilot.

**Results:** ATTAIN adoption (i.e., proportion of ATTAIN-eligible patients with whom provider used ATTAIN) was 100%. Post-pilot, providers rated ATTAIN as feasible ( $M=3.6$  out of 4,  $SD=0.4$ ) and acceptable ( $M=3.7$  out of 4,  $SD=0.5$ ). Providers rated their intentions to continue using ATTAIN as high ( $M=3.0$  out of 4,  $SD=0.3$ ). Providers reported agreement to a "moderate extent" towards the specific components of ATTAIN ( $M=1.8$  out of 4,  $SD=1.1$ ). Significant changes in providers' knowledge of ASD+ ( $t(5)=-6.1$ ,  $p < 0.01$ ) and confidence talking and answering questions about ASD+ ( $t(4)=-3.7$ ,  $p < 0.05$ ) were demonstrated. No changes in comfort identifying co-occurring mental health conditions ( $t(6)=0.2$ ,  $p > 0.05$ ) nor interpreting screening results ( $t(6)=1.0$ ,  $p > 0.05$ ) were observed.

**Conclusions:** Post-pilot ratings indicated favorable perceptions of the feasibility, acceptability, and intentions to continue using ATTAIN. ATTAIN adoption was high in this FQHC setting. Findings demonstrated significant gains in provider knowledge of ASD+ and confidence talking and answering questions about ASD+. Further work is needed to understand the lack of change in providers' comfort identifying ASD+ and interpreting screening results. Next steps include sustainment and scaling of ATTAIN across providers and clinics at the FQHC.

**426.123 (Poster)** Part C Provider- and System-Level Factors Influencing Engagement in Training and Consultation

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**Background:** Naturalistic developmental and behavioral interventions (NDBIs) are evidence-based interventions for young children with ASD (Schreibman et al., 2015). There has been growing interest in translating NDBIs into community systems to better serve young children with or at risk for autism spectrum disorder (ASD), particularly those who encounter systemic disparities that limit access to specialty care (Jones & Mandell, 2020). Part C Early Intervention (EI) systems play a key role in serving these children and families and are a critical setting in which to study factors impacting the implementation and sustainability of NDBIs.

Although multiple efforts are underway to translate NDBIs into EI systems, little is known yet about the likely complex and varied factors that impact these implementation efforts. This study—which is part of an ongoing contract with a state-level EI system—responds to this gap. Provider- (e.g., Motamedi et al., 2021) and system-level factors (e.g., Herschell et al., 2010; Palinkas et al., 2018) were predicted to contribute to implementation outcomes.

**Objectives:** To identify the extent to which provider factors (i.e., attitudes and years of experience) and system factors (i.e., level of support) impact participation in ongoing NDBI training efforts and implementation outcomes.

**Methods:** Thirty-four interdisciplinary providers enrolled in NDBI training that included one of two specific models. All participants were actively providing services within the EI system to at least one child with an increased likelihood of having ASD. Prior to training, providers completed sociodemographic information including age, discipline, and years of experience supporting young children at risk for having ASD. Providers also completed the *Evidence-Based Practices Attitudes Scale* (EBPAS; Aarons, 2004) and *Organizational Readiness for Change* subscales (ORC; Lehman et al., 2002). Following enrollment, implementation outcomes (e.g., training completion, group consultation attendance, provider fidelity) were

collected. Linear and logistic regression models will be used to predict implementation outcomes from provider experience, attitudes, and reported level of support and resources.

**Results:** Data collection is ongoing. A preliminary logistic regression model was performed to ascertain the effects of selected *EBPAS* and *ORC* subscales on completion of NDBI training and was found to be significant ( $\chi^2(2) = 6.37, p = .041$ ). Specifically, providers with higher *EBPAS* scores related to openness to new practices were more likely to complete training. Preliminary linear regression results for providers who had completed training and could then participate in group consultation revealed that level of supervision support significantly predicted proportion of group consultation sessions attended,  $\beta = 0.03, t(20) = 2.48, p = .02$ . Years of experience did not predict either outcome.

**Conclusions:** This study will contribute insight into factors that may increase the likelihood of EI providers completing NDBI training and participating in group consultation to promote maintenance of these evidence-based practices. Identification of these factors can then shape how implementation efforts respond to system-specific barriers and facilitators, which may increase adoption of evidence-based practices like NDBIs and maximize system capacity to sustain NDBIs over time.

#### **426.124 (Poster) Poorer Self-Reported Healthcare Quality Among Autistic Compared to Non-Autistic Adults**

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**Background:** Several studies suggest that autistic adults have higher rates of both physical and mental health conditions, and that they have shorter lifespans than others; however, only two studies to date compare the healthcare quality of autistic and non-autistic adults.

**Objectives:** To compare the self-reported healthcare quality of autistic and non-autistic adults in the areas of sensory experience, patient-provider communication, anxiety, access and advocacy, and systemic problems. The study also aimed to consider the self-reported quality of healthcare related to autism specifically, from the patient's perspective.

**Methods:** We administered an anonymous survey via Qualtrics to autistic and non-autistic adults using a 4-point Likert Scale. The final sample included  $n=2,649$  participants, including  $n=1,285$  autistic individuals. The results were binarized to assess whether individuals endorsed or rejected each statement and the research team employed Fisher's exact tests and binomial logistic regression adjusting for age, ethnicity, education-level, and country of residence to provide unadjusted and adjusted estimates of group differences in healthcare experiences, respectively; missingness for covariates only was addressed using five iterations of multiple imputation. To account for multiple testing, a  $p$ -threshold of  $<0.001$  was established for significance.

**Results:** Overwhelmingly, autistic individuals reported lower quality healthcare experiences compared to their non-autistic peers; Table 1 shows the unadjusted and adjusted results below. The only item that did not meet the significance threshold was whether participants had health insurance or were part of a national healthcare program (e.g., NHS, Medicare, Medicaid, etc...). In addition, when discussing autism-specific areas of healthcare, 33.75% of autistic adults did not think that their healthcare provider knew what autism was; 68.83% did not think that their healthcare professional usually tries to make adjustments because of their autism; and 71.54% of autistic adults did not think that their healthcare professional considers their autism when making diagnoses and treatment plans. Full results for these analyses are shown in Figure 1 below.

**Conclusions:**

This study is the largest to date that compares the healthcare experiences of autistic and non-autistic adults. The results suggest that there are sweeping differences in healthcare quality across a wide range of modalities, resulting in poorer self-reported healthcare quality for autistic adults compared to their non-autistic peers. Further, though not comparative, autistic adults perceive their healthcare professionals as having limited knowledge of autism and that the majority do not attempt to make adjustments or considerations for their autism. Future research must focus on practical means of improving healthcare quality for autistic adults to ensure that they are receiving equal access to high quality healthcare.

#### **426.125 (Poster) School Leaders' Perspectives on the Implementation of Evidence-Based Practices for Students with Autism Spectrum Disorder** **I. Taormina<sup>1</sup>, A. Sridhar<sup>2</sup>, M. Rajadhyaksha<sup>3</sup>, S. Moore<sup>1</sup> and G. F. Azad<sup>1</sup>, (1)Psychiatry, Columbia University Medical Center, New York, NY, (2)Psychology Department, Michigan State University, East Lansing, MI, (3)University of California Riverside, Riverside, CA**

**Background:** School leaders are imperative for setting the organizational context (e.g., climate, culture, resources) which may facilitate or hinder the implementation of evidence-based practices (EBPs) in special education settings serving students with autism spectrum disorder (ASD). School leaders may work in an administrative role (e.g., principals, assistant principals) or a practice role (e.g., school psychologists, social workers). School leaders who actively create a supportive organizational context (e.g., using teacher training/coaching as implementation strategies) may positively impact individual implementers (e.g., teachers) and their use of EBPs. However, few studies have examined the perspectives of school leaders on organizational context broadly, and implementation strategies specifically, and its association with EBP implementation in special education settings serving students with ASD.

**Objectives:** The purpose of this mixed methods study was twofold: 1) To examine how leaders perceive the organizational context of their schools; and 2) To examine the most important and feasible implementation strategies for supporting special education teachers use of EBPs for students with ASD.



**Methods:** Participants included 34 school leaders, 59% administrative and 41% practice leaders; 81% were female and identified as either White (86%) or Black (14%). Approximately, 54% worked at public schools serving both general and special education students and 45% worked at nonpublic schools serving only special education students. Semi-structured interviews were conducted to ask participants: 1) The culture/climate of their school and the existing supports for special education teachers; 2) To rate 15 implementation strategies on their feasibility and importance; and 3) To discuss their top three rated strategies. Interviews were coded using a combination of inductive and deductive coding.

**Results:** Qualitative findings indicated that family and student-level factors, as well as organizational-level factors (e.g. programming, staffing) influenced perceived culture and climate. Additionally, school leaders reported a number of supports for the implementation of EBPs by special education teachers including access to resources, professional development, staff meetings, and support from non-teaching staff. Quantitative ratings converged with qualitative findings. More specifically, the top three important implementation strategies were: 1) Providing ongoing consultation/coaching ( $M = 4.82$ ;  $SD = 0.39$ ); 2) Conducting ongoing training ( $M = 4.71$ ,  $SD = .46$ ); and 3) Monitoring the progress of implementation efforts ( $M = 4.64$ ,  $SD = .58$ ). The top three feasible implementation strategies were: 1) Conducting educational meetings ( $M = 3.86$ ,  $SD = 1.08$ ); 2) Changing/altering environment ( $M = 3.82$ ,  $SD = .91$ ); and 3) Providing ongoing consultation/coaching ( $M = 3.77$ ,  $SD = .92$ ). However, importance and feasibility ratings differed by school (i.e., public or non-public) or personnel type (i.e., administrator or practice leader).

**Conclusions:** Our findings are significant because they suggest that school leaders are perceptive of the multiple levels of factors (i.e., student, family, school) that influence culture and climate, as well as the numerous supports necessary for high-quality implementation. Providing ongoing consultation/coaching was rated as the most important and feasible implementation strategy for supporting special education teachers in implementing EBPs for students with ASD.

**426.126 (Poster)** Special Education Services Among Preschool and School-Age Children with Autism with and without Co-Occurring Conditions  
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**Background:** Children with autism spectrum disorder (ASD) represent 11% (830,000) of students served by the Individuals with Disabilities Education Act and often receive special education services to support preschool and school-age education planning. Existing research highlights wide variability in service utilization, though studies are limited in sample size and treat ASD as homogenous. Students with ASD may have numerous co-occurring conditions that impact academic learning, including intellectual disability (ID), attention-deficit/hyperactivity disorder (ADHD), and/or language disability (LD).

**Objectives:** To examine within a large, national sample of school-age (preschool-12th grade) children with ASD if differences exist in use of special education services relative to the presence of no, one, or multiple co-occurring conditions (ID, ADHD, and LD).

**Methods:** This study uses information collected from parents participating in the Simons Foundation Powering Autism Research initiative, a large database of families with verified ASD diagnoses. The current study includes the following subgroups of children: 1) ASD ( $n=6,554$ ; 74% male; age=9.13[4.32]); 2) ASD+ID ( $n=491$ ; 78% male; age=9.98[5.15]); 3) ASD+ADHD ( $n=5,642$ ; 81% male; age=11.44[3.47]); 4) ASD+LD ( $n=7,790$ ; 79% male; age=7.43[3.99]); 4) ASD+ID+ADHD ( $n=473$ ; 77% male; age=12.10[3.76]); 5) ASD+ID+LD ( $n=3,251$ ; 75% male; age=8.93[4.74]); 6) ASD+ADHD+LD ( $n=3,744$ ; 84% male; age=10.32[3.79]); and 7) ASD+ID+ADHD+LD ( $n=2,021$ ; 78% male; age=11.27[4.07]). All children received special education services for early education, Individualized Education Program (IEP) for autism or other educational reasons, 504 plan, classroom and school supports, and/or targeted skill supports.

**Results:** Chi-square tests examining differences in special education service use by group were statistically significant ( $ps<.001$ ) with small-to-moderate effect sizes (Cramer's  $V$  range=0.05-0.35). Largest effects were identified for preschool services (birth to three=0.31, preschool special education=0.35), IEP/504 services (IEP other=0.27, 504 plan=0.25), and support services (speech=0.36, physical therapy=0.21, social skills=0.20). Post-hoc analyses using standardized adjusted residuals (adj.) highlighted the observed count for the ASD only group fell under the expected count for all 18 services (adj.  $M[SD]=-10.08[7.04]$ ). Notable trends across subgroups included higher usage of IEP (other), classroom support, and targeted support services among co-occurring ID groups; higher 504 plan usage and targeted support in behavior and social skill services among co-occurring ADHD groups; and higher use of preschool and speech support services among co-occurring LD groups. Additional trends across mixed co-occurring groups will be highlighted and discussed based on post-hoc findings from examining standardized adjusted residuals.

**Conclusions:** Findings highlight variable special education services used when contrasting children with ASD with co-occurring conditions. Findings suggest knowing an ASD diagnosis provides limited information about a child's special education services, and accounting for co-occurring conditions can provide additional insights into children's expected special education service usage.

**426.127 (Poster)** The Enduring Predominance of Basic Research in ASD: No Evidence for a Relative Increase in Applied Research Published Since 1979  
*P. Doehring, ASD Roadmap, Chadds Ford, PA*

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**Background:**

**Background:** It is generally understood that basic research on the characteristics, trajectory, correlates, and possible causes of ASD will eventually translate into applied research seeking to develop assessment and intervention tools, and finally to demonstrate that these can be used effectively in community settings. We have designed a research roadmap that categorizes individual studies to track this progress. We recently reported on the application of this roadmap to articles published between 1979 and 2019 in the Journal of Autism and Developmental Disorders (JADD). We found

that basic research was consistently predominant, comprising about 2/3s of all research publications throughout this period. Despite the tremendous number of research publications, there was no evidence of a shift towards applied research involving interventions delivered in community settings.

**Objectives:** To begin to replicate the publication patterns noted in JADD to other journals over the same time period.

**Methods:** We searched PUBMED for all articles published in 1979, 1989, 1999, 2009, and 2019, with "aut\*" in the title or abstract. We scanned abstracts to select original empirical research focused on autism while excluding case studies, reviews, meta-analyses, research focused on other populations, and research published in JADD. We distinguished between Basic and Applied Research, and between three stages of the latter (Assessment, Intervention, and Other Applied Research). Applied research directly achieves - or documents the achievement of - a specific clinical, behavioral, or educational outcome through services provided to a clinical population. Because of the tremendous increase in research publications over the past two decades, we randomly sampled abstracts published in 2009 and 2019 so as to yield the same number of original research studies retrieved and reviewed in each of these two time periods, relative to the total number of original research studies reviewed for the previous three time periods.

**Results:** Over 7300 abstracts were retrieved, 94% of these from the last two time periods. Our abstract screening yielded 176 original empirical research studies across the first 3 time periods, and so we continued to screen randomly selected abstracts from 2009 and 2019 until we had retrieved 176 original research studies from each (see Figure 1). The distribution of original research across the categories of Basic and Applied research was generally consistent with the patterns noted in our earlier review focused on research published in JADD. An exception is the recent increase in Basic Research. We are now undertaking additional reviews to seek evidence for increases in applied research involving interventions delivered in community settings.

**Conclusions:** Despite an explosion of research over the past two decades, there has been no appreciable shift in the proportion of research seeking to directly improve assessment and intervention. This pattern has now been replicated across the full range of peer-reviewed research publications available in electronic databases - in fact, the emphasis on Basic Research may have increased. The relative lack of applied research, especially involving intervention, has tremendous implications for service delivery and social policy moving forward.

#### **426.128 (Poster)** The Impact of Poverty and Anti-Poverty Program Utilization Among Autistic Adults

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**Background:** Between a quarter and three-fifths of adults with disabilities live in poverty in the US, and autistic adults are likely no exception because of high unemployment and underemployment rates. For autistic adults, poverty may necessitate ongoing utilization of anti-poverty programs that are part of the US social safety net and have potential to improve quality of life (QoL).

**Objectives:** We aimed to describe anti-poverty program utilization and test whether poverty and anti-poverty program utilization were associated with QoL in a large sample of autistic adults.

**Methods:** We recruited 888 autistic adults without intellectual disability (76.9% white; 58.0% female) aged 18-83 (mean=40.47; SD=13.88) via Simons Powering Autism Research for Knowledge Research Match. Autistic adults participated in a broader online study of adult outcomes. Measures assessed: demographic factors, QoL measured via the brief version of the World Health Organization Quality of Life assessment across physical health, psychological health, social relationships, and environmental health domains, as well as an autism-specific QoL measure; binary income below or above 150% of the federal poverty guidelines (standard cut point used for eligibility); and utilization of anti-poverty programs including Medicaid, Social Security Disability Insurance (SSDI), Supplemental Security Income (SSI), and Section 8 housing vouchers. We used five multiple linear regression models to test the association between our dependent variables (QoL domains) and poverty and anti-poverty program utilization, controlling for age, sex, autism symptomatology, and race.

**Results:** Overall, 30.1% of autistic adults in our sample had a household income that was less than 150% of the federal poverty guidelines. 30.6% of our sample utilized Medicaid, 15.0% utilized SSDI, 12.3% utilized SSI, and 6.3% utilized Section 8 housing vouchers. More than half of our sample (55.4%) did not utilize any anti-poverty programs. As expected, autistic adults with income below 150% of the federal poverty guidelines utilized a greater number of anti-poverty programs than autistic adults with incomes above these guidelines. ( $t=13.84$ ,  $p<0.001$ ,  $d=1.07$ ). Having an income above 150% of the federal poverty guidelines was associated with *better* QoL in the domains of physical health ( $b=0.158$ ,  $p<0.001$ ), psychological health ( $b=0.105$ ,  $p<0.001$ ), social relationships ( $b=0.118$ ,  $p<0.01$ ), environmental health ( $b=0.228$ ,  $p<0.001$ ), and autism-specific QoL ( $b=0.204$ ,  $p<0.001$ ). Utilizing Medicaid was associated with *worse* QoL in the domains of physical health ( $b=-0.129$ ,  $p<0.01$ ), environmental health ( $b=-0.148$ ,  $p<0.01$ ), and autism-specific QoL ( $b=-0.162$ ,  $p<0.05$ ). Utilizing SSI, SSDI, and Section 8 housing were not associated with QoL.

**Conclusions:** Findings indicate that both poverty and Medicaid utilization are significantly associated with lower levels of QoL in autistic adults. Our finding that autistic adult Medicaid beneficiaries have worse QoL may reflect that Medicaid beneficiaries are a lower income, be more impacted by co-occurring conditions, and/or have higher support needs than autistic adults who do not utilize Medicaid. Thus, Medicaid beneficiaries may need additional services that can improve their QoL. However, future research is needed to disentangle causal mechanisms underlying the association between service utilization and QoL. Although findings are preliminary and correlational in nature, they suggest reducing poverty among autistic adults has the potential to improve their QoL.

#### **426.129 (Poster)** Understanding Middle Aged and Older Autistic Adults Experiences with Health and Healthcare

**Background:** Physical health problems are highly prevalent in autistic adults, particularly as they age. Although causal mechanisms are not fully understood, it is likely that autistic adults experience their health and access healthcare differently, and these differences may help explain poor health outcomes among middle aged and older autistic adults. However, no qualitative research conducted to date has explored middle aged and older autistic adults' experiences with health or healthcare.

**Objectives:** We conducted a qualitative study that aimed to understand how middle aged and older autistic adults experience health and make decisions about how and if to interface with the healthcare system.

**Methods:** We have conducted a series of one-on-one interviews (N=11) with middle aged and older autistic adults and family members or friends who help them manage their health or healthcare ("emergency contact"). Autistic adults were eligible to participate if they: (1) were age 35+; (2) have an administrative or professional diagnosis of autism spectrum disorder; and (3) were able to communicate in English. Semi-structured interviews probed experiences with health and healthcare across four domains: (1) health habits; (2) health problems; (3) health services; and (4) autism and aging impact. Data were transcribed and analyzed using conventional content analysis. Transcripts were analyzed consecutively, and emerging themes were continually tested against data.

**Results:** Middle aged and older autistic adults and their emergency contacts conceptualized health as the absence of pain, illness, and injury, as well as a lack of sensory changes in their bodies. Autistic adults report utilizing preventive care regularly but struggle with making decisions about when to see a physician for acute pain, illness, or injury because of sensory differences in how they experience health problems and challenges with executive functioning that make seeking preventive care more difficult. A theme that has emerged is that of "independence." Autistic adults strive to be independent in accessing and utilizing health services because independence is one of the primary goals emphasized by autism services. Yet, emergency contacts highlighted the importance for all adults—including autistic adults—of receiving support from loved ones while managing health and healthcare. One emergency contact noted that autistic adults need to know that "if they need certain types of supports, it's a sign of strength to ask for those supports." Participants identified systemic barriers to independence in healthcare, including transportation, physician turnover, and physicians' lack of understanding of autistic adults' communication differences.

**Conclusions:** Results suggest that middle aged and older autistic adults experience sensory differences that impact their experience of health and have difficulty with accessing healthcare for acute health problems because of challenges with executive function. Further, accessing healthcare is an area in which autistic adults want to be fully independent, yet full independence in accessing healthcare is not feasible for most adults, including autistic adults. Social workers working with autistic adults should encourage them identify ways to partner with loved ones to access healthcare while maintaining autonomy in their choices about their bodies and health.

#### **426.130 (Poster)** The Implementation of the Screening Tool for Autism in Toddlers in Part C Early Intervention Systems

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**Background:** Although parents often report developmental concerns about their child by 18 months of age, most children are not diagnosed with ASD or enrolled in ASD-specific services until much later (Baio et al., 2018). To address this problem, the American Academy of Pediatrics published a recommendation for universal screening, which has led to increases in screening in pediatric settings over the last several decades (Murray & Barton, 2021). However, pediatricians may not know where to refer children for ASD-specific assessment if they receive a positive screen or may consider the availability of services before making referrals. Given that children who are identified as having developmental concerns are often referred to receive services in Part C Early Intervention (EI), it is a reasonable setting to perform further ASD screening (Monteiro et al., 2016).

**Objectives:** The current study examines the implementation of the Screening Tool for Autism in Toddlers (STAT), a Level 2 screening measure used to identify children thought to be at risk for ASD, by community EI providers serving toddlers from birth to 3 years. Specifically, we examined the: (a) effectiveness of a 1-day STAT training workshop for increasing EI providers' self-efficacy in ASD screening; (b) key implementation factors related to providers' use of the STAT (i.e., adoption, feasibility, and perceived effectiveness); and (c) barriers and facilitators to STAT implementation.

**Methods:** Participants comprised 69 EI providers (M Age = 43.3 years, 93.7% Female, 92.4% White) who were trained to administer the STAT in their agencies with children for whom they had ASD concerns. An interrupted time-series design was used to examine STAT use, with the STAT training workshops representing the "interruption." Providers answered questions about ASD screening self-efficacy at two baseline timepoints (T1 and T2) and two post-training timepoints (T3, 6 months post-STAT training and T4, 18 months post-STAT training). They reported on their adoption of the STAT and their feasibility and effectiveness of the screener at T3 and T4. At both post-training time points, providers completed open-ended responses regarding barriers and facilitators to STAT use in their practice.

**Results:** Hierarchical linear modeling was used to determine changes in self-efficacy. There was no difference in provider screening self-efficacy levels between the two baseline timepoints. Self-efficacy levels significantly increased from baseline to post-training and providers who reported adopting the STAT had greater increases in self-efficacy post-training than those who did not. Although only half of trained providers reported utilizing the STAT in their everyday practice, those who did adopt it reported it to be feasible and effective. Qualitative analysis of barriers and facilitators to STAT implementation revealed 6 categories of facilitators (i.e., user-friendly, promotes communication with families) and 8 categories of barriers (i.e., certification process, fitting into existing workflow).

**Conclusions:** Results highlight the potential for use of the STAT in EI settings to increase children's access to early evaluation services and, subsequently, to ASD-specific early intervention services. Future research should aim to promote long-term sustainability of screening practices in settings in which children at-risk for social communication concerns are seen frequently.

**426.131 (Poster)** The Role of the COVID-19 Pandemic in Predicting Lack of Needed Health Services for Children with and without ASD  
*S. Brunt and M. O. Mazurek, University of Virginia, Charlottesville, VA*

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Background:

During the spring of 2020, as the COVID-19 pandemic caused the widespread closure of schools and places of business in the U.S, many healthcare services, including medical, dental, mental, and behavioral health services were restricted or suspended to mitigate the spread of COVID-19. Children with ASD often have unmet healthcare needs as well as barriers to ASD-specific services. Additionally, the negative consequences of the pandemic, such as disruptions in daily routines, increased parental stress, and loss of access to regular specialty services can have a particularly detrimental effect on children with ASD and their families.

Objectives:

The aim of the current study is to examine whether access to and utilization of needed health-related services differ pre- and post-pandemic for children with and without ASD.

Methods:

Data were obtained from the National Survey of Children's Health (NSCH), a parent questionnaire that examines the mental and physical health of children across the U.S. The sample consisted of 37,427 male (51.83%) and 34,783 female (48.17%) children aged 0-17 years. Pre-pandemic respondents (surveyed in 2019) comprised 40.8% of the sample, while 59.2% responded during the pandemic (surveyed between July 2020 and January 2021).

Relevant variables were selected from the questionnaire for use on this project. Current ASD diagnosis and year responding (pandemic vs. non-pandemic year) served as binary predictor variables. Covariates included child age, sex, race, highest level of education completed among parents, and how often the family found it hard to cover basic living expenses, which served as a proxy for income. Multiple logistic regressions were conducted, which included demographic covariates, ASD diagnosis, year, and the interaction between ASD diagnosis and year as predictors of the binary outcome of whether the child was not receiving needed health services (including medical, dental, and mental). Odds ratios are reported in lieu of coefficients for ease of interpretation.

Results:

Children who were older ( $OR=1.04, p<.001$ ), nonwhite ( $OR=1.16, p=.001$ ), and from lower-income families ( $OR=4.49, p<.001$ ) were significantly more likely to lack needed services. Controlling for covariates, children with ASD were over three times as likely to lack necessary services as children without ASD ( $OR=3.24, p<.001$ ), and all children were 1.4 times more likely to lack services during 2020 than 2019 ( $OR=1.39, p<.001$ ). The interaction between ASD diagnosis and year was not significant,  $OR=1.09, p=.58$ .

Conclusions:

Results suggest that, regardless of pandemic interference, children from more marginalized backgrounds (e.g., nonwhite, low-income), are more likely to lack necessary health services. Additionally, the pandemic significantly disrupted services for everyone, regardless of diagnosis or demographic characteristics. Children with ASD were more likely to lack services regardless of pandemic interference. Overall, results point to persisting disparities in access to health-related services as well as a significant disruption in services during the COVID-19 pandemic. Although children with ASD did not experience a disproportionate lack of healthcare services during 2020 compared to children without ASD, more research is needed to determine whether the quality of such services was differentially affected by the pandemic, particularly since many ASD-related services transitioned to virtual or telehealth.

**426.132 (Poster)** The Use of Psychological and Organizational Theories to Predict Implementation of Evidence-Based Practices in School Settings  
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Background: The increased prevalence of ASD has impacted public schools, the primary setting where autistic children receive services. Schools are required to provide education in the least restrictive environment; thus, many autistic children are included in general education. There are several evidence-based practices (EBPs) that can be used to purposefully include autistic children. It is unclear which EBPs, if any, general and special education teachers and paraeducators are commonly trained in or whether they use those EBPs to support inclusion. We draw on the Theory of Planned Behavior to examine individual characteristics (attitudes, norms, self-efficacy, intentions) and apply the Exploration, Preparation, Implementation, and Sustainment (EPIS) framework to examine organizational characteristics (implementation climate and leadership) associated with EBP use.

**Objectives:** The purpose of this study is to identify which EBPs educators use to meaningfully include autistic children in general education settings and individual and organizational characteristics that increase EBP use. In this presentation, we will discuss our conceptual model that combines psychological theories of behavior change and organizational theory to guide our study design and each study phase; however, results will only be presented on Study 1 given Studies 2 and 3 are currently underway.

**Methods:** In Study 1, we gathered quantitative and qualitative data to explore which EBPs educators have been trained to and consistently use to support autistic children. We asked participants (n=86 from 73 schools in 40 districts) to complete a modified Autism Treatment Survey about their EBP use (n=21 EBPs) and training and invited participants to a semi-structured interview (n=81) to expand upon their survey responses. Nine themes were developed, and three raters applied the codebook to all transcripts (95% reliability). In Study 2, we will quantitatively measure individual characteristics of educators as well as organizational factors of the school, and in Study 3, we will qualitatively examine mechanisms through which individual and organizational factors facilitate or hinder EBP use in a subset of participants.

**Results:** We collected quantitative data from 27 general education teachers, 31 special education teachers, and 28 paraeducators who support at least one autistic student in a general education setting. Across roles, the most used EBPs to support inclusion were reinforcement (98.8%), modeling (96.4%), visual supports (92.5%), and antecedent-based intervention (86.8%). Video modeling (31.6%), technology-aided instruction and intervention (38.5%), peer-based instruction and intervention (52.4%), and time delay (56.4%) were the least used. Across roles, "District/ESD in-service or workshops" were the most endorsed training type across roles (52.3%) followed by "Teacher Preparation or Educator Certification Program" (51.2%). The least endorsed training types were "Webinars" (15.1%) and "Conferences" (16.3%). Qualitative data highlighted discrepancies between EBP definitions and applied use.

**Conclusions:** The four most frequently used EBPs to include autistic children in general education settings are: reinforcement, modeling, visual supports, and antecedent-based interventions. Implementation theory that describes how multi-level factors simultaneously influence EBP use has yet to be articulated and thoroughly tested.

#### **426.133 (Poster) Trends in English Proficiency Among Autistic English Learners**

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**Background:** There is an ever-increasing rate of immigrant origin children in the United States where at least one parent speaks a language other than English. This has directly resulted in an increased number of English Learners (EL) being served in both general education and special education, including children with autism spectrum disorder (ASD). California statewide reports show that on average, 88% of EL students become reclassified as English proficient by 8th grade but little to none is known about the time to reclassification for students who are both EL and autistic.

**Objectives:** The present study aimed to examine differences in the development of English proficiency among students classified under ASD by (1) identifying changes in English language proficiency, (2) examining the probability of continued EL classification, and (3) identifying student level predictors associated with becoming English language proficient (ELP).

**Methods:** The current study utilized longitudinal special education data collected by the administration of a large urban school district in the US. Students served under a primary eligibility of autism were included for the academic school years from 2011-2012 through 2018-2019. The percentage of students who transitioned from EL to ELP was computed for all students regardless of educational placement. For students who transitioned to English proficient, mean age of classification change was computed along with highest probability transition age. Survival analysis was performed utilizing Kaplan Meier curves and were generated to determine the probability of students remaining classified as EL across time (measured by student age). Finally, a linear regression was conducted to investigate if any student level predictors were correlated with becoming ELP.

**Results:** Of the students with ASD 7532 (77.7% male, 87.3% Hispanic/Latinx,  $M_{age}=5.73$ ,  $M_{observations}=6$ ) were classified as EL sometime between 2011-2019 in grades TK/Kinder-5th. 38.4% classified as EL transitioned to ELP at some point between 2011-2019. The mean age at which students transitioned to ELP was approximately 12.2 (SD= 2.47) years old. Kaplan Meier curves (Figures 1a) revealed that the probability of classification as EL decreased as students aged and had a continuous negative trend. The highest probability age for becoming ELP was 10.8. The student level predictor that was significantly associated with becoming ELP was the classroom placement the year prior to the reclassification of ELP, indicating that students in special day classes became ELP at older ages.

**Conclusions:** The present study revealed the striking number of autistic students classified as EL who are served in a large Southern California urban school district. A minority of ELs with ASD gain English proficiency by middle childhood. Future work is required to identify methods to best support ELs with ASD in schools.

#### **426.134 (Poster) Understanding Differences in Involvement with Community-Based ASD Care Systems between Non-Hispanic and Hispanic Children from Linguistically Diverse Families within a Family Navigation Model**

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**Background:** Many barriers to diagnostic care exist, especially for children from ethnically and linguistically diverse backgrounds. We created a Family Navigation Network that provides resources to underserved families who have a child with diagnosed or suspected autism spectrum disorder

(ASD). Mindful of care disparities, we focused on reaching Spanish speaking families and tracking their care experiences. We previously found that limited English proficient families received less services than the English speaking families at time of referral. In this work, we further explore these differences in an updated sample by looking at our model through the lens of ethnicity, with a focus on the Hispanic population.

**Objectives:** To identify existing differences in baseline engagement with community-based care systems for families who have a child with diagnosed or suspected ASD, with a specific emphasis on differences for Hispanic families (see Table 2).

**Methods:** Families were referred for Navigation related to diagnosed or suspected ASD. At first point of contact, Navigators logged information into a REDCap database about existing family engagement with 5 community care systems representing best practice for children with developmental risk in our region (see Table 1). Families then received information about community resources, with Spanish speaking families contacted by a bilingual Spanish speaking Navigator. Out of 1054 participating families, 877 identified as non-Hispanic and 177 identified as Hispanic. Of the Hispanic families, 80 identified as English Speaking (ESH) and 97 identified as Spanish Speaking (SSH).

**Results:** As in previous work, Hispanic families were almost twice as likely as non-Hispanic families to not be receiving services at baseline (42.9% vs. 23.1%, respectively). This difference was more subtle across the SSH (45.4%) and ESH (40%) groups. At baseline, ESH families generally received more services than SSH families, with the exception of Part B (school-based services): More Hispanic families received Part B services than non-Hispanic families (see Table 1) and similarly, more SSH families received these services than ESH families (see Table 2). When looking at Part C early intervention services, 71.5% of the non-Hispanic group received services compared to only 47.4% of the Hispanic group. Mean age at point of navigation referral for Hispanic versus non-Hispanic groups was 38.1 and 35.9 months, respectively, and while ESH families were referred at 33.9 months, SSH families were referred almost 7 months later at 41.6 months.

**Conclusions:** We note with concern that the SSH group was referred for navigation at older ages than the ESH group. Similarly, Hispanic families continue to have greater lack of baseline care engagement relative to non-Hispanic families, regardless of primary language spoken. This identifies a need to understand the complex variables across ethnically, racially, and linguistically diverse families that influence service engagement at point of referral. To broaden equal access to care and resources, future research should continue to expand on family navigation and screening tool models inclusive of diverse parenting experiences.

**426.135 (Poster)** The Impacts of the COVID-19 Pandemic on Therapy Utilization Among Racially/Ethnically and Socio-Economically Diverse Children with Autism Spectrum Disorder

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**Background:**

The COVID-19 pandemic and associated restrictions to in-person gathering have raised concerns about disruption to therapeutic services for children with autism spectrum disorder (ASD). Early research on the impacts of the COVID-19 pandemic on children with ASD provides preliminary evidence of ASD related service disruption and worsening behavioral and affective outcomes (Jeste, 2020; Collizzi et al, 2020). Pre-pandemic literature has demonstrated racial and socioeconomic disparities in access to and utilization of ASD related services (Smith, 2020), however little or no research has evaluated these disparities in the context of the COVID-19 pandemic.

**Objectives:**

The current study aims to evaluate disruption to the ASD behavioral health delivery system by describing change in hours of ABA therapy before and through the COVID-19 pandemic and by evaluating if there is differential disruption based on the race/ethnicity and socio-economic status of the child. Additionally, the current study utilizes an extended structure-process-outcome model to interpret the implications of the findings for the quality of the ABA treatment delivery system as a whole and in the context of patient variability and environmental stress.

**Methods:**

Retrospective clinical data on children's demographics and therapy utilization were collected from five ABA clinics throughout California (N=203; 23.6% Asian, 6.4% Black, 21.2% Latinx ethnicity (of any race), 33.5% White, 1% other race/ethnicity, 14.3% not reported). A three-way mixed ANOVA was used in order to evaluate the main effect of time period (Sep-Nov 2019, pre pandemic; Mar-May 2020, early pandemic; Sep-Nov 2020, mid pandemic) on hours of ABA therapy received by children with ASD as well as the moderating effects of child's race and child's primary funding source (private insurance, public insurance, school district).

**Results:**

We found that there was a significant effect of time period on hours of ABA therapy (partial  $\eta^2 = .205$ ) so that there was a reduction in hours between pre COVID-19 and the beginning of COVID-19, with no significant changes in hours of ABA therapy between the beginning of COVID-19 and 6-9 months into the pandemic. Analysis of moderators revealed no significant effect of race or race x payer on the relationship between time period and hours of ABA therapy. There was a significant moderating effect of primary payer on the degree to which time predicted hours of ABA therapy (partial  $\eta^2 = .255$ ) so that children who receive primary funding from school districts experienced a more severe drop in ABA therapy hours during the pandemic compared to children whose treatment is funded by other sources.

## Conclusions:

Findings indicate that ABA services were disrupted at the beginning of the pandemic and did not significantly recover after 6-9 months. A delay of this magnitude carries implications for the long term effects of service disruption, given literature on the negative impacts of delayed start to treatment among children with ASD (Tarbox et al, 2013). These findings also carry implications for how the autism treatment delivery system reacts to world events and how it can be strengthened in anticipation of future crises.

**426.136 (Poster)** Aligning Ecosystems: How Multi-System Brokerage Shapes Autism Interventions for Children on the Autism Spectrum  
**E. McGhee Hassrick<sup>1</sup>, J. Suhrheinrich<sup>2</sup>, P. Schetter<sup>3</sup>, C. Nguyen<sup>4</sup>, M. Melgarejo<sup>2</sup>, Y. Yu<sup>5</sup>, T. Holt<sup>6</sup>, J. Li<sup>6</sup>, J. Ventimiglia<sup>7</sup>, A. Nahmias<sup>8</sup> and A. C. Stahmer<sup>6</sup>, (1)A.J. Drexel Autism Institute, Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (2)San Diego State University, San Diego, CA, (3)UC Davis, Sacramento, CA, (4)AJ Drexel Autism Institute, Philadelphia, PA, (5)Indiana University - Purdue University Indianapolis, Indianapolis, IN, (6)UC Davis MIND Institute, University of California, Davis, Sacramento, CA, (7)AJ Drexel Autism Institute, Drexel University, Philadelphia, PA, (8)Stony Brook University School of Medicine, Stony Brook, NY**

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## Background:

Educational interventions for autistic children are impacted by people situated at different levels of the child's ecosystem. However, coordination of evidence-based interventions (EBIs) across the ecosystem, recommended by decades of research and policy, remains challenging. Professional development (PD) providers play a potentially unique role in the ecosystem supporting the implementation of EBIs for autistic children. Ecological systems theory considers a child's social context as a key mechanism for development and learning across life stages (Bronfenbrenner, 1994; Vygotsky, 1980) and levels of engagement, including the microsystem, mesosystem, exosystem and macrosystem (McGhee Hassrick, 2021; McGhee Hassrick, 2019; Gulsrud, 2021; Shattuck, 2020). This study uses an ecosystem theoretical framework to identify and measure network mechanisms of PD providers participating in a state-wide implementation improvement intervention (CAPTAIN) that impact ecosystem coordination of EBI for autistic children in educational settings

## Objectives:

To investigate the qualitative and quantitative aspects of ecosystem interaction for professional development (PD) providers as they engage in capacity building work, coaching, and training of educational providers of children on the autism spectrum. PD providers self-reported performance as coaches. A performance score was calculated for each PD provider to incorporate both how well they fulfilled their coaching and training requirements as well as how often they used quality training and coaching practices.

## Methods:

High and low performing PD providers were recruited from county-level organizations. PD providers completed a social network survey about their professional support networks and also participated in qualitative, semi-structured interviews about their support networks. Qualitative themes were identified, using a multi-stage coding process in NVIVO. Network data, analysis using R-programming, characterized structural aspects of PD provider ecosystem connections

## Results:

**Qualitative findings** suggested PD providers participated in building and sustaining a *goal-aligned, relational ecosystem*, with a proactive commitment to coordinating the implementation of EBIs across systems. PD providers sought out school, district and county level leaders to secure resources for educators implementing EBIs in their classrooms to build the capacity for change and improvement across the system (Figure 1.1). PD provider reported their own interactions with the child and the child's team of providers and also to exosystem actors provided broader access to resources and support for the child's microsystem team (Figure 1.2). **Social network** results revealed difference between high and low performing PD providers in average network size (HP:15.9/LP:21.4). On average, high performing PD providers reported more connections with microsystem people (HP:13.4/LP:10.4) and exosystem people (HP:9.3/LP:5.9); more ties among microsystem people (HP:27.1/LP:22.5), among exosystem people (HP:27.2/LP:13.3) and between micro/exosystem people (HP:49.3/LP:29.9).

## Conclusions:

Recent research suggests that educational institutional settings are "ghost systems" (Fixen et al 2012) with siloed, disconnected processes at the district, county and state level that interfere with the successful implementation of EBPs for autistic students. Findings from this study suggest that PD providers who work toward building and sustaining a *goal-aligned, relational ecosystem* provide higher quality coaching and support for educators implementing EBPs for autistic students, suggesting network interventions training PD providers how to forge aligned ecosystems.

**426.137 (Poster)** United: Using Collaborative Teaming Strategies and Social Network Theories to Sustain the Implementation of Evidenced-Based Intervention for Children on the Autism Spectrum  
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#### Background:

Although evidence-informed autism-specific interventions have increased, most evidence-based interventions (EBIs) are implemented inconsistently or are not widely available to families from historically excluded groups. Those providing community-based intervention (e.g., teachers, agency staff) may feel unsupported in using models that require extensive training and resources. Social network theories prioritize social connections for communication, influence, and behavior changes. Organizational theory suggests that successful implementation is supported by systematic, planned internal “conditions,” including clearly-defined roles, collaborative teams, and transparent expectations. To support creation of critical organizational “conditions,” we integrated social network implementation theories and organizational teaming to develop an intervention to facilitate implementation/ sustainment of EBIs in low-resourced settings: UNITED (Using Novel Implementation Tools for Evidence-based intervention Delivery).

#### Objectives:

Describe how social network and teaming theoretical mechanisms informed UNITED, and how UNITED is designed to impact sustainment of EBI implementation for children with autism spectrum disorder (ASD) from historically excluded communities.

#### Methods:

UNITED integrates two strategies derived from social network and organizational theory: 1) social network analysis (SNA) and 2) collaborative teaming.

1. SNA promotes comprehensive team selection by asking staff at different levels of the organizational hierarchy to identify people with the best expertise, rather than relying solely on formal positional leaders for team selection, potentially overlooking people with key expertise. Potential implementers at a given site rank staff regarding who can best support them in using the intervention effectively. This method of building and supporting a team is one of four key types of SNA interventions. During sustainment, we will use SNA to promote UNITED team strengths and potential gaps by calculating team cohesion, collaboration intensity, and team reach.
2. Collaborative teaming is supported through the strategies such as identifying team structure and roles, development of communication norms and conflict resolution strategies, and development of a clear and operationalized implementation plan. Consultants from the research group assist teams in these collaborative processes.

UNITED is tested via RCT, implemented across three EBIs in community settings. Sites are randomized to UNITED or implementation as usual (IAU; stratified across the three interventions). In accordance with social network and organizational theory, we hypothesize that compared to IAU, sites in UNITED will demonstrate higher team cohesion, greater fidelity to each intervention (our primary outcome), higher sustained implementation, and better child/family outcomes.

#### Results:

We successfully developed the UNITED intervention, including four core modules and supplemental models. For the RCT, we are enrolling community providers in schools and agencies (current n = 75 participants across 18 sites). Data will be presented across the first year of implementation for 1) recruitment and retention; 2) UNITED intervention fidelity; 3) social network size and site implementation climate; and 4) qualitative experiences in UNITED.

#### Conclusions:

Theoretical frameworks provide viable strategies to inform the development of new interventions, such as UNITED, focused on improving implementation outcomes. Evaluating implementation-focused interventions in large-scale trials, in real-world settings, can yield much-needed data to support the use of such interventions to improve equitable delivery of EBI.

**426.138 (Poster)** Using Quality Improvement Science to Standardize ADHD Care in a Pediatric ASD Population in the Autism Care Network  
**D. S. Murray**<sup>1,2</sup>, **J. S. Anixt**<sup>3</sup>, **K. L. Ratliff-Schaub**<sup>4</sup>, **S. Wootton**<sup>5</sup>, **C. Lannon**<sup>6</sup>, **K. Kuhlthau**<sup>7</sup> and **D. Coury**<sup>8</sup>, (1)Science, Autism Speaks, Boston, MA, (2)Developmental & Behavioral Pediatrics/University of Cincinnati, Department of Pediatrics, School of Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (3)Division of Developmental & Behavioral Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (4)Developmental-Behavioral Pediatrics, Prisma Health, Greenville, SC, (5)Anderson Center for Health Systems Excellence, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (6)Anderson Center for Health Systems Excellence/Department of Pediatrics UC Medical School, Cincinnati Children's Hospital/University of Cincinnati, Cincinnati, OH, (7)Massachusetts General Hospital, Boston, MA, (8)Developmental-Behavioral Pediatrics, Nationwide Children's Hospital, Columbus, OH

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#### Background:



More than half of children with autism spectrum disorder (ASD) are diagnosed with co-occurring Attention Deficit / Hyperactivity Disorder (ADHD). Although there are published ADHD diagnostic and treatment clinical practice guidelines, the complexity of ADHD management in the setting of ASD is not fully addressed with existing guidelines. The Autism Care Network (ACNet), a learning health network for ASD, is focused on reducing parent-reported challenging behavior, prioritizing three of the most common co-occurring conditions: ADHD, Anxiety, and Irritability. QI methodology was used to improve reliable implementation of an ADHD clinical pathway across multiple centers, with a goal of improving clinical care and accelerating the implementation of best practices.

#### Objectives:

To achieve reliable implementation of a consensus based best-practice clinical pathway for ADHD in children with ASD to improve: a) the identification of ADHD, b) the standardization of care across network centers c) the ability to evaluate impact of pathway implementation on outcomes.

#### Methods:

Network leaders with expertise in ADHD and ASD developed a consensus based best-practice clinical pathway for the identification and treatment of ADHD in children with ASD based on an extensive literature review and previous network research. An improvement lab of six pilot ACNet sites was developed to establish reliable implementation of the ADHD clinical pathway in those centers. A bundle of six markers of reliable pathway implementation at clinical visits were identified, including: use of standardized assessment tools to measure ADHD symptoms (to confirm a new diagnosis and to monitor treatment every six months), assessment of safety concerns, discussion of behavior therapy, discussion or prescription of medication, and, if prescribed medication, assessment of vital signs and side effects. QI methodology including tests of change (PDSA cycles) and data tracking with run charts were used to improve reliability of the bundle care practices. Reliability was calculated on 4 levels <80% chaos, 80%-89% level 1 reliability, >90% level 2 reliability, >99% level 3 reliability (cite). Bi-monthly interval sampling was conducted for eight cycles (N=63-110 encounters/ per cycle). QI support and data sharing were provided at lab meetings with opportunities for sites to share learnings about successful strategies to improve reliability.

Results: At baseline, 0/6 of the ADHD pathway markers were at or above level 1 reliably. Sampling results indicated that 3 markers (discussion or prescription of medication, vital signs, side effects) reached level 1 or level 2 reliability (80-89% or 90-98% reliable, respectively) in cycle #2 and maintained reliability through cycle #8. Clinical improvements were seen in all 6 markers, although 3 markers have not yet achieved level 1 reliability. At the completion of cycle #8, 2 additional markers are approaching level 1 reliability: assessment of safety concerns and discussion of behavior therapy (78-79%). Use of a standardized rating scale for ADHD symptoms is a focus area for current testing (currently achieved at 40% of encounters).

#### Conclusions:

The use of QI methodology and network sharing has supported six ACNet sites to improve reliability of care practices for the diagnosis and treatment of ADHD in the setting of ASD.

#### **426.139 (Poster)** What I Wish You Knew: Insights on Burnout, Inertia, Meltdown, and Shutdown from Autistic Youth

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Background: Burnout, inertia, meltdown and shutdown (BIMS) have been identified as important parts of daily life for at least some autistic people. This study builds on our earlier work that offered initial academic descriptions of these phenomena, informed by the perspectives of autistic adults.

Objectives: This study aimed to leverage the insights and experiential knowledge of eight autistic children and youth to extend and refine our earlier descriptions of burnout, inertia, and meltdown, with additional study of shutdown. We also aimed to examine how these youth cope with these phenomena and what others around them do that make things better or worse. We did this to glean experiential knowledge for the design of better supports.

Methods: Each participant complete two one-to-one interviews. Collected demographic data indicates that these youth were from families of middle to high socioeconomic status and of Caucasian or European descent. Their ages ranged from eight to eighteen. Five identified as male and three identified as female. The interviews explored their experience with BIMS. To match data generation methods with individual communication strengths of the children and youth, we took a flexible approach to interviews, allowing for augmentative communication systems and use of visual images to support verbal interviews, as needed. We conducted a reflexive, inductive thematic analysis, using an iterative process of coding, collating, reviewing, and mapping themes.

Results: Our analysis indicates that these youth describe BIMS as a complex and multi-faceted experience involving cognitive, emotional, and physical components, which do not entirely fit into any singular clinical model, such as arousal regulation. These multifaceted experiences are often misunderstood, and the associated observable behaviours are often misinterpreted by neurotypical adults. This lack of understanding contributes to inadequate support in managing BIMS in the youths' home and school environments. Of the four BIMS phenomena, these youth identified meltdowns as most common. Additionally, the youth were best able to describe experiences of meltdown and discuss the strategies they find helpful. A limitation to consider is that the descriptions generated are reflective of a sample with limited demographic diversity.

**Conclusions:** By exploring the firsthand experiences of these youths, we have generated new insights into BIMS and developed a more holistic understanding of these phenomena. These youths' descriptions of supportive strategies for BIMS highlight the importance of compassion and collaboration from trusted adults. This new knowledge offers foundational insights for how to better support autistic children and youth in their home and school environments. Further research is required to develop an understanding of BIMS, with particular focus on how it is experienced by children and youth. Future research should leverage the experiential knowledge and insights of autistic children and youth to co-design a support tool(s) for BIMS.

**426.140 (Poster)** When Elementary Students with Autism and Intellectual Disability Are Removed from the General Education Curriculum  
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**Background:** The majority of public school students are provided instruction from the general education (GE) curriculum, aligned with the state's academic standards. However, students who are significantly impacted by intellectual and developmental disabilities may require an alternate curriculum (AC) to address their unique learning goals. Timing of student transition from the GE curriculum to AC is highly variable and may occur as early as preschool. Early placement on AC, however, may adversely impact a student, including reduced access to grade level learning opportunities and engagement with their peers in GE.

**Objectives:** The present study aimed to examine the patterns of AC participation for elementary students receiving special education services under primary Autism Spectrum Disorder (ASD) or Intellectual Disability (ID) eligibility by (1) identifying the number of students on AC compared to GE, (2) examining the patterns of curriculum switching for students between grades preschool-5, and (3) identifying sociodemographic predictors of AC in elementary school (ES) and the moderating influence of eligibility group.

**Methods:** The current study utilized annual longitudinal special education administrative record data from a large urban school district and included students in grades preschool-5 served under a primary eligibility of ASD or ID from the academic years 2011-2012 through 2018-2019. The number of students with at least one observation of AC during ES was tabulated. Patterns of switching from GE curriculum to AC during ES was also tabulated for students in both eligibility groups. To determine sociodemographic predictors (i.e., eligibility group, English language learner status, free or reduced lunch status, ethnicity, gender) of AC during ES, logistic regression was used, where all sociodemographic variables and the interaction between sociodemographic variables and disability were included as predictors in the model.

**Results:** Results revealed 29,410 unique students served under ASD or ID eligibility in ES. Of those students, N=20,406 (69.4%) remained on GE curriculum, N=1,163 (3.9%) transitioned to AC in TK/K, N=1,627 (5.5%) transitioned in 1st grade, N=652 in 2nd grade (2.2%), N=542 in 3rd grade (1.8%), N=283 in 4th grade (.96%), and N=236 in 5th grade (.8%). Eligibility and ethnicity emerged as significant predictors of AC in ES, where the odds of being placed on AC in ES are significantly higher for students served under ID than for students served under ASD. African American and Hispanic students served under ID are significantly more likely than White students served under ASD to be placed on AC in ES.

**Conclusions:** Results reveal the majority of students served under ASD or ID remained on GE throughout elementary. Of those who switched to AC, the majority were likely to do so in TK/K or 1st grade. Eligibility and ethnicity impact placement on AC in ES, but free or reduced lunch, gender, and English learner status showed no impact on AC participation. The study indicates that access to GE curriculum and grade level content is limited for certain populations beginning early in their schooling.

**426.141 (Poster)** Readiness for Change: Implementing Mental Health Interventions for Autistic Youth in Virginia Community Service Boards  
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**Background:** Autistic youth have elevated service needs due to the chronicity and severity of core ASD symptoms and co-occurring psychological challenges. While mental health evidence-based interventions (MH-EBIs) for autistic youth have been identified, barriers to implementing MH-EBIs in community service agencies exist. Organizational factors (e.g., readiness to change) may interfere with implementation success. Providers may lack proficiency to treat the unique needs of autistic youth, lack specialized training, or perceive autistic youth as particularly challenging to treat. In Virginia, community service board (CSB) organizations provide publicly-funded mental health, developmental, and substance use disorder services for citizens in their communities and are funded and regulated by the Virginia Department of Behavioral Health and Developmental Services. There are 40 CSBs across the five Virginia regions that service all 133 city/county localities.

**Objectives:** We surveyed Virginia CSBs to obtain descriptive data to inform (1) current needs for and (2) barriers to implementing MH-EBI for autistic youth at the organizational- and provider-level.

**Methods:** Twenty-three of the 40 CSB agency leaders responded to recruitment emails and completed REDCap surveys from February-May 2021. They reported their CSB's number of total clients (0-21yrs) and autistic clients (0-21yrs), and the number of providers delivering ASD services (Table 1). Participants reported their CSB's readiness for organizational change using a 4-point (1-5) Likert scale where greater scores reflected greater readiness to implement evidence-based practices (Organizational Readiness to Change Assessment [ORCA] Context Scale; Table 1). The readiness for change subscale of the ORCA Context Scale reflects the extent to which CSB opinion leaders: believe that the current intervention strategies can be improved, encourage and support changes in intervention strategies to improve client care, are willing to try new intervention strategies, and work cooperatively with senior leadership/clinical management to make appropriate changes.

**Results:** Multiple linear regression indicated that number of total clients ( $\beta=0.44, p=.011$ ) and number of autistic clients ( $\beta=-0.23, p=.013$ ) predicted approximately 31% of the variance in a CSB's readiness for change,  $F(2,19)=4.18, p=.031, R^2=.31$ . In hierarchical regression analyses, adding the

number of contracted ASD service providers to the model did not explain significant additional variance in readiness for change,  $\Delta R^2=0.01$ ,  $p=.611$ ; adding the number of ASD service providers within the CSB to the model, instead, also did not explain additional variance,  $\Delta R^2=0.002$ ,  $p=.831$ .

**Conclusions:** Results indicated that CSBs with a greater number of clients overall but with fewer autistic clients were more likely to endorse greater readiness for change and that the number of contracted providers or providers within their CSB that deliver ASD services did not affect readiness to change after accounting for the number of clients. This differing pattern between number of total clients and autistic clients on an organization's readiness to change indicates that there may be elements specific to ASD services (e.g., requirement of specialized training) that impact readiness to implement new MH-EBI for autistic clients. This provides evidence for the need to address organizational factors, such as readiness, to increase MH-EBI implementation in an effort to increase access to quality care for autistic clients.

**426.142 (Poster)** A Mixed-Method Evaluation of the Satisfaction and Acceptability of a Group-Based Parent Coaching Intervention Via Telehealth Based on the Early Start Denver Model

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**Background:**

The Early Start Denver Model (ESDM) is considered as an Evidence-based Practice (EBPs) designed for young children with Autism Spectrum Disorder (ASD) aged 1-5, using both developmental and relationship-building frameworks to promote overall development and autism-related outcomes (Rogers & Dawson, 2010). Research demonstrated the efficacy and effectiveness of ESDM both in university and in community settings (Vivanti et al., 2014, Vismara et al., 2009). However, evidence showing the positive outcomes of early intervention studies for children with ASD mainly conducted in university-based efficacy studies in high-income countries, research in low- and middle-income countries is severely limited due to lack of resources and trained professionals (Liao et al., 2021). Additional challenges exist in language and culture when implementing EBPs in the non-English-speaking countries. It is crucial to first examine the satisfaction and acceptability of parents when delivering an EBP in a non-English-speaking country with different language and culture, therefore providing a deeper understanding of the experience or needs of these families and informing future development, adoption and implementation of EBPs in an under-resourced population.

**Objectives:**

This study used a mixed method design to evaluate the experience of parents from China after receiving a 12 weeks group-based parent coaching intervention via Telehealth based on the Early Start Denver Model.

**Methods:**

This mixed method study used the post intervention data from a randomized controlled feasibility trial for a group-based parent coaching intervention in China via Telehealth. The quantitative data collected from satisfaction survey provided descriptive statistics to allow comparisons between intervention arms. The qualitative data collected from focus groups offered a detailed perception from parents with feedback and suggestions based on their 12-week experience of the intervention.

**Results:**

A total of 32 parents in the intervention completed the satisfaction survey and 24 out of them participated the focus group at the post intervention assessment. Parents across intervention groups rated the program favorably with average scores falling on the positive end of the scale in terms of satisfaction(4.6±.5), recommendation(4.6±.5), acceptability(4.4±.5), appropriateness(4.2±.5), feasibility(4.4±.5), and difficulty levels of the program(3.0±.8), etc. Qualitative themes confirmed and expanded the survey scores by adding rich detailed information about the program content and Telehealth delivery.

**Conclusions:**

Findings of this study showed parents in China had an overall positive perceptions about their experience of the group-based parent coaching intervention via Telehealth. The integration of both quantitative and qualitative results provided a nuanced understanding of the satisfaction and acceptability from parents of children with ASD in China. It may suggest the potential of using Telehealth as a service delivery option for the resource-limited countries, and more studies are urgently needed to develop and evaluate the feasibility and effectiveness of the EBPs in resource-limited communities.

**VIRTUAL POSTER SESSION — SERVICE DELIVERY/SYSTEMS OF CARE**

**526 - Service Delivery/Systems of Care --- (V)**

**526.073 (Virtual Poster)** A Scoping Review of Clinical Decision Support System (CDSS) Use in Autism and Other Neurodevelopmental Disorders  
**R. P. Sulek<sup>1</sup>, J. Robertson<sup>1</sup>, A. W. C. Liew<sup>2</sup>, G. Upson<sup>2</sup>, A. J. Whitehouse<sup>2</sup> and D. Trembath<sup>2</sup>,** (1)School of Health Sciences and Social Work, Griffith University, Brisbane, QLD, Australia, (2)School of Information and Communication Technology, Griffith University, Brisbane, QLD, Australia,

**Background:** The provision of clinical supports for all children during the early years can promote optimal developmental outcomes. However, for children with a diagnosis of autism and other neurodevelopmental conditions, a key challenge for clinicians is how to select supports that are most likely to be effective in meeting the therapy aims, from a range of available options. Several factors which contribute to this challenge include; the large number of available supports, the rapidly growing and changing evidence-base, a lack of tools to assist the systematic utilisation of evidence from clinical practice, and the degree of heterogeneity that exists in individual child and family characteristics and preferences around supports. A potential avenue for overcoming some of these challenges is through the application of Clinical Decision Support Systems (CDSS) in a clinical setting to enhance the capacity of health practitioners to make effective decisions when selecting supports for neurodiverse children, including those on the autism spectrum. The extent to which CDSS are currently utilised in this context, however, is relatively unknown.

**Objectives:** We conducted a scoping review of available literature to examine CDSS use for children on the autism spectrum, and with other neurodevelopmental conditions.

**Methods:** The review was conducted according to procedures outlined in the JBI manual for evidence synthesis and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping review (PRISMA-Scr) guidelines.

**Results:** Studies identified in online searches (n=287) were screened against eligibility criteria, with six articles meeting all inclusion criteria. All studies described the application of CDSS to support screening and surveillance of young children for neurodevelopmental conditions which included attention deficit hyperactivity disorder, autism, developmental disorders, and language disorders. Five of the included studies described one CDSS, the Child Health Improvement through Computer Automation system (CHICA), modified to include additional neurodevelopmental condition specific screening and surveillance modules. Overall, included studies reported favourable outcomes, with screening rates of children improved compared to control or baseline results, or strong agreement between CDSS screening results and a qualified clinician.

**Conclusions:** The scoping review highlights the seemingly limited application of CDSS in the context of autism and other neurodevelopmental disorders to date. Further, studies rarely reported on the experience of CDSS end users (both clinicians and clients). While CDSS provide a potentially useful addition to clinical practice, by providing ready access to updated to the latest empirical evidence, further research is needed to understand their potential for success within a clinical context if we are to see an increase in the adoption.

**526.074 (Virtual Poster)** Applying the Exploration, Preparation, Implementation, and Sustainment Framework to Adapt and Test an Executive Functioning Intervention for ASD for Mental Health Services

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**Background:** Approximately 70% to 80% of autistic individuals meet criteria for at least one-co-occurring psychiatric condition necessitating intervention or support,<sup>1</sup> resulting in the mental health service system playing a critical role caring for autistic youth.<sup>2</sup> Yet, mental health providers report limited autism-specific training and knowledge and instead cite frustration and challenges serving autistic children.<sup>3</sup> Therapists also report lower intention and self-efficacy with respect to using evidence-based mental health interventions for autistic individuals.<sup>3,4</sup> There is a need to apply implementation science theories and methods to improve the uptake and delivery of effective, evidence-based mental health services for autistic youth.

**Objectives:** The current study presents an application of the Exploration, Preparation, Implementation, Sustainment (EPIS; Aarons et al., 2011) framework to systematically adapt and test an evidence-based intervention (EBI) targeting executive functioning in mental health services; a corresponding implementation plan also was developed. EPIS details the influence of key outer (e.g., system, policy) and inner (e.g., organizational, provider) context factors and innovation factors (e.g., fit) on the implementation process.

**Methods:** Data were drawn from a multi-phase study applying EPIS to select and adapt a school-based executive functioning EBI for implementation in community-based mental health settings. The Powell et al., (2012; 2015) taxonomy of implementation strategies was also applied to develop a corresponding implementation plan. Data from an initial needs assessment with mental health therapists (n=43; 83% female; 45% Marriage and Family Therapists) was collected to examine EBI utility and feasibility, using a 5-point Likert scale (1-Strongly Disagree; 5-Strongly Agree). Perspectives regarding necessary adaptations for mental health services as well as EBI implementation determinants were collected to inform necessary adaptations and identify relevant implementation strategies for the proposed implementation plan.

**Results:** Consistent with EPIS, the targeted EBI was selected given its potential to optimally fit organizational constraints and meet both provider training and client clinical needs. This was confirmed by our initial needs assessment findings, with mental health providers rating the EBI as useful (M=3.8, SD=1.5), and a fit with their practice (M=3.3, SD=1.6) and agency (M=3.3, SD=1.5) EBI adaptations primarily centered around further optimizing EBI fit with mental health organizations, providers, clients, and their families. Adaptations included: adjusting the delivery format (group-based to individual), increased psychoeducation materials, addition of parent engagement strategies, and adjusting the length of treatment to accommodate session caps. Top EBI determinants reported included limited resources, skills, time needed to learn and use EBIs, EBI fit, and EBI complexity. In response, a corresponding implementation plan also was developed for the following strategies: use of a community-academic partnership, developing educational materials, promoting intervention adaptability and making training dynamic, including multiple training formats and ongoing supervision and consultation. A pilot test examining the feasibility, utility, and effectiveness of the adapted EBI and implementation plan is underway within community-based mental health settings.

Conclusions: Results indicate the utility of implementation science theories and frameworks to inform the development and adaptation of feasible, context-specific EBIs and implementation plans in service of improving the uptake and delivery of effective mental health services for autistic youth.

**526.075** (Virtual Poster) Clinical Diagnosis and Educational Eligibility: Is There a Match for Latino Children with Autism Spectrum Disorder? *E. Kaplon<sup>1</sup> and N. Reyes<sup>2</sup>, (1)1201 Larimer Street, University of Colorado Denver, Denver, CO, (2)JFK Partners, University of Colorado Anschutz Medical Campus, Aurora, CO*

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**Background:** The prevalence of autism spectrum disorder (ASD) has increased in the last decade; however, discrepancies in identification and diagnosis in minority children continue to be widespread. Specifically, Latino children are diagnosed with ASD at lower rates than non-Latino peers in both clinical and educational settings. As the proportion of Latino students in schools and communities is expected to continue to grow, it is imperative to examine the experiences of Latino families and children with special needs. However, to the authors' knowledge, previous research has not investigated the intersection of clinical and educational disability evaluation for this group of children and simultaneously considers within-group differences.

**Objectives:** This research seeks to investigate the trends in educational disability identification for Latino children with clinical ASD by answering the following questions: (1) To what extent do Latino children with a diagnosis of ASD also have an ASD educational classification? (2) For children who did not have educational ASD, what educational disability was assigned? (3) Are children older than nine years of age more likely to have both a clinical and educational classification of ASD? (4) Are there differences in the educational disability classifications between Latino children from English Proficient (EP) families compared to families with Limited English Proficiency (LEP)?

**Methods:** This study included 131 medical records of Latino children, who were seen at public hospital in a large city in the western US. The criteria used to select these medical records included: children were Latinos, between the ages of 6 to 12 years, were seen at the hospital between 2015-2019, and had a diagnosis of ASD. The ASD diagnosis was extracted from their psychological reports by the first author and 20% of records were reviewed and compared by second author for accuracy.

**Results:** Of all participants, just 15% of Latino children were identified with educational ASD in schools. An additional 70% were identified with an educational disability other than ASD, with Speech-Language Impairment and Developmental Delay being the most common classifications. When comparing families of differing language proficiencies, children from LEP families were more likely to receive an ASD identification than their EP peers. There were no differences identified based on children's age.

**Conclusions:** These data revealed that Latino children with ASD are not likely to have an educational identification of ASD. That is, most Latino children who meet clinical criteria for a medical diagnosis of ASD receive services under an alternate disability category at school. While children from LEP families were significantly different from peers from EP families, both groups were found to follow similar trends. The reasons for this misidentification are likely to be complex, but it is likely that this misidentification results in having increased and unmet needs in Latino children with ASD. This indicates a need for further training and support of culturally responsive educational ASD evaluations. This research also highlights the need for effective communication between educational and clinical providers, so that each setting's unique evaluation results may be considered in assessment and intervention planning.

**526.076** (Virtual Poster) Critical Autism Theory within Disabilities Studies  
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**Background:** Internationally, research in disability sciences on autism revolves mainly around autistic children. When autistic adults are the group of interest, the research methods are chosen often involve those around them, including the family and the intervening staff, but very rarely the autistic people themselves (Elias et al., 2016; Elias et al. White, 2018). Several studies in disability sciences observe the lack of representativeness of the heterogeneity of autism (Wehman et al., 2014; Woods et al., 2018). Several autistic researchers, since 2010, have carried out critical autism studies (CAS)(Woods et al., 2018).

**Objectives:** As part of this presentation, we wish to elaborate on CAS as a research movement still unknown in research through a literature review.

**Methods:** This literature review was carried on articles released since 2010. In fact, CAS emerged from the neurodiversity promoting movement in the UK, created in opposition to the biomedical model that attempts to normalize, reduce and eliminate as many as possible behaviors associated with autism (Kapp et al., 2013). For our descriptive analysis, we considered a total of 13 documents internationally.

**Results:** CAS is distinguished by three characteristics, namely the exploration of power dynamics, the development of discourses challenging the dominant medical model in autism research, and the theoretical and methodological creation of emancipatory approaches. Some authors argue that CAS necessarily calls into question the scientific validity of the diagnosis of autism spectrum disorder (ASD) (APA, 2013) and the need to use labels associated with this diagnosis in order to emphasize the experiences associated with recognizing oneself as an autistic person. Consistent with the extraction of the richness, depth, nuances, and complexity of the experience shared by the autistic participants through ethnographic methodologies (Mason, 2017), CAS are interdisciplinary in order to consider the intersectional nature of the experiences of people with autism, who live with other types of oppression related to gender and sexual orientation, ethnicity, their education, and socioeconomic status. Known through the perspectives of participants, adults with autism challenge stereotypes and stigma associated with being diagnosed with autism (Runswick-Cole et al., 2016; Woods, 2020)

**Conclusions:** CAS are emancipatory spaces for the voice of people with autism through their experiential narratives that they reappropriate, which can positively, through the co-construction of knowledge which positively influence: the results of research, recommendations in terms of services; educational, social, financial, residential, identity, family and professional needs; and policies and laws governing the services offered to adults with autism. In addition, by sharing their experiences, the discourse of adults with autism can shed light on the different oppressions and power dynamics of which they are victims on a daily basis, making it possible to become aware of them and to propose compensatory mechanisms (eg. political, social, financial) in society.

**526.077 (Virtual Poster)** Delivery of Psychotherapy to Autistic Youth: Treatment Approaches, Adaptations and Clinician Knowledge

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**Background:** Despite the effectiveness of evidence-based mental health interventions for youth with autism (Weston et al., 2016), many barriers still exist in accessing psychotherapy (Adams & Young, 2020). Some common barriers include therapists' limited knowledge about autism, low levels of competence and confidence, or a lack of intervention adaptations to fit the needs of autistic youth.

**Objectives:** To understand the different treatment approaches and adaptations that mental health clinicians use with youth with mental health problems who are also autistic or have ADHD, and clinicians' perceived helpfulness of these approaches.

**Methods:** 611 publicly funded service providers who deliver psychotherapy to youth in Ontario, Canada, completed an online survey, in partnership with Children's Mental Health Ontario. Of this group, 561 noted providing psychotherapy to autistic clients and clients with ADHD. Participants selected the treatment approaches they use when working with youth with mental health problems with autism or with ADHD separately, from a list of 19 approaches and open-ended options. Participants rated each used treatment approach in terms of its helpfulness on a 10-point Likert scale (1 = *not at all helpful*; 10 = *extremely helpful*). Participants completed the Self-Rated Knowledge of Specific Mental Health Topics, a 6-item self-rated knowledge measure related to mental health topics, using a 5-point Likert scale (1 = *not at all knowledgeable*; 5 = *extremely knowledgeable*). Participants also identified the adaptations they used from a list of 14 adaptations for standard evidence-based interventions (Cooper et al., 2018). Items were counterbalanced with regard to autism and ADHD. We asked about clients with ADHD to be able to compare against service delivery for clients who have another neurodevelopmental diagnosis.

**Results:** Clinicians reported using a broad set of treatment approaches and selected similar treatments for co-occurring mental health conditions in clients with autism or with ADHD. Cognitive behaviour therapy had the highest endorsement for use with both autism (72%) and ADHD (85%), followed by solution-focused therapy (47% for autism and 64% for ADHD), family therapy (49% for autism and 55% for ADHD) and dialectical behavioural therapy (26% for autism and 36% for ADHD). For the majority of treatments, Wilcoxon signed-ranks tests indicated that participants rated the interventions as more helpful for clients with ADHD compared to autism, though in both cases, the average level indicated helpfulness. Paired sample t-tests indicated more total adaptations were used for clients with ADHD compared to autistic clients,  $t(558) = 2.55$   $p = 0.006$ , though it was a small effect size. Spearman's rho demonstrated a positive association between clinicians' average self-perceived knowledge and the number of adaptations used for both clients with autism ( $r_s(558) = 0.33$ ,  $p < 0.001$ ) and ADHD ( $r_s(558) = 0.34$ ,  $p < 0.001$ ).

**Conclusions:** Results indicate that despite mental health clinicians' use of similar treatment approaches for clients with autism or ADHD, many clinicians perceive them to be more helpful for clients with ADHD. Additionally, greater knowledge of how mental health topics can be understood within the context of autism or ADHD was linked to greater use of adaptations across treatments, for both groups.

**526.078 (Virtual Poster)** Enhanced Training Models for Capacity Building in Autism Service Delivery

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**Background:** Capacity building in autism-related healthcare service delivery is a critical need. Nationwide and internationally, waitlists at autism specialty clinics have skyrocketed, largely due to the convergence of: 1) improved ASD awareness within communities, 2) referring providers' self-reported lack of training and competence in ASD diagnosis and management (McCormack et al., 2019), and 3) service disruptions and challenges related to the COVID-19 pandemic (Keehn et al., 2021). Physicians commonly report that they graduate into clinical practice without a useful toolkit to document autism diagnosis and initiate management (Fenikile et al., 2015). They therefore are forced to refer even children with unambiguous autistic traits to autism specialty clinics, despite the long wait they know this will entail. To improve provider competence and confidence and reduce specialty autism clinic referrals, enhanced training models are needed that include utilization of multidisciplinary approaches for skill building, ongoing professional mentoring, and community building among providers working with ASD children and families.

**Objectives:** Evaluate the feasibility, acceptability, and benefits of our virtual ECHO (Extension Community Healthcare Outcomes) Autism Clinics as part of an enhanced training model for building autism-related knowledge and competencies among trainees and providers using multidisciplinary approaches.

**Methods:** Consistent with the ECHO Autism model (Mazurek et al., 2018), we used video technology (Zoom platform) to hold virtual "clinics" to provide mentorship and a shared learning forum among autism specialists from six disciplines ("hub") and community providers ("spokes"). Clinics ran in 6-month sessions on a bimonthly basis and consisted of case presentations and discussion, and ASD specific didactics. Research participation was voluntary and consisted of Redcap survey completion at various study time points. Study data collected focused on participant demographics,

self-reported change in ASD-specific knowledge and self-efficacy in autism-related care, as well as overall acceptability/feasibility of the program. No-cost continuing education credits were provided for attendees and incentive pay was offered for participation in research surveys.

**Results:** Data is provided on three cohorts (2 completed, 1 ongoing) who participated in ECHO Autism programming over the course of 15 months. 101 participants (23% trainee, 75% professional, 2% unknown) from a total of nine medical and behavioral health disciplines (see Figure 1) attended at least one clinic. Program evaluation data available in a subset of participants (N=33) indicated 94% improved knowledge and 100% reported improved competency in autism-related care (67% reporting top ratings of improved competency). Race of participants was 3% Asian, 15% Black/African American, 73% White, 6% Other (reported as Middle Eastern), and 3% not reported; ethnicity was 3% Hispanic or Latino, 94% Not Hispanic or Latino, 3% Other. Feasibility/acceptability data was available on some of these participants (N=20) and all reported good satisfaction with the ECHO program as a mode of learning (N=20).

**Conclusions:** We found that our ECHO Autism program is a feasible and acceptable model for building autism-related knowledge and competencies through multidisciplinary mentoring and community building among professionals and trainees.

**526.079 (Virtual Poster)** Exploring the Experiences of Autistic Young Adults and Their Transitions into Employment

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**Background:** Adults with autism spectrum disorder (ASD) are underrepresented in the workplace (National Autistic Society, 2016), and previous research has identified barriers which lead to poor employment outcomes for autistic people including: diagnostic characteristics of autism, personal, environmental, and discrimination related issues (Chiang, et al., 2013; Harmuth et al., 2018; Lindsay, et al., 2019). Research has suggested potential solutions and interventions to these barriers and negative outcomes but there has been little research into the personal experiences of autistic people when entering the world of work.

**Objectives:** This study aimed to explore the experiences of autistic young adults when entering the world of work and identifying if there were differences between those who have had higher education compared with those who have only had secondary school education.

**Methods:** This study used an interpretive qualitative design comprising of one to one semi structured interviews. Inclusion criteria were that participants must be young adults (under 26 years of age) with a diagnosis of ASD who had experience with employment, or who were looking for employment, at the time of the study. 5 participants (3 males, 2 female) volunteered to take part. One to one semi-structured interviews were conducted in private over the virtual medium of video and/or voice calls due to the COVID 19 global pandemic. These virtual interviews were conducted and recorded using either the software 'Microsoft Teams' or 'Webex'.

**Results:** Using thematic analysis three themes emerged from the data. These were: Disclosure, Influences of Education, and The Application Process. The first theme, Disclosure, the autistic young adults were found to be selective on whether, and when, they would disclose their diagnosis to an employer. These choices appeared to be based on both past disclosure experiences as well as each participant's perception of the potential consequences of disclosing. The second theme, Influences of Education, it was found that education had a multifaceted role on the experiences of autistic young adults entering employment. Participants in this study had differing views on the extent that education influenced their career paths. Educational qualifications appeared to have differing significance for each participant. The final theme, The Application Process it was found that, regardless of educational level, participants reported experiencing difficulties. Online applications were identified as a particular issue as participants perceived them as a lengthy process, with differences in application websites resulting in each application meaning starting a new process.

**Conclusions:** The findings of this study have implications for employers in terms of the need to develop autism friendly application and interview processes, how they respond to disclosures of an autism diagnosis, and providing tailored workplace supports. In addition, the need for schools to support autistic young people in preparing for all aspects of the process of securing employment was highlighted. The importance of a combination of qualifications and work experience was identified as essential in leading to positive employment outcomes.

**526.080 (Virtual Poster)** Healthcare Access of Language Minorities with Autism: The Case of English Official Language Minority Language Speakers in Quebec, Canada

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**Background:** English and French are both official languages in Canada. Yet, official language minorities (English speakers in Quebec, French speakers in other provinces) face negative health outcomes, including worse subjective health status (1) and more unmet health needs (2). There are critical differences between official and non-official minority language, or immigrant, groups (3), but they share common barriers to healthcare access. Reviews of healthcare access by immigrants in Canada cite language as a primary barrier (4, 5). Qualitative research with Canadian immigrants who have a child with autism have echoed language as a key barrier (6, 7). In US immigrant families who are language minorities, language barriers negatively impact access to autism diagnostic and intervention services (8) as well as the quality of autism services (9).

**Objectives:** Little intersectional data is available on language minorities in Canada with intensive service needs, as is the case for individuals on the autism spectrum. We conducted an online survey examining healthcare and social service access among English (minority language) speakers from Quebec, French (majority language) speakers from Quebec, and English speakers from elsewhere in Canada (majority language speakers) who are autistic adults or someone who cares for a family member with autism.

**Methods:** We analyze responses from 111 participants (51 English - Quebec, 30 French - Quebec, 30 English - rest of Canada, data collection ongoing). Participants self-identified as being autistic, someone who cares for a family member with autism, or both. Surveys were conducted online using LimeSurvey, in either English or French.

Access to primary healthcare was assessed by an adaptation of the Official Language Minority Healthcare Questionnaire (10). Access to specialized autism services was measured by the Family Needs Survey-Revised (11) to evaluate both access (needs met) and unmet needs in multiple healthcare and service domains commonly accessed by people on the autism spectrum.

**Results:** We present the result from a summary question "...How well are your language needs met in obtaining services in your official language of choice (i.e., English)?" Responses were on a likert scale from 1 "clearly not met" to 5 "fully met." Responses are shown in Figure 1. There was a significant effect of language status on language needs being met when obtaining services [ $p = .000$ , English speakers from Quebec ( $M = 3.41$ ,  $SD = 1.31$ ), French speakers from Quebec ( $M = 4.46$ ,  $SD = 1.16$ ), and English speakers from elsewhere in Canada ( $M = 3.90$ ,  $SD = .98$ )]. Post hoc comparisons indicated that satisfaction was lower in English speakers from Quebec than in French speakers from Quebec. Analysis of open-ended responses, and how demographic factors may interact with needs and access, is in progress.

**Conclusions:** This preliminary finding suggests that English official language minorities in Quebec who are autistic, or have a family member with autism, have more difficulty accessing satisfactory services than majority language speakers in the same province. By identifying barriers to access, this project aims to improve services and outcomes for people on the autism spectrum who are language minorities.

**526.081 (Virtual Poster)** Innovation in Access to Early Interventions for ASD in Kenya: Neurodevelopmental Early Intervention Scholarship  
**W. L. Owotoki<sup>1</sup>, M. V. Marques<sup>2</sup>, J. Mathaga<sup>3</sup>, J. Muiruri<sup>3</sup> and P. O. Owotoki<sup>1</sup>,** (1)Vitafluence.ai, Kronberg im Taunus, Germany, (2)Arthur's Dream Autism Trust (ADAT Foundation), Nairobi, Kenya, (3)Kenya Autism Alliance, Nairobi, Kenya

**Background:** Autism spectrum disorder (ASD) is a neurodevelopmental disorder generally characterized by a combination of impairments in social communication and interactions as well as repetitive and restrictive behaviors. According to the CDC, ASD affects 1 in 54 American children, whereas global prevalence is highly variable (1-2% of the population) based on socio-cultural and economic factors. High income countries may contend with long waiting times to diagnosis, while low/middle income countries deal with insufficient access to information, diagnoses and therapies. Here, logistics to therapy centres and finances for therapy are especially cumbersome; all now further exacerbated by the COVID-19 pandemic. Kenya has one healthcare professional for 41666 inhabitants and one healthcare facility for 70922 people - significantly less than the WHO recommended 4.45 healthcare professionals per 1000 people. For neurological conditions, Nairobi, the capital city, has one neurodevelopmental paediatrician for 1.5 million inhabitants. To achieve equality in healthcare and global well-being, barriers to early diagnosis and multi-professional therapy must be removed. Digital health solutions are expected to fill those gaps and shorten the distance between patients and practitioners but may not be affordable for families in financial need.

**Objectives:** To present an innovative solution tackling the financial and logistical gap for children with ASD in need of multi-professional early interventions and offer high quality and affordable therapy to families struggling financially in Kenya through a scholarship and a digital therapeutic platform.

**Methods:** We report on a Neurodevelopmental Early Intervention Scholarship (NEIS). Families were invited to apply for partial financial support to access therapy for their children (0-18 years) with ASD or related neurodevelopmental disorders but not currently receiving therapy. Therapeutic modalities offered face-to-face or via a digital therapeutic platform included occupational, speech and language, music, art and behavioural therapies.

**Results:** NEIS was launched in April 2021 in Kenya running to October 2021. Of 151 applicants, 84 reported an ASD diagnosis while 67 either reported other neurodevelopmental conditions or had not received diagnosis. Of 125 children offered NEIS, 61 (39 with ASD) proceeded to access multidisciplinary therapy face-to-face or via a digital platform. Our data analysis ( $n=39$ ) shows that 82% of the children receiving therapy are boys; 84% of applicants were female guardians; 51% of the carers reported unemployment, unstable work or closed businesses; 28% of the families reported financial issues due to COVID-19. Based on self-reported evidence following consistent therapy, carers and therapists report: reduced tantrums and echolalia; improved attention, speech, reading and counting skills; progress in social interaction; refined motor coordination skills; decreased touch sensibility; and improved autonomy for daily routines.

**Conclusions:** In five months, 61 children have received therapeutic support after financial and logistic needs were met. We report that innovatively minimising the logistical and financial barriers enables carers to focus on their children's therapies, while also ensuring therapy adherence. Carers who have consistently adhered to therapy for their children observed the anecdotal evidence reported above. We can conclude that the NEIS program enabled children living with ASD to receive consistent non-medicinal therapies thus improving their quality of life.

**526.082 (Virtual Poster)** Online Social Support By and for Autistic Adults – Assessing Needs and Interest  
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**Background:** In Quebec, Canada, many autistic adults are neglected by formal support services. Meanwhile, online exchange groups are numerous and initiatives aiming to provide online support by and for autistic adults have been implemented all around the world.



**Objectives:** This research aimed to assess Autistic adults' needs and interest for online social support offered by and for Autistic adults, in order to inform the implementation of such a service.

**Methods:** Participants ( $\geq 18$  years old Autistic, either formally and professionally identified or self-identified) were recruited through social media. A survey was launched using an online questionnaire between July 5 and September 15, 2021. The questionnaire (completion  $\approx 20$  min.) comprised four sections: 1) sociodemographic; 2) actual access and limits to access, source and frequency of use of current social support, either formal or informal; 3) specific area of needs related to social support; and 4) interest in accessing an online platform to provide or receive social support by and for autistic peers. Data analysis relied on descriptive statistical tests.

**Results:** 116 Autistic adults responded to the survey. Participants were between 18 and 64 years of age ( $M = 37$  years old) and most of them have been professionally identified as Autistic (79%). Use of formal social support services was limited due to their inadequacy with participants' needs and preferences (32.0%), their cost (30.9%), and obstacles in their access (47.4%). Meanwhile, most participants expressed receiving informal social support a few times a month (36.4%) or a few times a week (23.2%), either from friends (50.0%), a partner (49.0%) or a family member (34.4%). Participants mentioned needing social support in regards with own life experiences (73.5%), professional or academic life (57.1%), their place and role within society (57.1%), family life and children (48.0%), relationships with friends (45.9%), couple or romantic relationships (41.8%). Finally, among participants, 80.9% were mostly to very favourable to using an online support service that would be offered to Autistic by Autistic, as well as to volunteering to offer such a support (62.2%). Regarding the communication means through which such social support could be offered, participants mentioned they would appreciate an online chat (72.3%), videoconference (51.8%), emails (49.4%), telephone (44.6%) and text messages (43.4%).

**Conclusions:** Findings show even though participants did receive social support from people within their personal social network, various obstacles limit Autistic's access to social support, in addition to not addressing autistic individuals' needs and preferences. Findings also suggest there is a real need for diversifying the social support offered to Autistic individuals. According to this study's participants, an online social support service for and by Autistic adults would receive a very strong support by the community. Moreover, findings do not suggest any challenge in reaching potential users nor in recruiting volunteers.

**526.083 (Virtual Poster)** Parental and Provider Satisfaction with Teletherapy Services for Children with Autism Spectrum Disorder (ASD) during COVID-19 Pandemic.

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**Background:** Teletherapy usage in pre-pandemic times had been limited in LMICs like India, due to varied factors, including provider limitations and end-user scepticism. The COVID-19 pandemic forced providers to increase their telehealth services in lieu of traditional in-person patient encounters.

**Objectives:** The current study's primary objectives are to measure satisfaction among parents of children with autism spectrum disorder (ASD) and providers in urban India seeking and providing teletherapy services.

**Methods:** A multi-centric cross-sectional observational study was conducted at three child development centres in metropolitan Mumbai in January-February 2021. An online survey questionnaire adapted and translated from the Parent and Therapist Satisfaction Questionnaire (Constantinescu, 2012) was used to measure parent satisfaction across seven domains- Perceived Efficiency, Cost-effectiveness, Reliability, Perceived Ease of Use, Usefulness, Quality of interaction and Intention to use. Parents of children with ASD who had participated in a minimum of one telehealth therapy session and multi-disciplinary therapists who had provided a minimum of one teletherapy session and completed the online survey questionnaire were included. Descriptive and analytical analyses were employed to determine the satisfaction level with teletherapy usage among parents and clinical or demographic predictors of satisfaction scores.

**Results:**

A total of 80 caregivers and 38 therapists were considered for data analysis. Demographic data and satisfaction scores were recorded across the seven satisfaction domains, and an overall score was calculated. 93.75% of the respondents to the Parent Questionnaire were mothers, with the mean age of children receiving teletherapy  $5.78 \text{ years} \pm 2.42$ , and 36.25% from outside Mumbai. The overall mean parental satisfaction score was  $3.55 \pm 0.49$  (on a Likert scale of 1-5, with 1=Strongly Disagree and 5=Strongly Agree), with highest scores (3.8) for cost-effectiveness and lowest (3.2) for intention to use. Multivariate regression revealed significant predictors of overall parental satisfaction being non-Mumbai residents ( $p=0.004$ ), and lower/ no fee charged ( $p=0.004$ ) for the session.

Therapists' mean age was  $31.64 \pm 7.98$  years, females (97.37%), with  $7.47 \pm 7.01$  years of experience. Therapists included Occupational therapists (34.21%), Autism interventionists (21.05%), Speech therapists (13.16%) and others (31.58%). The majority (89.47%) had provided in-person services earlier. The therapists' overall mean satisfaction score was 3.32, with the highest (3.84) for cost-effectiveness and lowest for perceived ease of use (2.86). Multiple regression showed that not having provided in-person services before the pandemic had a significant adverse effect on satisfaction scores ( $t = -2.33$ ,  $p=0.026$ ).

**Conclusions:** COVID-19 has forced parents and providers to use telehealth services for ASD. Telehealth services have increased access to therapies for people living in remote areas with limited access to services. In addition, parents were more satisfied when telehealth services were subsidized compared to in-person therapy. On the other hand, therapists' satisfaction levels were comparatively lower, with the ease of use perceived as least satisfactory. While teletherapy has emerged as a feasible solution to increase access to services in under-served areas, conventional in-person services appear to be preferable when accessible. Implications of the findings on how telehealth services can be delivered in the future will be discussed.

**526.084** (Virtual Poster) Predicting Student Success of Autistic Students in Higher Education

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**Background:** Individuals with autism increasingly enroll in universities, but we know little about predictors for success. This study developed predictive models for academic success after one, two, and three bachelor years of autistic students (n = 101) in comparison to students with other health conditions (n = 2,465) and students with no health conditions (n = 25,077).

**Objectives:** Predictive modeling is a machine learning technique to develop models that predict future observations and evaluate their predictive power. Predictive modeling plays a vital role in theory building. It helps to discover new predictive measures and create new hypotheses, find improvements to existing explanatory models, compare competing theories, and quantify the level of predictability by benchmarking predictive accuracy (Shmueli & Koppius, 2011). The number of studies on the application of predictive algorithms in the field of autism is growing (Hyde et al., 2019; Thabtah, 2018; Vabalas et al., 2019), in particular related to diagnostic or physical aspects of autism. However, its use in educational studies on autistic students is virtually absent (Madaus et al., 2020; Morgan, 2018). We studied the feasibility of predictive modeling of academic success of autistic students and the importance of success predictors to improve theory building.

**Methods:** Our sample included 27,643 first-year, full-time students in 54 bachelor programs at a major university in the Netherlands from 2010 to 2016 (M = 19 years of age, 55.0% female) with study measures from the university's student information system. The study population consisted of (1) 101 students with a clinical diagnosis of ASD (0.37%), (2) 2,465 students with other conditions such as ADD/ADHD and dyslexia (8.92%), and (3) 25,077 students with no recorded conditions (90.72%). Propensity score weighting was applied to balance outcomes. We built and trained weighted models that cover a wide range of possibilities in predictive modeling for multi-class outcomes: classification and regression trees, random forest, neural network, boosting, and bagging models.

**Results:** The research showed that autistic students' academic success was predictable and even more accurate than their peers' success predictions. For first-year success, study choice issues were the most important predictors (parallel program and application timing). They had more impact than issues with participation in pre-education and academic performance (age and average grades). Delays at the beginning of their studies predicted delays in their bachelor's program.

**Conclusions:** This innovative methodological approach demonstrates that the student success of autistic students can be predicted. Especially in the second and third years, different predictors should be applied compared to their peers to prevent dropout or study delay of autistic students. Autistic students with non-regular pre-educational study paths are more prone to dropout or study delays. Predictors to identify these risks, age and missingness of average grades in math in secondary education, are easy to register and collect in any student administration and can be used to develop appropriate early warning systems from the start of any study program.

**526.085** (Virtual Poster) Professional Development Programs for Community Professionals Who Support Autistic People: Process and Outcomes

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**Background:** There is a need for more professional development to increase inclusion of autistic and neurodivergent individuals in the community. Toward this end, four on-line, self-paced, freely accessible professional development programs were developed and evaluated for the service sectors of human resources/employers; primary care providers/physicians; dental professionals; and childcare providers.

**Objectives:** The goal of the professional development programs is to teach professionals in each field to adjust their practices to better support, accept and include autistic and neurodivergent individuals in their practice.

**Methods:** Autistic individuals and their family members were actively involved in the development and creation of each professional development program. To develop the content for the program Autism and Neurodiversity in the Workplace, for example, a work environment survey was completed by over 170 autistic individuals from across Canada. Autistic individuals were also interviewed on camera and shared their personal experiences and opinions. There are five modules in the workplace program: Understanding autism in the workplace; Benefits of hiring inclusively; Creating a diverse and inclusive workplace and culture; Inclusive recruitment strategies; and Inclusive employment retention strategies. To evaluate the effectiveness of each program, registrants completed a pre and post survey to examine if the program led to increased knowledge and behavioral practice change.

**Results:** To date, results are available for the Autism and Neurodiversity in the Workplace program only. Over 1,700 people have registered for the program, 957 have completed the pre-survey, and between 352 and 550 have completed the post surveys for each of the five modules.

Respondents reported that their ability to support autistic employees increased from 26% to 75%. They also reported that their knowledge in each topic area increased as follows: knowledge on the benefits of hiring inclusively and the strengths of autistic employees increased from 28% to 72%; knowledge on the strategies to create inclusive work environments increased from 27% to 69%; knowledge on strategies to attract, recruit and interview autistic candidates increased from 7% to 73%; and knowledge on the cost and range of accommodation strategies to support onboarding and day-to-day success increased from 10% to 77%. In addition, 94% of respondents reported that they are likely or very likely to incorporate the

strategies learned into their professional work. The program was rated by 97% of respondents as somewhat or very useful to the respondent's work, and 94% of respondents rated the quality of the information as high or very high.

**Conclusions:** The preliminary results reveal that these professional development programs have the potential to significantly increase professionals' understanding and knowledge about how to better support and include autistic individuals in a variety of service sectors. They also reveal that these free online, self-paced programs have the potential to result in practice change.

**526.086 (Virtual Poster)** Testing a Theory of Implementation Leadership and Climate across Autism Evidence-Based Interventions of Varying Complexity

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**Background:** Evidence-based practices (EBPs) are infrequently delivered in community settings such as public schools. When they are, fidelity to their essential components often is poor. Diminished fidelity to EBPs reduces their effectiveness. Consequently, identifying factors that influence providers' fidelity to EBPs, and developing implementation strategies that target those factors, holds significant promise to improve the quality and outcomes for autistic youth. Implementation theories have emphasized the importance of first-level leaders who manage or supervise direct service providers. Research suggests first-level leaders (i.e., those who manage providers) can improve the delivery of EBPs through focused implementation leadership behaviors that create an organizational climate for EBP implementation. However, this work has been criticized for poor articulation of boundary conditions that may attenuate leadership and climate's influence.

**Objectives:** This study tests Aarons and Ehrhart's (2014) theory of EBP implementation leadership and climate in schools that serve autistic youth, focusing on how intervention complexity may modify the effects of these antecedents on observed educator fidelity. This study tests the hypothesis that the predictions of EBP implementation leadership and climate theory will hold for observed fidelity to a complex EBP for autism—pivotal response training (PRT)—but not for less complex interventions—discrete trial training (DTT) and visual schedules (VS)—delivered in public schools.

**Methods:** Teachers and staff (n=225) in kindergarten to third-grade autism support classrooms in 65 schools assessed their principals' EBP implementation leadership and school EBP implementation climate prior to the school year. Mid-school year, trained observers rated educator fidelity to all three interventions. Expert raters confirmed PRT was significantly more complex than DTT or VS.

**Results:** For each EBP, a set of simultaneous linear regression models were fit, estimating (a) the association of principal EBP implementation leadership with school EBP implementation climate; and (b) the association of school EBP implementation climate with educator fidelity to one of the three EBPs (i.e., PRT, DTT, or VS) controlling for EBP implementation leadership. Results indicated that principals' increased frequency of EBP implementation leadership predicted higher school EBP implementation climate, which in turn predicted higher educator fidelity to PRT, but not DTT or VS. Comparing principals whose EBP implementation leadership was +/- one standard deviation from the mean, there was a significant indirect association of EBP implementation leadership with PRT fidelity through EBP implementation climate ( $d = 0.49$ , 95% CI = 0.04 to 0.93).

**Conclusions:** Building on research from organizational psychology and management, this study confirms that a theory of implementation leadership and climate explained variation in observed fidelity to a complex EBP (PRT) in public schools. These results answer the call for research testing leadership and climate theory with specific EBPs and clinical populations using observed fidelity. Further, these findings apply these theories within a new population of settings (i.e., schools), leaders (i.e., principals), and providers (i.e., educators) and identified a boundary condition that may modify the association between EBP implementation leadership, climate, and fidelity, namely, the EBP's level of complexity. This study suggests strategies that target EBP implementation leadership and climate may support fidelity to complex behavioral interventions.

**526.087 (Virtual Poster)** Understanding Autistic Parents' Experiences and Relationships with Schools

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**Background:** Positive partnerships between families and schools can substantially improve engagement with learning as well as success in and out of school. Such family-school partnerships are particularly important for autistic children and young people, who are at increased likelihood for poor academic and mental health outcomes. Despite this knowledge, virtually nothing is known about *autistic parents'* experiences of navigating school for their autistic children and how autistic parents navigate home-school partnerships, and the impact this has on their families and themselves.

**Objectives:** This study therefore aimed to (1) understand autistic parents' views and experiences of interactions with schools for their autistic child(ren), and (2) identify the potential impact of these interactions on themselves and their family.

**Methods:** We adopted a participatory approach where autistic and non-autistic researchers worked together as a team, including an advisory group of four autistic parents with autistic children, who guided the research. We also used a qualitative approach where 30 autistic mothers took part in semi-structured interviews conducted by an autistic researcher to gain a rich understanding of their and their child's experiences of school, of navigating the school system, of their relationships with school staff and community, and the impact this has on them. We are in the process of analysing the data, using reflexive thematic analysis, adopting an inductive approach within an essentialist framework to identify key themes and subthemes.

**Results:** Families with positive home-school partnership experiences spoke of having teachers and school staff who valued autistic parental insight, a school culture that respects diversity and demonstrates acceptance, open, honest, and authentic communication between parents and teachers, and

effective leadership in actioning inclusion and accommodations. Families who recounted negative experiences instead highlighted, teachers and school leadership with limited knowledge about autism, situations in which they and their children did not feel safe at school, imposed generic accommodations that did not reflect individual needs, and broken trust between parents and teachers. These experiences were often highly distressing and had a negative impact on the mental health and wellbeing of the entire family.

Conclusions: Autistic mothers reported wanting to see their autistic children enjoy the same social and curriculum opportunities as non-autistic children; to feel safe and secure at school and be understood and respected for who they are. They also emphasised wanting that for themselves. Our findings suggest that, although there are successful examples of home-school partnerships already, schools need to be more flexible, adaptive, collaborative and caring in their approach to supporting autistic families.

**526.088 (Virtual Poster) Understanding Implementation Readiness in School Systems in California**

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Background: Most state systems have limited capacity for scaling up interventions that lead to meaningful improvement in student outcomes (Fixsen et al., 2013). Effectively scaling up Evidence Based Practices (EBP) use for students with autism is challenging, given the distributed leadership and complex organizational structures within special education. Implementation science research has identified mechanisms related to successful implementation including implementation climate, leadership, and attitudes toward EBP. Examining these mechanisms is a critical step in evaluating implementation readiness at various levels of the system. Outcomes may inform selection of implementation strategies to support state-wide scale up.

Objectives: To examine implementation climate, leadership, and attitudes toward EBP across special education structures and providers.

Methods: California school personnel completed the *Implementation Climate Scale (ICS)*, *Implementation Leadership Scale (ILS)*, and the *Evidence-Based Practice Attitude Scale (EPBAS)*. Data were collected at the Special Education Local Plan Area (SELPA), County Office of Education (COE), District and School levels from SELPA directors (n=153), school and district administrators (n=270), specialists (n=373), teachers (n=873), paraprofessionals (n=231) and other direct service providers (n=373). Participants represent 1,379 schools, 473 districts and 132 SELPAs. Participants provided data related to their direct leaders and their school, district, and/or SELPA depending on their role. Multilevel modeling was conducted to characterize implementation readiness across levels of special education structures. Comparisons were made by employment setting (school, district, COE, SELPA) and SELPA type (multi- or single-district).

Results: Overall, implementation climate and leadership scores are low in the education system across levels. For ICS, personnel rate SELPA significantly higher than COE, districts or schools, and COE higher than schools or districts. In terms of ILS, leaders in all settings rated themselves significantly higher than employees rated them. In general, district leaders were rated as having lower implementation leadership by their employees than any of the other settings. School leaders rated themselves significantly lower than the other leaders on most ILS subscales. Attitudes toward EBP were moderate overall, with those working in schools having the poorest ratings (compared to district or SELPA). Specialists/trainers had the highest scores on the EPBAS compared to administrators, teachers and paraprofessionals.

Conclusions: In general, school personnel have moderate attitudes toward the use of EBP for students with ASD. Teachers' self-report of EBP attitudes were similar to those from a California sample over a decade ago (Stahmer & Aarons, 2009), potentially indicating limited change in attitudes over time. Specialists/trainers had the most positive attitudes, which is promising given they are likely to be providing professional development related to ASD EBP. Implementation climate and leadership are low across levels, indicating a need to provide training and support to facilitate effective EBP use and scale up. SELPA personnel rated their

**526.089 (Virtual Poster) Understanding of the Police Caution in the Autistic Population**

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**Background:**

Research indicates that some offenders, students and even police officers (Clare et al., 1998; Fenner et al., 2002; Shepherd et al., 1995) do not always fully understand the police caution: a statement of rights given to those suspected of criminal behaviour. Misunderstandings can have significant ramifications: failure to guard against self-incrimination and failure to seek legal advice, for example. Comprehension of the caution in an autistic population is unknown, yet they may experience additional challenges due to atypicalities in information processing, metacognition, working memory, episodic future thinking and compliance (Chandler et al., 2018; Grainger et al., 2014; Kercood, et al., 2014; Lind et al., 2014; Williams et al., 2015)

**Objectives:**

The objective of this study was to investigate understanding of the England and Wales police caution statement in autistic adults compared to typically developed individuals. In doing so we considered i) whether comprehension was impacted by delivery mode (written vs. verbal) and ii) the structure in which it was delivered (as a whole, in full or sentence by sentence).

## Methods:

Seventy-six adults took part in the study. Inclusion criteria was i) resident in the UK, ii) native English speaker, iii) aged over 18 years and iv) with a verbal IQ score of 90 or above (WASI). Group inclusion criteria for the autistic group (n=26) was a T score of <60 on the Social Responsiveness Scale and for the non-autistic group (n=50) >60.

Comprehension of the police caution was assessed across the two adult participant groups (Autistic; Typically developed) using a non-verbal cartoon comprehension test comprising cartoon images depicting 10 true or false scenarios (CCT). There were two conditions, each with two levels: i) Mode of delivery (verbal vs written) and ii) structure of delivery (sentence-by-sentence vs full). Participants participated via Zoom video conferencing platform, which was also used to complete the Pyramids and Palm Trees Test (to check non-verbal lexical semantic ability) followed by the WASI verbal subtests.

## Results:

Preliminary findings revealed that autistic individuals had a significantly poorer understanding of the police caution than non-autistic individuals  $F(1, 72) = 6.67, p = .01, \eta^2 = .09$ . No significant differences emerged in understanding of the police caution as a function of modality but understanding was significantly better when the caution was presented in full rather than sentence-by-sentence across both groups. More data needs to be collected to confirm these latter findings.

## Conclusions:

Interim findings indicate autistic individuals may be vulnerable to misunderstanding the caution and consequently, may require further support such as provision in a written format. Policy makers may wish to consider how they present the police caution to those suspected of criminality to ensure their rights are fully understood.

**526.090** (*Virtual Poster*) "I Wouldn't Discount How Hard We Have Tried" Understanding the Experiences of Chinese Parents of Autistic Children As They Navigate School

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Background: Developing effective partnerships between parents and schools is especially important for autistic students since they can benefit from learning supports and consistent approaches across contexts. Yet, parents of autistic children have often reported adversarial relationships with professionals and a lack of two-way partnerships. Minority background families, including Culturally and Linguistically Diverse families, are at greater risk of being marginalised, including in schools. But we know exceedingly little about these families' experiences, and critically of how best to support relationships with schools. The views of Chinese migrant families with autistic children are particularly scarce in Australia, even though Australia is home to more people of Chinese ancestry than any country outside Asia.

Objectives: This research therefore sought to understand in depth Chinese parents' views and experiences of interactions with Australian schools for their autistic child(ren). It also may shed light on how cultural differences and expectations influence home-school partnerships in general.

Methods: We adopted a participatory approach in which autistic and non-autistic researchers worked together as a team, and an advisory group, including five Chinese parents of autistic children, also steered this research. We also adopted a qualitative approach in which 16 Chinese parents (14 mothers, two fathers;  $M_{age} = 43$  years, range = 31 – 56) took part in semi-structured interviews conducted by a Chinese collaborator in Mandarin, Cantonese or English. A separate interpreter provided a simultaneous English translation of Cantonese and Mandarin interviews for transcription purposes. Interview topics included understanding their and their child's experiences of school, navigating the school system, and of their relationships with school staff. We used reflexive thematic analysis to analyse the data.

Results: Most parents had one autistic child (n=13, 81.3%); three families had two autistic children ( $M_{age}=8$ , range 2-17). Most children were in mainstream schools (n=10, 52.6%), with four children in kindergarten (21.1%), and the remainder (n=5, 26.3%) in disability-specific schools or dual schooling (i.e., both mainstream and specialist). We identified five themes, including: (1) Parents were deeply devoted to their children, which included having high expectations of children and schools; (2) Parent and teacher roles were clearly defined and respected; (3) Parents lacked confidence and trust in teachers; (4) Advocacy was difficult for parents due to employment, lack of extended family supports, language barriers, community misunderstanding of autism, and felt stigma; yet, despite all of this, (5) there was a sense of optimism and gratitude for what Australia could offer their children.

Conclusions: Overall, Chinese parents wanted their children to be happy and to lead full lives. Although parents were appreciative of the financial support, acceptance of diversity and provision of holistic education in Australia, parents wanted more transparency from teachers about their children's strengths and challenges and higher expectations for their children. They also wanted to be more involved in their child's schooling. Schools must develop effective ways to be more flexible, open and understanding when working with Chinese parents and their autistic children.

**526.091** (*Virtual Poster*) Usual Care Settings and Differences in Screening and Treatment of Trauma for Autistic Youth

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**Background:** While potentially traumatic events (PTE) impact about 60% of youth (Kerns et al., 2015), autistic youth are at an even higher risk of experiencing PTEs (Kerns et al., 2020). Further, negative mental health outcomes are associated with PTEs in autistic (Kerns et al., 2020) and non-autistic (Hoover, 2015) populations. Youth with ASD are served in a wide variety of treatment settings by providers from diverse professional disciplines (Kerns et al., 2019), but often have difficulty obtaining trauma-focused treatment (Hoover, 2015; Kerns et al., 2015). Recent work has begun characterizing the landscape of PTE care for autistic youth in usual care (UC) settings, which found that despite an increased risk of PTE, only 10% universally screened and only 5% universally treated PTE (Kerns et al., 2019, 2020). Additionally, Kerns and colleagues (2020) identified that providers from community mental health centers (CMHCs) were more likely to screen and treat PTE than those not working in CMHCs, however, variation of frequencies of screening and treatment across UC settings (i.e., those practicing in different settings) have not been explored. Analyzing which types of UC settings are more likely to address PTE in autistic individuals is essential for understanding the landscape of UC treatment and improving access to care for autistic youth.

**Objectives:** We aimed to build from the results of Kerns et al. (2020) to assess frequency of PTE screening and treatment in multiple different UC settings.

**Methods:** 700 community-based ASD providers from different practice settings participated in the Usual Care for Autism Study (UCAS; Kerns et al., 2020). Providers were asked to disclose practice setting (Table 1) and whether they screen or treat PTEs in ASD youth.  $\chi^2$  tests were used in all analyses.

**Results:** Results revealed differences in PTE screening [ $\chi^2(5, N=700)=43.721, p<.001$ ] and treatment [ $\chi^2(5, N=700)=40.43, p<.001$ ] by UC setting. Providers from four of the six UC settings reported both screening and treating PTEs at least 50% of the time, however CMHC remained the UC site addressing PTEs more than any other setting (Figure 1).

**Conclusions:** This study aimed to further explore variations in PTE screening and treatment by UC setting. While providers from most settings addressed PTEs at least half of the time, CMHCs continued to address PTEs at a higher rate than any other setting. As autistic youth experience PTEs more often than non-autistic youth (Kerns et al., 2020), having providers that are actively addressing these difficulties are important. Notably, autistic youth are most likely to receive services from school-based providers (van Roekel et al., 2010), which, considering these results, indicates that PTEs are less likely to be screened in settings where children are most likely to receive services. As many providers report a lack of training and awareness of PTEs in autistic youth (Brookman-Frazee et al., 2012; Kerns et al., 2020), there is an increased importance for training and development of evidence-based treatments (Kerns et al., 2019). Future work should focus on increasing training and the use of evidence-based treatments for PTEs in UC settings.

## **526.092 (Virtual Poster)** Examining the Balance of Fidelity and Family-Centered Care within a Parent-Mediated Intervention Delivered in a State-Funded Early Intervention System

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**Background:** Parent-mediated intervention (PMI) is an effective intervention approach for young children with autism spectrum disorder (ASD; Nevill et al., 2018). Although efforts to increase access to PMI are underway, their success has been limited by high attrition when implemented in underserved communities (Kasari et al., 2015). Strategies that have been added to PMI to enhance caregiver engagement have had mixed results (Pellechia et al., 2018) and may reflect an assumption that PMI content itself should engage families and, when not, that engagement must be targeted separately so that fidelity is maintained. The emphasis on maintaining fidelity may restrict how PMI is delivered, at times, placing it at odds with the diverse needs of underserved families. To date, research has yet to evaluate how family needs, values, and preferences are accounted for within PMI delivery.

**Objectives:** The current study examined the delivery of an evidence-based PMI, Project ImPACT (Ingersoll & Dvortcsak, 2019), when delivered within a Part C Early Intervention system. Specific objectives were to examine: 1) providers' fidelity to Project ImPACT; 2) decisions providers weighed in their delivery of Project ImPACT; and 3) perceived impact of these decisions.

**Methods:** Participants were interdisciplinary providers within Georgia's Early Intervention system providing services to children 12-30 months of age with an increased likelihood of having ASD. Providers completed Project ImPACT training and submitted video of each of their Project ImPACT sessions, which were scored for fidelity. After every other session, providers completed an open-ended survey that asked about their intended goals for the Project ImPACT session, how the session played out, the decisions that factored into their delivery of Project ImPACT, and the perceived impact of the decisions. Following participation, providers rated their overarching adaptations to Project ImPACT (Stirman et al., 2019).

**Results:** Preliminary data from 12 of 25 Early Intervention providers indicate improvement in Project ImPACT fidelity towards benchmarks of 80%. Across a random sample of 28 Project ImPACT sessions, providers reported experiencing events that impacted their program delivery. These events occurred in about 40% of sessions and represented acute stressors (e.g., housing eviction, family death), chronic needs (e.g., extended family illness), and stated preferences (e.g., asking for support with feeding or sensory sensitivities). In response to these events, providers indicated pausing Project ImPACT to provide relevant support with the intention of returning to Project ImPACT in subsequent sessions. Providers perceived balancing

fidelity and family-centered care as essential to aligning Project ImPACT with family-centered Early Intervention delivery. Data regarding overarching fidelity and adaptation will be presented.

**Conclusions:** This study provides insight into how providers delivered an evidence-based PMI within a state-funded Early Intervention system and the decisions they weighed in program delivery. Although preliminary data suggest that providers can learn Project ImPACT, findings also highlight the perceived need to deviate from core intervention content to support diverse family needs. These types of family-centered adaptation are not currently accounted for within existing fidelity tools. These results underscore the need to better measure intervention adaptation processes within Early Intervention systems.

**526.093 (Virtual Poster)** A Preliminary Investigation of Code Related Emergent Literacy Skills in Bilingual Children with Autism Spectrum Disorder

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**Background:**

Emergent literacy skills are the reading and writing experiences of young children before they learn to write and read conventionally, which serve as a foundation for later academic success (Rohde, 2015). Children with Autism Spectrum Disorder (CwASD) have impaired emergent literacy skills due to the challenges faced in areas such as social communication, sensory perception and cognition at younger age. Code related emergent literacy skill predict fluent and accurate reading. Studies suggest that code related skills (alphabet concept and phonological awareness) are non-impaired and meaning related skills (oral language and narration) are impaired in CwASD (Westerveld et al., 2017b). Given the socio-cultural, linguistic, and educational system differences in the Indian context, there is a need to explore emergent literacy skills of bilingual (English language learners) CwASD in India to develop individualized empirical intervention strategies.

**Objectives:** The objectives of the study were

- a) To explore the performance of CwASD on code related emergent literacy measures such as concept about print, alphabet knowledge and phonological awareness
- b) To find an association between code related emergent literacy measures and home literacy environment measures.

**Methods:**

A total of 25 CwASD between the age of 4 to 8 years of age, with mild to moderate autism severity and average or above average intelligence were included in the study. English was the second language and the medium of instruction for all CwASD. Code related emergent literacy measures such as concept about print, alphabet knowledge and phonological awareness were assessed using Tool for Emergent Literacy Assessment (Khurana & Rao, 2011). Home literacy environment was investigated using a questionnaire (Buvaneswari & Padakannaya, 2017) completed by the parents of CwASD.

**Results:**

Mean and standard deviation of all the code related tasks were computed. Performance of CwASD on code related emergent literacy measures were categorised into good, average and poor by computing the 33<sup>rd</sup> and 66<sup>th</sup> percentile scores as shown in Table 1. Most CwASD (n=18) obtained good and average scores on concept about print and alphabet knowledge. A significant positive correlation was observed between home literacy environment and concepts about print concept, alphabet knowledge, and moderate correlation was observed with phonological awareness (Table 2).

**Conclusions:**

Our findings show good and average performance on print concept and alphabet knowledge in bilingual CwASD which is similar to findings from English speaking CwASD (Westerveld et al., 2017b). Association between code related emergent literacy skill and home literacy scores signifies the need to consider home literacy practices such as shared reading, focus on print, and exposure to story book at a younger age. Further, an understanding of performance of CwASD on code and meaning related emergent literacy measures allow us to provide focused early intervention to prevent reading failure. Future research should compare the performance of bilingual typically developing children and CwASD on measures of code and meaning related emergent literacy skills with larger sample size, and compare with age and language matched peers.

**526.094 (Virtual Poster)** Factors Contributing to Employment and Job Satisfaction for Autistic Adults

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**Background:** Extant research in the field of employment for autistic adults describes bleak outcomes—high rates of unemployment and underemployment, frequent job changes, challenges adapting to new job settings/routines, lower wages than coworkers, and less time employed than neurotypical peers (Hurlbutt & Chalmers, 2004; Muller, Schuler, Burton, & Yates, 2003). However, research has also elucidated a number of desirable workplace traits that individuals with autism possess such as: attention to detail, reliability, increased productivity, and low absenteeism.

(Baldwin, Costley, & Warren, 2014; Hillier et al., 2007). To better inform employment-related interventions, it is essential to further develop an evidence base which describes successful employment experiences of autistic adults.

**Objectives:** The current study aimed to (1) identify differences between autistic adults who are employed and autistic adults who are unemployed; (2) identify differences between employed autistic adults who are satisfied with their jobs and those who are not.

**Methods:** The current study conducted secondary analyses on a previously collected sample of autistic and non-autistic adults who responded to an online survey (Schwartzman et al., 2015). From this sample, a smaller sample of autistic adults were identified based on survey questions indicating whether they had previously received a formal diagnosis or considered themselves to be autistic (N = 238). Other survey questions assessed personality (IPIP NEO-120), autistic traits (RAADS-R), sensory sensitivities (HSPS), employment status, duration of employment, employment satisfaction, happiness, life satisfaction, level of education, as well as other demographic categories such as age, gender, and ethnicity. Independent samples *t*-tests were utilized to compare differences between employed (N=133) and unemployed (N=105) autistic adults. Within the group of employed autistic adults, two groups were created based on responses to the Job Satisfaction question which was assessed using a 5-point Likert scale. Individuals who indicated they were “Very Satisfied” and “Satisfied” with their jobs were placed in the “Satisfied” group (N=80), while those who indicated “Neither Satisfied nor Dissatisfied,” “Dissatisfied,” or “Very Dissatisfied” were placed in the “Not Satisfied” group (N=53). Independent samples *t*-tests were utilized to compare differences between the “Satisfied” and “Not Satisfied” groups of employed autistic adults.

**Results:** Employed autistic adults reported significantly lower Neuroticism in addition to higher Extraversion, Conscientiousness, happiness, life satisfaction, and level of education than unemployed autistic adults. Further, groups did not significantly differ in reported autistic traits or sensory sensitivities (See Table 1). Autistic adults who were “Satisfied” with their current employment reported significantly lower Neuroticism, higher life satisfaction, and happiness than those “Not Satisfied” (see Table 2). Further, reported autistic traits and sensory sensitivities did not differ between the groups.

**Conclusions:** Current literature on employment of individuals with autism often lumps this diverse population into a homogeneous of individuals who experience employment challenges. While this may be true of a majority of individuals with autism, to better inform future employment-related interventions for those experiencing unemployment and underemployment, it is essential to further develop an evidence base which identifies factors that contribute to successful employment experiences for autistic adults.

**526.095 (Virtual Poster)** Completing Autism Evaluations in an Integrated Pediatric Primary Care Setting.  
**T. Snider, Nationwide Children's Hospital, Columbus, OH**

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**Background:** The prevalence of Autism Spectrum Disorders (ASD) has continued to increase over the past decade with a current reported prevalence of 1.7% of children in the United States. The frequency of recommended well-child checks (WCCs) and developmental surveillance recommended by the American Academy of Pediatrics (AAP) between the ages of 0-3 years makes the pediatric primary care center a critical and valuable setting to aid in early identification and recognition of children with concerns for a possible ASD. The evidence supporting integration of behavioral health providers in to the primary care center further creates an opportunity to promote early identification of developmental delays as well as access to ASD evaluations resulting in earlier age of diagnosis and successful linking with recommended treatments and therapies. The ability to offer ASD evaluations in the pediatric primary care setting also helps to minimize barriers to care, as the primary care provider (PCP) is often a trusted and familiar setting for families.

**Objectives:** The Integrated Primary Care Autism Spectrum Disorder (IPC ASD) evaluation project was developed with the goals of decreasing the time families wait from first concern to ASD diagnosis **and** improving timely access to evidence-based care and critical early intervention services, particularly for families who identify as racial or ethnic minorities.

**Methods:** In 2020, the average wait time from referral to diagnosis was approximately 15 months at our affiliated autism center. With an average time from diagnosis to treatment of approximately 6 months. The IPC ASD project was piloted in an urban, busy pediatric primary care center, which serves a predominately-underserved and diverse patient population. The target population is children ages 18 months – 5 years who present to their primary care center (PCC), and the PCP identifies concern for a possible ASD based on their clinical judgement, behavioral observations, and results from developmental screeners.

**Results:** Since November 2020, the IPC ASD project has evaluated 70 patients (88% male) from two PCCs. The average age of diagnosis is 34 months (18 – 58 months range), which is over 12 months earlier than the national average. Over 90% of families identified as minority patients (predominately African, Latinx, or African American) with nearly 25% of families identifying English as their second language or as non-English proficient. Compared to treatment as usual, there was over a 160-day reduction in time from referral to diagnosis of ASD. Results revealed an average of 5.5 weeks from diagnosis in the primary care setting to initial treatment appointment at the affiliated autism center (N = 37).

**Conclusions:** The IPC ASD model is a promising approach to ASD evaluation and diagnosis in integrated pediatric primary care setting. Results demonstrate earlier age of diagnosis compared to the national average and more timely access to efficacious behavioral and early intervention services. Perhaps most importantly, results suggest that this model is feasible and acceptable to families from diverse racial and ethnic backgrounds and could help minimize disparities in age of diagnosis and linking with treatment.

**526.096 (Virtual Poster)** ACEs Screening Pilot for Children Clinically Referred for Neurodevelopmental Disorders  
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**Background:** Children with neurodevelopmental disorders, including Autism Spectrum Disorders (ASD), are at an even greater risk for Adverse Childhood Experiences (ACE) than children in the general population, contributing to the health disparities for this group (Rigles, 2016). Further, children with ASD experiencing more ACEs often demonstrate delays in diagnosis and initiation of therapies (Berg et al., 2012).

Research exists on screening for ACEs within primary pediatric practices to identify needs for trauma treatment and prevention of intergenerational transmission of toxic stress (Gillespie, 2019); however, little is known about screening for ACEs within a clinical setting for children with developmental disabilities.

**Objectives:** The purpose of the study is to pilot an ACEs screening tool within a clinical sample of children referred for evaluation for neurodevelopmental disorders. ACEs rates and possible differences in rates of ACEs amongst gender, race, and insurance sources will be explored.

**Methods:** Retrospective chart reviews were conducted for children referred for neurodevelopmental evaluations at a children's hospital in the Southeastern United States. The families of all children completed the Identified Pediatric ACEs and Related Life Events Screener (PEARLS). Child-level demographic and diagnostic information was gathered.

**Results:** See Table 1 for demographic information. Preliminary results indicate that 64% of children have experienced at least 1 ACE ( $M = 1.41$ ;  $SD = 1.63$ ) and 32% have experienced at least 1 related life event ( $M = .43$ ;  $SD = .43$ ). No differences were found in number of ACEs across sex ( $t(42)$ ,  $= -.446$ ,  $p = .33$ ;  $-1.144$ ), primary diagnosis ( $F(2, 41) = .487$ ,  $p = .62$ ,  $\eta^2 = .023$ ) or White, non-Hispanic and Black non-Hispanic races ( $t(38)$ ,  $= .279$ ,  $p = .78$ ;  $d = 0.088$ ). The number of ACEs and the severity of ASD were also not significantly correlated ( $r = .106$ ;  $p = .246$ ).

Differences in the number of ACEs across insurance types were significant ( $F(2, 41) = 4.468$ ;  $p = 0.018$ ;  $\eta^2 = .179$ ). Post-hoc Tukey HSD Test for multiple comparisons found that the mean value of ACEs was significantly difference between private insurance ( $M = .36$ ;  $SD = .674$ ) and Tricare ( $M = 2.75$ ;  $SD = .957$ ;  $p = .027$ , 95% CI =  $(-4.54, -.24)$ ).

**Conclusions:** Consistent with literature, children referred for a neurodevelopmental evaluation have a high likelihood of having experienced an ACE or Related Life Event. Similar to previous studies, little to no difference in ACEs in children with ASD were found across gender and race; however, differences in insurance coverage were associated with number of ACEs (Berg et al., 2018). In particular, the possible higher levels of ACEs for children autism with military-based insurance deserves further attention. Research has identified that military families with a child with ASD may demonstrate particular challenges (Klin et al., 2015; Davis & Finke, 2015). Further, military families with a child with ASD may be at additional risk for high levels of stress and therefore increased levels of ACEs for their children. Opportunities for targeted family support may be available based on identified ACEs. Limitations include the small sample size.

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**526.097 (Virtual Poster) Access to Care: Training and Partnership with Primary Care in Colorado**  
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**Background:** Autism is a prevalent neurodevelopmental disorder identified in 1 out of 54 children nationwide. Symptoms of autism can be detected in children 2 years of age; however, only 44% of children under 36 months have received an autism diagnosis. Earlier diagnosis is crucial because early intervention affords the best prognosis across the lifespan. Primary care providers (PCPs) serve an important role in early identification of developmental delays and symptoms of autism. Therefore, expanding PCPs' knowledge of autism and screening skills can help speed up the time from first concerns about a child's development to screening, diagnosis, and intervention.

**Objectives:** The program ACCESS (Access to Care for Communities through Education, Service and Support) aims to increase access to a timely diagnosis of autism and related neurodevelopmental disabilities for children living in Colorado's rural and underserved communities. This presentation will focus on the program's aim to 1) expand the knowledge, comfort, and skills of PCPs through direct education and training, and 2) support PCPs by providing on-site and telehealth autism evaluations and follow-up visits.

**Methods:** The program ACCESS has partnered with ECHO (Extension for Community Health Outcomes) Colorado, a nonprofit organization dedicated to increasing the management of complex health issues by using technology to bring professionals together to share knowledge, experiences, and viewpoints. Specifically, the Autism ECHO series (10 virtual session didactic training program) trains PCPs on core concepts including the screening, diagnosis, and medical/behavioral management of children with autism and related neurodevelopmental disabilities. An additional training pathway includes Community of Practice Monthly Case Review, a virtual meeting where PCPs share complex cases and consult with developmental specialists including psychologists, developmental behavioral pediatricians, and licensed clinical social workers. Importantly, the ACCESS program bridges the Autism ECHO training with an Outreach Clinic that provides interdisciplinary evaluations with psychologists and developmental behavioral pediatricians, and referrals to a social work team and genetic counselor. A bilingual/bicultural psychologist completes Spanish-language testing in the context of Colorado's large Spanish-speaking population.

**Results:** To this date, the program ACCESS has successfully trained 8 cohorts of PCPs through the ECHO training series. In total, over 100 PCPs across 22 Colorado counties have been involved in the ECHO trainings. Additionally, a total of 2 STAT trainings have been completed as part of the ACCESS program, and this effort trained a total of 30 providers to utilize the STAT in their primary care settings. Finally, the ACCESS program has established Outreach Clinics in primary care clinics across 6 rural and under-served communities in Colorado. A total of 30 autism evaluations have been completed, with 43% of those being Spanish-language evaluations.

**Conclusions:** In summary, the ACCESS Program serves families from rural, underserved, and diverse backgrounds in Colorado who face barriers to a timely ASD diagnosis. This innovative combination of virtual and in-person outreach services underlies a novel approach to care pathways that

increases the capacity of PCPs to manage the identification and care of children with ASD and related neurodevelopmental disabilities within their practices.

**526.098 (Virtual Poster)** Better Together: Using a Coaching Model to Support Teachers' Use of Evidence-Based Practices with Students on the Autism Spectrum

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**Background:** Almost all students on the autism spectrum experience educational restrictions that impact their learning and participation at school (92.3%; Australian Bureau of Statistics, 2018). Teacher delivered evidence-based practices (EBPs) can improve student outcomes; yet, translating these from research to practice can be difficult (e.g., Brock et al., 2020). The need to provide tailored supports, such as coaching, has been highlighted as a potential strategy in international research to bridge this gap (e.g., Ruble et al., 2013). However, there is limited evidence, drawing on the views and experiences of teachers, to guide the development and implementation of such models in general education to inform tailored solutions and build capacity for sustained change.

**Objectives:** Our interdisciplinary team aimed to build capacity of Australian general education teachers to select and implement EBPs via development and evaluation of a coaching model with stakeholder input across each phase.

**Methods:** A mixed methods approach was used across three iterative phases: (1) Qualitative study of 21 teachers to understand needs, barriers, and facilitators to EBP, and attitudes toward coaching; (2) Development and implementation of EBP and coaching training with 35 teachers; (3) Evaluation of the coaching model within four schools. Phase 1 data collection was conducted across three focus groups. Phase 2 involved face-to-face training of teachers (day 1) and senior teachers (day 2) in autism and EBP. Phase 3 focused on implementation of Phase 2 training with online training covering core components that could be shared with others. Schools were randomly assigned to information only (two schools) or coaching support (two schools). Phase 2 and 3 included quantitative measures of self-efficacy to work with students on the spectrum, knowledge/use of EBP, attitudes to EBP, attitudes to coaching, and social validity of training. Measures were completed immediately pre/post training in phase 2 and at 10 weeks follow-up. Measures were completed at school entry to Phase 3, four weeks post-training, and at the end of the school term.

**Results:** Phase 1 analysis identified themes that informed the content and design of the coaching model. In phase 2, results from day 1 participants were used to refine content and targeted recruitment for day 2. Participants from day 1 showed significant increases in confidence working with students on the spectrum ( $t(17)=6.90, p<.001$ ) and in providing peer coaching to other staff ( $t(17)=3.82, p<.001$ ). Day 2 participants demonstrated significant improvements in self-efficacy ( $t(16)=4.12, p=0.001$ ) and coaching investment ( $t(16)=2.14, p=0.048$ ). In Phase 3, trained coaches reported on their own experiences, as did teachers receiving coaching in terms of change to their practice, attitude to coaching, and attitudes to EBPs.

**Conclusions:** Our findings build on evidence from international research, by demonstrating the value of including teacher perspectives in the design and refinement of a coaching model in the Australian context. Future research that investigates fidelity of implementation of EBPs and student outcomes is an important next step to evaluate whether changes in EBP implementation support students on the spectrum to achieve their potential at school.

**526.099 (Virtual Poster)** Evaluating Factors That Influence Provider ASD Referrals in Underserved Primary Care Settings

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**Background:** Early identification and intervention for autism spectrum disorders (ASD) promote best outcomes for the child and their family<sup>1</sup>. Universal ASD screening has been recommended to promote access to referrals for ASD services<sup>2</sup>. Differences in ASD referral rates have been observed across racial boundaries<sup>3</sup> and based on the presence of caregiver or provider concern<sup>4</sup>, but few studies have explored how these factors interact. Further understanding of considerations that catalyze a primary care provider's (PCP) decision regarding different types of referrals may mitigate service access issues and indicate areas to improve provider knowledge.

**Objectives:** To evaluate factors that influence PCP decision-making when referring at-risk toddlers for ASD services via Classification Trees (ctree), which use "nodes" and "splits" to order predictors in a superordinate way related to how much of the variability in outcome they explain.

**Methods:** A four-item checklist inquired about child characteristics (sex, race, ethnicity, familial risk), types of developmental screeners implemented (ASQ, M-CHAT), presence of caregiver and/or provider concern, and types of ASD referrals made during pediatric well-child visits. Sixty-one PCPs completed the checklist for children between 18- and 24-months old. A total of 3,066 checklists were completed across 32 months. Three separate ctree models predicted whether referrals were made for Dx evaluations (Dx), EI services (EI), or any ASD services (Any Referral; Dx, EI, other), respectively. All three ctrees were developed using a training dataset and were evaluated on test/validation dataset using the same 80:20 data split. The predictors considered were child characteristics, screening results, and the presence of caregiver and/or provider concern.

**Results:** The Any Referral ctree had five nodes, two splits, and three levels ( $p = 0.01$ ). The final model included the predictors of ASQ and M-CHAT results and predicted whether a PCP acted with high accuracy, sensitivity, PPV, and moderate specificity and NPV (Table 1). Both PCP and/or caregiver concern were significant predictors but did not explain variability beyond screening results and are not retained in the final ctree; child characteristics were not significant predictors. The two ctrees models conducted for Dx and EI referrals, respectively, did not significantly predict the outcomes.

**Conclusions:** Results indicate that a child failing either screener between 18- and 24-months old was associated with the PCP referring for ASD services. Interestingly, a child failing the ASQ, a generalized developmental screener, was more influential than the child failing the M-CHAT, an ASD-specific screener. Provider and caregiver concern was a potential influencing factor, but PCPs did not act on concern alone. There was no indication that child characteristics, such as race, led PCPs to make certain referral decisions.

Our results also suggest that there is no clear decision-making process for either diagnostic or generalized EI referrals given the current predictors. These predictors did not explain the decision to refer to EI services, yet referral to these services is a recommended guideline for when developmental delay and/or ASD concerns/risk are present. Overall, further investigation is needed to better understand PCP decision-making and explore ways to further systematize the process for referrals beyond current guidelines.

**526.100 (Virtual Poster)** Exploring the Impact of Policy on Access to Early Autism Diagnosis and Other Services in Five States

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**Background:** State policy—defined as any rule, regulation, law, or practice—and context more broadly have been shown to impact an array of health outcomes (e.g., childhood obesity, binge drinking). The enactment of certain state laws such as Medicaid Home and Community-Based Services waivers and Autism Insurance Mandates has been linked to improved service delivery for autistic children. Yet little research has examined state policy and context more comprehensively in relation to early autism diagnosis and timely access to other, needed autism-related services. By identifying which policy and contextual factors substantially influence autism-related service access and delivery, it will be possible to advance policy promoting health for autistic individuals and their families across states.

**Objectives:** This study sought to identify policy and other contextual factors across five states participating in a national autism collaborative (Arizona, California, Connecticut, Massachusetts, and Pennsylvania) that impact access to early autism diagnosis and other, needed autism services for children.

**Methods:** We conducted semi-structured interviews by telephone or video conference during 2021 with a purposive sample of 17 experts in autism and/or state policy across Arizona, California, Connecticut, Massachusetts, and Pennsylvania. Snowball sampling was used to determine additional key informants in each state. Interviews were audio recorded and transcribed. Preliminary data were coded using applied thematic analysis.

**Results:**

Eight themes related to policy and contextual factors influencing access to early autism diagnosis and other services across the five states were identified. The following three themes were related to early autism diagnosis: (1) initiatives to promote widespread screening and referral in primary care facilitate early diagnosis; (2) lack of trained and ethnically diverse providers, limited availability of culturally and linguistically appropriate evaluation tools, and poor reimbursement for comprehensive evaluation impede early autism diagnosis; and (3) community autism stigma and family ability (e.g., time, perceived need) to pursue services affect early diagnosis. The following four themes additionally emerged that were related to accessing other, needed autism-related services: (4) needing an autism diagnosis for insurance coverage and/or Medicaid waiver eligibility is a barrier to timely service access; (5) differential financing within states affects the geographic availability of high quality autism services; (6) variable provider training and state licensure requirements impact the quality of autism services families receive; and (7) early intervention enrollment facilitates special education evaluation and access to autism-related services via an individualized education program once children become school aged. The final theme identified pertained to both early autism diagnosis and other, needed service access: (8) state autism agency organization including structure and interagency coordination, as well as the provision of resources influence service access.

**Conclusions:** Policy and contextual factors relevant to workforce, insurance reimbursement, program eligibility, financing, and the organization of service agencies were identified as influencing access to early autism diagnosis and other, needed autism-related services across the five states. Study findings will inform the development of an autism state policy index.

**526.101 (Virtual Poster)** Feasibility and Acceptability of an Integrated Evaluation Program for Autism Spectrum Disorder in a Pediatric Primary Care Clinic

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**Background:** Primary care providers (PCPs) are often the first to identify concerns for Autism Spectrum Disorder (ASD) through routine screening in the first two years of life. However, most children do not receive a diagnosis of ASD until after age four. Delays in receiving a diagnosis of ASD disproportionately impact children who are historically disadvantaged based on socioeconomic status or race. To address these issues, leaders in the field have called for the expansion of ASD diagnostic services in primary care by better equipping PCPs to make a diagnosis, particularly when symptoms are clear. However, PCPs alone do not have the ability or capacity to serve as an agent of change in decreasing time to ASD diagnosis. One can therefore look to other clinicians embedded within pediatric medical homes to facilitate increased access to services for children at risk for ASD. It is becoming an increasingly common practice for mental health clinicians, such as psychologists, to be embedded within primary care. Therefore, enabling such providers to provide ASD-specific services offers a promising opportunity to address barriers to accessing services after PCPs identify concerns.

**Objectives:** To evaluate the feasibility, acceptability, and benefits of a program in which embedded psychologists provide ASD diagnostic evaluations in an urban primary care setting.

**Methods:** Children with suspected ASD were referred by their PCPs (pediatricians, nurse practitioners, pediatric residents) or embedded primary care psychologists for an ASD evaluation. Evaluations were conducted by an embedded psychologist with supervision and/or consultation from a psychologist who specializes in ASD. Services were provided in-clinic and via telemedicine due to COVID-19 related disruptions to clinical services. Descriptive data related to sample characteristics were collected and referring providers completed follow-up provider satisfaction questionnaires.

**Results:** Sixty-six families were referred and completed evaluations between October 2019 and October 2021. Sixty-five percent of the evaluations were conducted via telemedicine and thirty-six percent were conducted in person. Mean child age was 34.3 months (SD: 13.9; 59% male). Eighty-two percent of children were Black, 87% of families were insured by Medicaid, and 23% were not primary English speakers. Sixty-eight percent of children received a diagnosis of ASD, 12% had the diagnosis ruled-out, and 20% had the diagnosis deferred, usually due to telemedicine services being insufficient for diagnostic clarification, with follow-up in-person testing recommended. The 17 referring providers who completed questionnaires were overall Satisfied/Very Satisfied with the assessment program (mean satisfaction rating [1-5] = 4.35). Providers ranked the following aspects of the program as “most important”: 1) Accessing evaluations regardless of barriers that may otherwise prevent them accessing this service (e.g., insurance, transportation) and 2) short wait-times for evaluations.

**Conclusions:** Data suggest that an integrated ASD diagnostic clinic in primary care is an acceptable and feasible approach to improve access to ASD evaluations. The program was successful in providing services to families who previously had difficulty accessing care. Expansion of such programs, which increase provider capacity and provide services in the medical home, has the potential to decrease racial and socioeconomic inequities in access to ASD diagnostic services.

**526.102 (Virtual Poster) Feasibility of Screening of Pediatric Neurodevelopmental Patients for Suicide Risk Via Telehealth: A Pilot of the ASQ Instrument Validation Study**

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**Background:** Suicide is the second leading cause of death for youth aged 10-24 years (Centers for Disease Control and Prevention, 2019). Previous research has suggested youth with Autism Spectrum Disorder (ASD) and other neurodevelopmental disorders (NDD) are at increased risk for suicide. Screening tools are available to detect suicide risk in youth, identifying patients who require further assessment, but there are no screening tools that have been specifically validated for youth with NDD. In a previous investigation of universal suicide risk screening in an outpatient setting for youth with NDD, 73.3% of patients completed screenings with a 6.8% positivity rate (Rybczynski et al., 2021.) Notably, clinics serving children with ASD had higher rates of positive screenings compared with all other clinic attendees.

**Objectives:** To examine the feasibility of administering a suicide risk screening tool to children with ASD and/or other NDD through telehealth.

**Methods:** As part of a suicide risk screening instrument validation study, ongoing recruitment is occurring across four clinics serving youth with NDD at the Kennedy Krieger Institute. Eligible children ages 8-17 years, English-speaking, and verbally fluent are recruited during intake for medical appointments. Parents/Guardians are asked if they agree to hear about a research study and, if they agree, are contacted by study staff to obtain parental/guardian informed consent and child assent. During a subsequent telehealth research appointment, three measures of suicide risk are completed: First, child participants complete the Ask Suicide-Screening Questions for Youth with Autism and Intellectual Disability (ASQ-AID). This questionnaire includes the five items of the validated tool, the Ask Suicide-Screening Questions (ASQ), as well as an additional 10 candidate items. Second, parents/guardians complete the ASQ-AID, modified for caregiver self-report. Lastly, both are validated against a gold-standard brief clinician interview using the ASQ Brief Suicide Safety Assessment. The clinician is blinded to results of the ASQ-AID. Children who screen positive follow standard clinic safety procedures, including notifying the parent(s) and guiding them through the process of safety planning, and if necessary, scheduling follow-up appointments for the same day or following day.

**Results:** Of 53 eligible patients to date, 32 children were enrolled and screened, with an enrollment rate of 60.4%. Of those 32, 93.8% (n=30) were diagnosed with an NDD including ASD and 71.9% (n=23) with psychiatric disorders. 37.5% (n=12) were positive on any of the three suicide risk tools. 100% of the positive screens were “non-acute” positives and did not require emergency safety precautions. Mental health care providers were contacted for all positive participants. 96.3% of parents and 53.1% of patients were in favor of screening on study evaluation measures.

**Conclusions:** This study has demonstrated the feasibility of administering a suicide risk screening tool to psychiatric and medical pediatric patients with NDD, including ASD, safely over telehealth. Preliminary pilot data reveal a high screen positive rate, which may reflect screening in a sample enriched for psychiatric disorders or possible selection/ascertainment bias, and underscores the need for a validated suicide risk screening instrument for youth with NDD.

**526.103 (Virtual Poster) Implementing Standard of Care Diagnostic Genetic Testing for Autism Spectrum Disorders in Outpatient Psychiatry Clinics**

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#### Background:

Autism spectrum disorders (ASDs) are among the psychiatric conditions with the highest genetic burden, with clinically identifiable pathogenic genetic changes explaining up to 40% of cases. This has led to the recommendation of genetic testing, specifically chromosomal microarray and Fragile X testing, as a key element in the evaluation of people with ASD. However, only a small proportion of patients with this diagnosis receive such tests, highlighting a stark contrast between professional recommendations and clinical practice.

#### Objectives:

We aimed to increase the uptake of diagnostic genetic testing for ASDs. To maximize the generalizability of our efforts to other clinical sites, we focused on implementing genetic testing strategies at the outpatient level of care; at this level, testing is generally covered by medical insurance companies after a preauthorization process.

#### Methods:

Through partnerships with families, advocates, and hospital administration, we developed diverse strategies ranging from low to high levels of support to help clinicians in our system implement genetic testing and to communicate the availability of these services to the ASD community. These included dedicated administrative support for the testing preauthorization process, establishment of hospital-wide agreements with genetic testing companies, educational materials to discuss the process with patients, clinician and trainee education, shift to buccal swab collection, an in-house genetic counseling service to explain and perform genetic testing in families who agreed and deliver the results, and a genomic psychiatry consultation service to provide psychiatry recommendations based on a wide array of abnormal genetics results. Services are available in both English and Spanish. We anchored these interventions on the Consolidated Framework for Implementation Science (CFIR; Figure 1).

#### Results:

Our preliminary data shows that genetic testing at our hospital increased with these strategies. While some psychiatrists started using the available supports to initiate genetic testing themselves, strategies that provided a higher level of support were favored among clinicians. The high demand for these services supported their continued availability and viability. Families received counseling, testing, and psychiatric recommendations in their native language, which was Spanish in over 20% of cases. The yield of pathogenic genetic testing results appears to be in line with previous reports, and families reported a high level of satisfaction and engagement with these services.

#### Conclusions:

Synergistic and diverse implementation strategies for outpatient genetic testing in psychiatry achieve increases in the rate of adoption of these professional recommendations, with high satisfaction reported by ASD families and clinicians alike.

**526.104 (Virtual Poster)** Increasing Understanding of Autism Among University Students Using ‘the Birthday Party’ Psychoeducational Video  
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#### Background:

Understanding of autism in the general population is often limited (Tipton & Blacher, 2004), which can have negative consequences for autistic people and their families (Kinnear et al., 2016). Psychoeducational tools can be an efficient way of educating people about autism (Gillespie-Lynch et al., 2015). However, training packages are seldom evidence-based and empirical testing of their effectiveness is rarely conducted. We evaluated the effectiveness of an 18-minute evidence-based psychoeducational video, The Birthday Party ([www.autismchildsigns.com](http://www.autismchildsigns.com)), in increasing understanding of autism and improving attitudes in undergraduate students. The film includes the 14 most discriminating items (Carrington et al., 2015) from the Diagnostic Interview for Social and Communication Disorders (DISCO; Wing et al., 2002). Autistic community members gave feedback on the film during development. The film highlights five ‘SIGNS’ (Social interaction; Imagination; Gestures; Narrow interests; Sensory responses) of autism and focuses on three autistic children (two boys, one girl) attending a birthday party.

#### Objectives:

To assess the effect of The Birthday Party, a psychoeducational video, on the understanding of autism and attitudes towards autism in undergraduate students.

#### Methods:

In study 1, 71 students (55 female; mean age = 19.15 years, SD = 1.56) were shown either The Birthday Party (N = 36) or an educational film about dyslexia (N = 35). At baseline, groups were matched on previous knowledge of autism (Autism Awareness Survey; Gillespie-Lynch et al., 2015) and previous contact with autistic people (Level of Contact Report; Holmes et al., 1999). Following video presentation, we assessed understanding of autism by presenting participants with ten clinical vignettes that described four autistic children, four children with other childhood disorders, and two with no disorder. Participants had to identify the correct diagnosis for each vignette.

In study 2, we replicated the original design in 136 students (123 female, 2 'other'; mean age = 19 years; SD = 1.92). However, The Birthday Party (N = 38) and dyslexia groups (N = 36) were joined by a third group that read the transcript of The Birthday Party (N = 62). In addition, we measured attitudes to autism following the video/text presentation using an adapted attitude measure (Nevill & White, 2011).

#### Results:

In both studies, participants who watched The Birthday Party video were significantly better at recognising autistic children from clinical descriptions compared to participants who watched the dyslexia video. However, preliminary analysis of Study 2 indicates that those who read The Birthday Party transcript did not significantly differ to those who watched The Birthday Party video. There was no significant difference between groups in their attitudes to autistic children.

#### Conclusions:

Training materials are commonly used to support autism education, but few have an evidence-base or have their effectiveness tested empirically. We established that The Birthday Party has a significant impact on the understanding of autism in undergraduate students, which was replicated across two independent samples. However, the video did not improve attitudes towards autistic children. Future research should investigate the effect of the video, which is available in seven languages, on improving understanding in frontline professionals.

#### **526.105 (Virtual Poster)** Integrating Routine Screening and Identification Strategies into Alabama's Part C/Early Intervention System

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**Background:** Children under age 3 with suspected or confirmed Autism Spectrum Disorder (ASD) benefit from a mix of naturalistic and developmental interventions that actively involve their families and address core and associated ASD characteristics as early as possible (Zwaigenbaum et al., 2015). Many children and families receive early intervention (EI) services through federally funded Part C, which mandates that EI is provided to children with developmental delays under age 3. Although autism is a qualifying diagnosis within Alabama's Early Intervention System (AEIS), few children receive this diagnosis prior to age 3, as Alabama children are diagnosed nearly 2 years later than the national average (Baio et al., 2014). This delay limits access to ASD-specific interventions that could be implemented in the AEIS setting (Pickard et al., 2021). Building capacity within community systems to screen and deliver ASD-specific interventions promotes equitable access for families of children with early ASD characteristics (Wallis, 2020).

**Objectives:** The current project describes collaborative partnerships between AEIS and a multidisciplinary statewide team of researchers, clinicians, caregivers, and other stakeholders in developing and implementing an ASD screening pilot within 4 EI programs serving 18 of Alabama's 67 counties. Additional goals include identifying the number of children referred to AEIS who are at-risk for or diagnosed with ASD and investigating score patterns relative to developmental and demographic variables.

**Methods:** The Alabama Advancing Autism Initiative team developed a pilot to integrate the Modified Checklist for Autism in Toddlers- Revised with Follow-Up (M-CHAT-R/F; Robins et al., 2009) at initial eligibility evaluations with referred children between 18 and 30 months of age. Children identified as at-risk were simultaneously referred for comprehensive ASD community evaluation as well as ASD-specific interventions within AEIS. In addition to M-CHAT-R scores and demographics (e.g., sex, age, county, insurance type), participating programs reported caregiver and provider ASD concerns and diagnostic outcomes. Additional data are available regarding the areas of developmental delays observed in each child.

**Results:** M-CHAT-R has been completed regarding 142 children, with 79 (56%) identified as at-risk, of which 54 (68%) families consented to referral for comprehensive ASD assessment. Of the 16 cases for whom diagnostic outcome is available, 13 (81%) received an ASD diagnosis. Preliminary descriptive analyses were conducted on a subset of 125 children. 49 (39%) of these children failed the initial screen, and 31 warranted the Follow-up interview with 26 obtaining failing scores. Parents of 21% of children who failed noted ASD concerns at time of referral. Average age at referral among at-risk children was 21.5 months, one-third were girls, and no differences were found between black and white children. Outcomes are pending for the remainder but are expected within 3 months of referral due to collaborative relationships within the pilot.

**Conclusions:** This pilot has revealed several opportunities for working with state systems of care for young children with ASD and added a structured process and objective measure to empower providers and caregivers to discuss concerns regarding possible ASD to ultimately increase access to ASD-specific intervention within existing state systems.

#### **526.106 (Virtual Poster)** Law Enforcement Officers' Interactions with Individuals with Autism: Commonly Reported Calls and Outcomes

**Background:** Individuals diagnosed with autism are significantly more likely to experience contact with law enforcement officers (LEOs) than others (Curry et al., 1993). Research suggests between 8 – 20% of individuals with autism have experienced LEO contact, with approximately 5% leading to arrest (Rava et al., 2017) and 20% leading to involuntary hospitalization (Gardner & Campbell, 2020). The disproportionate contact with LEOs in this population is often attributed to the core impairments characterized by autism, including deficits with social interactions and communication as well as atypical behaviors (Clark Mogavero, 2018). Although research indicates that autistic individuals interact with LEOs as victims of crime, suspects, elopement, and domestic disputes (Railey et al., 2020), there is little research into the outcomes of these interactions, and characteristics of LEOs and individuals with ASD that may impact the outcomes of these interactions.

**Objectives:** The primary author created a training program for LEOs that prepares officers to respond to calls involving autistic individuals. As part of this training, LEOs reported on the most recent call they responded to that involved an autistic individual. The purpose of the present study was to categorize the (a) most commonly reported calls and (b) level of force used by LEOs during the call.

**Methods:** One-hundred and thirty ( $N = 130$ ) LEOs attended seven separate training sessions. LEOs were 63.1% male with a mean age of 41.02 years ( $SD = 10.4$ ) and 12.98 years of law enforcement experience ( $SD = 9.4$ ). Most LEOs ( $n = 74$ ; 56.9%) reported no prior training in autism despite state mandated annual training effective in 2016. To evaluate LEOs' prior experience with ASD, participants completed a questionnaire that included professional experiences interacting with individuals with ASD including their most recent calls within the last 12 months. LEOs also reported on the circumstances and outcomes of the calls.

**Results:** The most common call ( $n = 47$ ; 36.2%) involved responding to disruptive behavior without aggression (e.g., 'out of control behavior'). The second most common call ( $n = 25$ ; 19.2%) involved responding to suspected abuse or neglect. The third most common call ( $n = 17$ ; 13.1%) involved aggression towards self or others (e.g., 'slapped caregiver,' 'subject was hurting himself'). The most common outcome ( $n = 72$ ; 55.4%) involved providing support to the individual or family (e.g., 'referred to Doctor'). The second most common outcome ( $n = 36$ ; 27.7%) involved use of extreme force (e.g., handcuffed; arrested; involuntary psychiatric hospitalization). The third most common outcome ( $n = 12$ ; 9.2%) involved low level controlling behavior (e.g., 'called parents to take home').

**Conclusions:** More than half of LEOs reported not completing mandatory autism training, despite the state requirement that LEOs complete such training since 2016. Approximately one-third of calls were in response to non-aggressive disruptive behavior. Roughly half of calls were resolved using supportive behaviors, such as LEOs referring families to behavioral health resources and LEOs remaining with families until resolution. Future research should examine the impact of autism specific training on LEOs' use of extreme force.

#### **526.107 (Virtual Poster) Reproductive Health and Obstetrics/Gynecology Health Care Use in Autistic Adults**

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**Background:** Adults with disabilities often have less access to reproductive and sexual health resources than adults without disabilities. Autistic adults may experience additional barriers because of social communication and sensory differences and low provider awareness of autism in adult medicine settings. Furthermore, research suggests autistic adults may be at higher risk of menstrual abnormalities and negative experiences with pain and emotion/behavior regulation related to menstruation than non-autistic adults. Improved access to obstetrics/gynecology (OB/GYN) services may help many autistic adults better manage menstrual conditions and promote their sexual and reproductive health.

**Objectives:** To characterize the utilization of OB/GYN healthcare among autistic adults compared with neurotypical adults.

**Methods:** Our study took place at Kaiser Permanente Northern California (KPNC), a large, integrated healthcare delivery system. Among members aged 18+ who were enrolled in the KPNC health plan from 2017 to 2019 and assigned female sex at birth, we identified two cohorts: autistic adults ( $n=1438$ ) and neurotypical adults ( $n=5752$ ) matched 4:1 on age and KPNC membership length to the autistic cohort. From electronic health records, we extracted information on sociodemographic factors, health conditions, and healthcare utilization during 2017-2019. We compared utilization between groups using chi-squared tests and risk ratios (RR) estimated with modified Poisson regression, adjusting for age, race/ethnicity, health insurance payer, pregnancy during the study period, and frequency of primary care utilization.

**Results:** The prevalence of menstrual disorders (23-25%) was similar across both groups after adjusting for covariates including OB/GYN use; however, some conditions such as polycystic ovary syndrome were more common in the autistic group than in the neurotypical group. In comparison with neurotypical adults, autistic adults were less likely to visit an OB/GYN provider for non-obstetric reasons (59% vs. 73%) and were less likely to receive routine screenings for cervical cancer (47% vs. 72%, among ages 21-65) and breast cancer (75% vs. 84%, among ages 40+) (Table 1). While autistic adults were generally less likely than neurotypical adults to use any form of reversible hormonal contraception overall (38% vs. 51%), they were 3.6 times (95%CI: 2.4, 5.5) as likely to use oral contraception for therapeutic rather than birth control purposes and 1.6 times (95%CI: 1.3, 2.0) as likely to use injectable contraception such as Depo Provera. These disparities between autistic and neurotypical adults in OB/GYN care and cervical cancer screenings were most pronounced during young adulthood (ages 18-30). Some health diagnoses were associated with OB/GYN utilization among autistic adults; for example, epilepsy (RR: 0.76, 95%CI: 0.62, 0.92) and gender dysphoria (RR: 0.64, 95%CI: 0.40, 1.02) were associated with a lower likelihood of cervical cancer screening while anxiety, depression, and ADHD were associated with a higher likelihood of screening.

**Conclusions:** In comparison with neurotypical adults, autistic adults have lower utilization of multiple types of reproductive health care including OB/GYN visits, routine preventive screenings, and use of hormonal contraception. These findings reflect care in an integrated healthcare system with strong outreach programs for preventive care. Thus, these reproductive healthcare disparities may be larger in the broader US population.

**526.108 (Virtual Poster) Service Use Among Asian American Caregivers of Children with Autism**

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**Background:** With a rapid increase in migrants, Asian Americans (ASA) are the fastest growing racial group in the US. It is projected that ASA will be the largest immigrant group by 2060. Accordingly, ASA with autism are increasing (Biao et al., 2018). Recent studies have documented disparities in service use among racial and ethnic minorities, as well as immigrants (Magana et al., 2013; Shattuck et al., 2009). Other studies found that even higher income racial minorities face barriers in service use (Kim et al., 2020; Dababnah et al., 2019). This demonstrates the needs for understanding service use by specific demographic characteristics.

**Objectives:** The purpose of the study is to describe characteristics of service use among ASA caregivers of children with autism.

**Methods:** We developed a survey that includes items about early intervention, various services, and reasons not to use services. Professional translators translated the survey into four languages: Korean, Japanese, Mandarin, and Vietnamese. Participants were eligible to participate if they 1) lived in Maryland; 2) identified as Asian or ASA; 3) and were a parent or other primary caregiver of a child 18 years or younger with autism. Between October 2019 and July 2020, 42 ASA parents of children with autism completed the survey online and in-person. We used descriptive statistics to summarize our findings.

**Results:** About half of the parents who participated were Chinese (54%); the remaining participants were Korean (26%), Indian (5%), Japanese (5%), Vietnamese (5%), Filipino (2%), or Bangladeshi (2%). Most participants were highly educated (80%), had high incomes (About 80% had \$75,000 household income or more), and born outside of the US (84%). More than half of parents (60%) reported they received early intervention through the Maryland Infants and Toddler program (Part C services). Half of the parents reported that health professionals helped them to find early intervention services, while the remaining parents heard from friends (25%) or searched online (25%). The majority of the parents (81%) reported that their children received therapeutic services starting on average at 39 months (SD=21.5). The most used service was speech therapy (69%), followed by Applied Behavior Analysis (33%), occupational therapy (28.6%), and recreational activities (26.2%). The most commonly cited reason for not using services was that they were not aware of services (15-45%, depending on service). However, for ABA services, being on a waiting list was another equally cited reason (15%).

**Conclusions:** To our knowledge, this is the first quantitative study targeting ASA caregivers of children with autism. Compared to other services, many parents used early intervention and speech therapy. The majority of ASA parents found out about early intervention services through health professionals and friends. For them, the lack of awareness was the biggest barrier in accessing services. Results imply that formal and informal social networks and information about services are significant factors impacting ASA families' service use. Family support programs or parent-focused interventions should tailor their programs to build social networks and create awareness of available community and clinical services.

**526.109 (Virtual Poster) Subjective Satisfaction of Smart School Programs during Lockdown for COVID-19 Pandemics: Comparison between Subjects with Autism Vs Subjects with Other Neuropsychiatric Disorders.**

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**Background:**

COVID-19 pandemic has forced almost all activities as businesses, schools and entire countries to move completely online. For children and adolescents requiring special education like those affected by neuropsychiatric disorders (NPD), a particular effort was needed to ensure good results. A special program called "Smart School" has been developed between April and June 2020 involving 97 subjects with NPD who were unable to access the school in our Institute, providing materials for specialized didactic, educational and rehabilitative activities.

**Objectives:**

The aim of this study is to compare the acceptance and compliance to Smart School programs between subjects with autism vs subjects with other NPD.

**Methods:**

The study group was composed by 28 subjects with autism (DSM-5 diagnosis), age 5-16 years (mean 11); 26 males and by 69 subjects with other NPD, age 4 – 17 years (mean 11); 32 males

The Smart School Project has foreseen the involvement of 20 Primary School Teachers and 5 specialized operators, 1 Chief of Professional Education that coordinates the whole project in all the different steps, 1 Developmental Psychologist 4 Professional Educators (EP) and 1 Neuro-Psychomotor Therapist of Developmental Age



The overall scheme of Smart School program is the following: The teachers (both Primary and Secondary classes) prepare weekly teaching materials for their students and using the Google-Drive platform they insert them in the link generated for each student.

The specialized operators automatically access the links of Google Drive and check weekly the material sent by teachers to compare and integrate it with the educational project. Through We Transfer, the specialized operators send all the material to the families. After sending the material, the families are contacted by the specialized operators assigned to help and support them both in carrying out the activities and in managing their child and any behavioral problems manifested.

After two weeks from the beginning of the online education (April 2020) the index of appreciation and satisfaction expressed by the children was detected through the principal caregiver (mother in 93%) through a 4-point Lickert scale from 1=unsatisfied to 4= very satisfied

#### Results:

The percentages of satisfactory + highly satisfactory judgment expressed by children and adolescents were 64.49% in group with autism and 25.8% in the group with other NPD ( $p < 0.01$ ). The corresponding percentages expressed by the caregiver were 60.8% and 55.3% ( $p = NS$ ) respectively .

#### Conclusions:

Subjects with autism showed a significantly higher appreciation of smart school online program at variance with subjects with other NPD. Caregivers judgments in the two groups were comparable. Lockdown for pandemic as expected seems to affect less the online education acceptance in students with autism despite their known resistance to the change routine context environment, probably because they suffer less from sociality lacking and because their environment at home seems to them more under control.

#### **526.110** (Virtual Poster) Systematic Adaptation of Evidence-Based Resources to Support Adults with ASD in Community Settings

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#### Background:

The number of adults with autism receiving services through developmental disability (DD) agencies increased by more than 15% from 2009-14, and across the next decade we can expect a 123% increase in the number of individuals with autism transitioning from school-based to adult services (IACC, 2017). These increases have placed growing demand on adult disability service systems including an increased need for staff training on evidence-based practices (EBP) to support adults with autism. The Interagency Autism Coordinating Council (IACC) indicates many challenges faced in working with adults with autism are related to the lack of a well-trained and motivated workforce (IACC, 2017). Further, insufficient use of EBPs is linked to poor pre-service training, lack of supervision, and a low sense that the use of EBP is expected, supported, and rewarded (IACC, 2017). These findings indicate a clear need for professional development to increase staff capacity to use EBPs.

The National Professional Development Center for ASD (NPDC-ASD) developed a model to support increasing the use of EBPs for ASD in public school programs (Cox et al., 2013). The model and resources are associated with increases in overall program quality, use and fidelity of EBP and individual student progress (Odom et al., 2013). Leaders from the California Autism Professional Training and Information Network (CAPTAIN) successfully piloted an adaptation of the NPDC-ASD training model into adult day program contexts.

#### Objectives:

This project used a community-partnered model to evaluate organizational, staff and client needs to inform the adaptation of NPDC-ASD EBP training resources for use within community care facilities serving adults with autism.

#### Methods:

An online survey was sent to community care facility staff and administrators, and parents/caregivers of adults with autism residing in community care facilities. Survey items included demographics and questions about the service context and perceived needs. To expand upon survey data, a focus group was conducted with administrators.

#### Results:

A total of 73 administrators, 13 direct care staff, and 2 parents completed the survey. Staff and administrators identified behavior ( $n=52$ , 22.4%), adaptive skills ( $n=43$ , 18.5%) and mental health ( $n=36$ , 15.5%) as the top areas of client need. Participants reported Antecedent-Based Interventions ( $n=26$ , 19.7%), Reinforcement ( $n=15$ , 11.4%), Prompting ( $n=12$ , 9.1%), Functional Behavior Assessment ( $n=17$ , 12.9%), and Differential Reinforcement ( $n=15$ , 11.4%) as the most helpful EBPs for their facility. The majority of administrators ( $n=25$ , 41.7%) reported that professional development in EBPs for skills teaching and/or behavior management occurs a few times per year.

Focus group findings identified barriers to staff trainings as well as suggestions for adaptations. Administrators primarily emphasized staff knowledge, attitudes, and skills as barriers and suggested trainings should be practical, include an ongoing coaching component to observe the application of knowledge, and be interactive to increase engagement.

#### Conclusions:

Given these results, interactive video training modules were developed for two EBPs and materials including a site assessment checklist were adapted for the service context. The next step in this project is to evaluate the effectiveness of the training modules and coaching model in three community care facilities.

**526.111** (*Virtual Poster*) Talking about Me: An Autistic Take on Autism Terminology and Language  
*S. C. Jones, J. Lowe, C. Gordon and S. Mizzi, Australian Catholic University, Melbourne, VIC, Australia*

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#### Background:

The public discourse surrounding the use of identity-first or person-first language in relation to autism has become a mainstay debate among autism researchers, health services and the autism community. Kenny (2015) reports identity-first language is preferred by autistic adults and parents/family members who care for autistic people in the UK, whilst person-first language is endorsed by professionals and community members. In relation to nomenclature, Bury et al., (2020) – using a ranked preferences methodology – found the term ‘person on the autism spectrum’ is preferred by autistic Australians.

#### Objectives:

The aim of this study was to understand the Australian autism community’s preferences in relation to autism language and terminology. The perspectives of autistic adults were also compared to the perspectives of family members and carers of autistic people.

#### Methods:

The research team, led by an autistic researcher, designed and implemented an online mixed method survey in consultation with a panel of experts – that is, autistic adults, parents and carers of autistic people. Data were collected in June 2021 and a combination of multiple choice and open-response questions provided an opportunity for participants to share their personal preferences and views on autism terminology and language. The perspectives of 1,666 autistic people were provided by 1,412 participants, including 634 autistic adults and 778 family members and carers of autistic people.

#### Results:

Participants were asked to select their preferred term(s) for autism from the options: autism, ASD, the spectrum, Aspergers, or other (multiple responses allowed). More than two-thirds (71.9%) of autistic respondents selected the term ‘autism’ and only 32.2% selected ‘ASD’. Family/carer participants were less likely than autistic people to select ‘autism’ (63.8%) and more likely to select ‘ASD’ (39.6%). Although ‘Aspergers’ has not been a valid diagnosis since the DSM-5 was released in 2013, 20% of autistic people and 13% of family/carers nominated this as a preferred term. Other preferred terms noted in the open-ended responses included Aspie, ASC (Autism Spectrum Condition), and neurodiverse/neurodivergent; and both groups emphasised the importance on following the lead of the autistic community.

More than half (57.7%) of autistic adults preferred identity-first language, whilst only 11% preferred person-first language; approximately one quarter (27%) had no preference. In contrast, only 27.1% of family members/carers preferred identity-first language, 28.9% preferred person-first language and 36.9% had no preference. In the open-ended comments both groups emphasised the importance of respecting autistic people’s personal preferences in language use.

#### Conclusions:

Autistic adults were five times more likely to indicate a preference for identity-first than person-first language. Conversely, family/carer participants were slightly more likely to indicate a preference for person-first than identity-first language. This divergence may reflect varying perspectives on the extent to which autism is an integral part of the individual. There is a need for further research into these differing perspectives and the extent to which they contribute to, or inhibit, autism acceptance among individuals, families and communities.

**526.112** (*Virtual Poster*) Trends and Variations in Receiving Care from Psychiatric Providers within 30 Days of Psychiatric Emergency Department Visits Among People with Autism Spectrum Disorder  
*G. Liu<sup>1</sup>, L. Kong<sup>1</sup>, D. Ba<sup>1</sup> and M. Murray<sup>2</sup>, (1)Public Health Sciences, Penn State University College of Medicine, Hershey, PA, (2)Department of Psychiatry/Division of Autism Services, Penn State University College of Medicine, Hershey, PA*

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Background: People with autism spectrum disorder (ASD) are more likely to experience psychiatric crises that require emergency department (ED) visits than those without ASD. It is critical for them to receive psychiatric care soon after these acute episodes. However, little is known on the trends and variations in utilization of service from psychiatric providers after ED visits.

**Objectives:** This study uses a large, national healthcare claims database of a privately insured population in the United States to examine the pattern of psychiatric care received within 30 days of psychiatric ED visits among people with ASD.

**Methods:** Using the 2005-2018 IBM MarketScan® database, we designed a retrospective cohort study to examine the visits to psychiatric providers including psychiatrists and psychiatric nurses within 30 days of the psychiatric ED visits among people with ASD aged under 65. We identified people with ASD as those with  $\geq 1$  inpatient or  $\geq 2$  separate outpatient diagnoses of ASD (ICD-9 code: 299; ICD-10 code: F84). We used the combined information from service place, category and provider to identify ED visits, of which those due to psychiatric reasons were further identified according to the primary/second diagnosis (ICD-9: 290-319; ICD-10: F01-99). For a subject's ED visit to be included in the analysis, a continuous enrollment of  $\geq 1$  year prior to and  $\geq 30$  days after the ED visit was required. Descriptive analyses and multivariable logistic regression are used to examine the trends and variations in receiving care from psychiatric providers in conjunction with other factors.

**Results:** Our study cohort consisted of 56,227 people with ASD, contributing 135,051 psychiatric ED visits from 2006 to 2018. The rates of receiving care from psychiatric providers within 30 days after ED visits (30-Day PsyCare) were generally low overall ( $<35\%$ ), and across all genders, age groups and types of residence (Figure 1). There were significant geographic variations across the states in 30-Day PsyCare (Figure 2). On one hand, states like Iowa, Alaska, and Rhode Island had higher rates above 40%; on the other hand, the rates in Mississippi, Arkansas, Tennessee, and Hawaii were below 20%. Multivariable logistic regression analysis confirmed the findings from the descriptive analysis that there existed significant demographic and geographic variations in the odds of receiving 30-day PsyCare. In particular, living in a rural residence was associated with decreased odds of receiving 30-Day PsyCare than in an urban residence (adjusted Odd Ratio: 0.72; 95% Confidence Interval: 0.67-0.78). Adolescents and young adults were more likely to receive 30-day PsyCare while children aged 12 or younger were the least likely. Other mental health comorbid conditions were strongly associated with 30-day PsyCare (4.96; 4.63-5.37). However, Intellectual disabilities were negatively associated with 30-day PsyCare (0.87; 0.82-0.92), so was history of epilepsy/seizures (0.68; 0.64-0.72).

**Conclusions:** This study documents the consistent trend of low utilization of, and significant geographic/demographic variations in psychiatric care within 30 days of psychiatric ED visits among people with ASD. Further studies are warranted in identifying barriers and points of interventions to improve the post-ED psychiatric care for this vulnerable population.

## Social Cognition and Social Behavior

### PANEL — SOCIAL COGNITION AND SOCIAL BEHAVIOR

#### 214 - Perceptions and Experiences of Social Acceptance and Peer Victimization for Autistic Youth and Adults

**Panel Chair:** **Hannah Morton**, *Binghamton University, Binghamton, NY, Oregon Health & Science University, Portland, OR, Binghamton University, Binghamton, NY, Oregon Health & Science University, Portland, OR*

**Discussant:** **Jonathan Campbell**, *Psychology, Western Carolina University, Cullowhee, NC*

**214.001 (Panel)** Non-Autistic Children Stigmatize Gaze Aversion, but Not Other Autistic-like Behaviors  
**Z. M. Sargent** and **V. K. Jaswal**, *University of Virginia, Charlottesville, VA*

**Background:** Autism is associated with behaviors that are considered atypical, including hand-flapping and decreased levels of eye contact. Non-autistic people quickly form negative impressions of autistic people on the basis of their atypical behaviors, but learning that someone who is behaving in an unusual way is autistic tends to mitigate these negative evaluations. Additionally, young children are sensitive to social norms, and they disapprove of individuals who violate such norms. Thus, it is possible that young children's aversion to norm violations could influence the development of their negative evaluations of autistic people. However, no studies have investigated how specific autistic-like behaviors and perceptions of normativity may influence young non-autistic children's attitudes towards autistic peers.

**Objectives:** The objectives of this study were to investigate whether young (4- to 7-year-old) non-autistic children stigmatize specific behaviors associated with autism, and to what extent diagnostic disclosure would influence their evaluations.

**Methods:** Over Zoom, we presented 112 non-autistic 4- to 7-year-olds (57 female) with six vignettes. Each vignette presented three characters engaging in a normative behavior, and a fourth character engaging in a specific behavior characteristic of autism. Half of the children were told that the autistic-like character had to behave in that way "because she/he is autistic, which means her/his brain is different from other kids'" ("label" condition); half received no such explanation ("no label" condition). After each vignette, we asked children what they would do and whether the autistic-like character could choose how to behave. We also asked whether the normative and autistic-like behaviors were okay, and whether they would like to be friends with the characters.

**Results:** Children usually reported that they would engage in the normative rather than autistic-like behavior themselves. Children in the no-label condition indicated that the autistic-like character could have chosen to engage in the normative behavior, whereas children in the label condition tended to be ambivalent. Crucially, children in both conditions were more accepting of the autistic-like behaviors and characters than would be expected by chance, though they gave higher ratings to the normative behaviors and characters. The only exception to this pattern was gaze aversion:

Children in both conditions disapproved of looking away while a teacher was talking, and they were ambivalent about befriending someone who did so. The disclosure of diagnostic information mitigated evaluations of gaze aversion and the character who engaged in it somewhat.

**Conclusions:** This study suggests that non-autistic children view autistic-like behaviors as non-normative, but that they do not consistently disapprove of these behaviors or individuals who engage in them. However, children did disapprove of gaze aversion, suggesting that norms about eye contact may be especially likely to influence their evaluations of autistic peers. Further work is needed to apply the findings of this study to real-life situations, but one possible implication is that teaching children how eye contact is difficult for some students, and that such students are still paying attention to the teacher, could improve non-autistic students' perceptions of their autistic peers.

**214.002 (Panel)** The Effect of Exposure to Autism and Sense of School Belongingness on Attitudes Towards Bullying and Autism in Schools – a Longitudinal Cohort Study

**A. H. Cook<sup>1</sup> and J. Ogden<sup>2</sup>,** (1)Department of Psychology, Goldsmiths University of London, London, United Kingdom, (2)Psychology, University of Surrey, Guildford, United Kingdom

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**Background:** In the UK, 40% of autistic children are bullied at school (DfE, 2015). Studies highlight the negative impact of bullying on social, emotional and academic outcomes. Little research explores bystander responses of non-autistic children to different forms of bullying targeted towards autistic peers. It has been suggested that adolescents' attitudes towards bullying and social exclusion are influenced by peer-group and school norms, which can moderate emotions and predict intended behaviours. The opening of new specialist centres for autistic pupils in Southern England (NAS, 2015) offered a unique opportunity to explore the impact of exposure to autism on attitudes of non-autistic children towards the bullying of autistic peers. The role of pupils' sense of school belongingness (SOSB) was also explored. This exists when members of the school community share positive and consistent relationships, and thus provides a proxy measure of school inclusivity.

**Objectives:** The study explored whether non-autistic children's attitudes towards bullying and autism vary according to school type (schools with vs. without a specialist centre), personal exposure to autism and SOSB. It also explored differences in attitudes towards contrasted bullying violations (verbal bullying vs. social exclusion).

**Methods:** Survey data were collected from 302 non-autistic pupils, aged 11-12 (Time 1) and again when they were aged 14-15 (Time 2) from four mainstream schools: two with specialist centres and two without. Participants read vignettes of bullying scenarios depicting either verbal bullying or social exclusion of autistic or neurotypical targets. They then completed measures of their judgements, emotions and intended behaviours in response to the vignette, personal exposure to autism and cognitive attitudes towards autistic people. At Time 2, they also completed a measure of their SOSB.

**Results:** While no differences were found according to school type, a significant interaction showed that the only increase in prosocial judgements occurred in response to social exclusion of autistic targets. Furthermore, a multiple regression analysis indicated that non-autistic pupils' SOSB at Time 2 provided a stronger prediction of attitudes to autism and judgements towards bullying of autistic targets than personal exposure to autism.

**Conclusions:** Findings indicate that non-autistic adolescents' tolerance of social exclusion of autistic peers decreases with age, regardless of school type. This was particularly striking since all other bullying scenarios resulted in lower prosocial responses with age. Verbal bullying – as the most common form of bullying – may be accepted as a social norm and hence be more tolerated in order to preserve group functioning. In contrast, social exclusion of an autistic peer may raise more moral considerations, supporting theories of moral development. Findings also indicate that personal exposure to autism is not as influential for change in cognitive attitudes towards autism and bullying as pupils' SOSB. Positive and consistent relationships may therefore lead to more prosocial attitudes towards neurodivergent peers. These results highlight the importance of developing an inclusive school environment where all pupils feel they belong, in order to reduce bullying and instil greater understanding and acceptance of autistic students and other stigmatised groups alike.

**214.003 (Panel)** Self-Report of Disability-Specific Peer Victimization in Autistic and ADHD Youth: A Pilot Study with Animated Video Stimuli  
**H. E. Morton<sup>1,2</sup>, S. Swinson<sup>1,3</sup>, K. R. Warnell<sup>4</sup>, J. M. Gillis<sup>4</sup> and R. G. Romanczyk<sup>1</sup>,** (1)Binghamton University, Binghamton, NY, (2)Oregon Health & Science University, Portland, OR, (3)Social Work, Columbia University, New York, NY, (4)Department of Psychology, Texas State University, San Marcos, TX

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**Background:** Autistic and ADHD (Attention-Deficit/Hyperactivity Disorder) youth are more likely to experience peer victimization compared to their neurotypical peers. Most research on this topic, however, is from the perspective of youth who can read prompts and complete written questionnaires. Additionally, autistic/ADHD youth are vulnerable to disability-specific bullying, but existing questionnaires assess bullying using items designed for neurotypical youth. To close these gaps, this study modifies and extends the Assessment of Bullying Experiences (ABE). The ABE is a recently validated, parent-report bullying questionnaire that includes 11 disability-specific victimization behaviors described by autistic youth in prior literature.

**Objectives:** The present study adapts the ABE parent-report questionnaire for youth self-report using both written (ABE-Written) and video-based (ABE-Video) formats.

**Methods:** The ABE-Written was created by revising the third person wording of the ABE parent-report questionnaire. To create the ABE-Video, Vyond Studio Software was used to create 55 brief animated videos (11-17 seconds each) portraying peer victimization behaviors corresponding to items on the written questionnaire. Participants viewed a version of each video that most closely aligned with their own gender and racial identities and then indicated if the scenario had happened to them, how often it had happened, and if this behavior was bullying. Non-bullying videos and impossible scenarios were included as controls. The ABE-Written and ABE-Video were administered online.

**Results: (Study 1)** Pilot findings from 40 undergraduate students (18-23 years old) confirmed that peer victimization videos more likely to be identified as bullying ( $M = 94.7\%$ ,  $SD = 22.4\%$ ) compared to non-bullying or impossible videos ( $M = 12.7\%$ ,  $SD = 33.4\%$ ;  $t(2165) = 49.15$ ,  $p < .001$ ). There was significant intrarater agreement (Intraclass Correlation (ICC)) for undergraduate self-report between the ABE-Written items and the corresponding ABE-Video items for 71% of bullying behaviors, with moderate agreement, on average, between methods ( $M_{ICC} = 52.4\%$ ,  $SD_{ICC} = 24.1\%$ ; range ICC = 0.23 – 1.00).

**Results: (Study 2)** Data collection is underway with autistic and ADHD youth (11-21 years old) via remote Zoom research sessions. To date, 19 youth have completed the ABE in both written and video formats and a sample of 100 adolescents is anticipated by January 2022. Preliminary analyses indicate autistic/ADHD youth are also more likely to identify victimization videos as bullying ( $M = 93.2\%$ ,  $SD = 25.1\%$ ) compared to non-bullying or impossible scenarios ( $M = 10.3\%$ ,  $SD = 30.5\%$ ;  $t(713) = 26.87$ ,  $p < .001$ ). The ABE-Written questionnaire is moderately correlated with the ABE-Video measure ( $r = .42$ ,  $p = .08$ ). Findings from the complete dataset will be presented, including exemplar animations from the ABE-Video digital measure that have high reliability with ABE-Written questionnaire items.

**Conclusions:** The ABE provides unique insight into disability-specific bullying vulnerability in autistic and ADHD youth. The video adaptation shows promise for understanding the peer victimization experiences of nonspeaking youth or those who do not read/write. The bullying behaviors frequently experienced by autistic and ADHD youth, as identified by the ABE, should be incorporated within psychoeducation and acceptance interventions.

### Example Videos:

Bullying1: <https://icd.binghamton.edu/media/bullying/Kid16/16.20b.mp4>

Bullying2 (disability-specific): <https://icd.binghamton.edu/media/bullying/Kid03/3.05c.mp4>

Non-bullying: <https://icd.binghamton.edu/media/bullying/Kid17/17.39.mp4>

**214.004 (Panel)** “Wanting to Belong and Never Quite Making the Mark” a Qualitative Exploration of How Autistic Females Experience Social Rejection

A. Boddy<sup>1</sup> and A. H. Cook<sup>2</sup>, (1)University of Surrey, Guildford, United Kingdom, (2)Department of Psychology, Goldsmiths University of London, London, United Kingdom

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**Background:** Despite the established link between rejection sensitivity (RS) and internalising symptoms (Bondü et al., 2017), the role of rejection has seldom been explored in relation to the internalising disorders commonly exhibited by autistic women (Kanne et al., 2009). Previous research has suggested that chronic rejection can lead to the development of a rejection-sensitive disposition (Downey et al., 1998) which may function bi-directionally to advance intra- and interpersonal difficulties. It is, therefore, of note that within the autistic community, the term 'Rejection Sensitivity Dysphoria' has been adopted to describe the adverse response to real, perceived, and anticipated rejection. However, this assumed phenomenon has, to date, received little research attention.

**Objectives:** Guided by this community insight and the recent impetus to elevate women's voices in the autistic community (Pellicano et al., 2014), this study sought to advance our understanding of how autistic women experience social rejection throughout their lives. With little research offering an in-depth exploration of responses to rejection amongst this population, this study adopted a do wide scope to address the question: How do women on the autistic spectrum experience social rejection?

**Methods:** Semi-structured interviews were conducted with 10 autistic women aged 19 to 56. Questions captured both the context, experience and response to social rejection at different stages in life; namely childhood, adolescence and adulthood. Accompanying this were questions that sought to elucidate participants overall concern with rejection, response to criticism, as well as any emotional impact of being socially rejected.

**Results:** Thematic analysis offered novel insights into the long-term emotional impact experiences of social rejection. Participants' accounts described the profound impact that formative experiences of social rejection had upon them: serving as a pivotal moment in which an internal sense of 'difference' became actualised. This was to the detriment of participant self-esteem, mental health and trust of others. Themes were highly inter-related, revealing a relationship between experience, response and emotional impact that was, at times, self-perpetuating in nature (Figure 1). Analysis revealed how women's concern with social rejection and desire for acceptance motivated the use of 'risk-mitigating behaviours' including camouflaging, avoidance and withdrawal which, although often protective, equally had the potential to further social isolation and psychological burden.

**Conclusions:** Congruent with the results outlined in this study, the RS model (Downey et al, 1998) proposes that ostracising experiences can sensitise youths to rejection. This can produce a rejection-sensitive disposition characterised by rejection anticipation becoming activated in situations where ostracism is possible. This model has previously been applied to ADHD, and our findings infer its potential applicability to autistic women. Moreover, the study highlights how social and communicative challenges inherent to autism may interact to intensify RS amongst this population. It is concluded that future research should seek to explore the role of RS in mediating the negative internalising outcomes commonly exhibited by autistic women.

## PANEL — SOCIAL COGNITION AND SOCIAL BEHAVIOR

### 216 - Double Empathy Problem: Investigating the Social Interaction Profiles of Autistic People When Interacting within and across Diagnostic Boundaries, and Implications for Theory and Practice

**Panel Chair:** Noah Sasson, *University of Texas at Dallas, Richardson, TX*

**Discussant:** Morton Ann Gernsbacher, *Department of Psychology, University of Wisconsin-Madison, Madison, WI*

**216.001** (Panel) Theorising the Double Empathy Problem: A Retrospective Review  
*D. Milton, Tizard Centre, University of Kent, Canterbury, United Kingdom*

#### Background:

The term the ‘double empathy problem’ was first coined as a practical way to describe to non-academic audiences that the social disjuncture often felt by autistic people was also often felt by non-autistic people in their interactions with autistic people. This way of framing the issue led to an academic article published in 2012, where the concept was situated within broader sociological and social psychological theory, drawing upon personal experience and emerging findings from qualitative studies. Since this work was first published ten years ago, numerous research groups examining social reciprocity between autistic and non-autistic people arrived at similar conclusions. In more recent years this work has been consolidated and has led to discussions regarding the practical implications raised by such a conceptualisation.

#### Objectives:

This presentation retrospectively reviews the theoretical development of the concept of the double empathy problem, its philosophical antecedents, and explores areas for future development of research on the topic.

#### Methods:

A scoping review of relevant literature was used to explore the conceptualisation of the double empathy problem over time and how this continues to be informed by empirical studies.

#### Results:

The issue of the double empathy problem has been theoretically and empirically explored across numerous subject disciplines, with important developments in the fields of psychology, neuroscience and linguistics among others.

#### Conclusions:

Whilst various conceptualisations of the double empathy problem have led to a burgeoning area of research, there is much work needed to fully understand how it operates and manifests in different contexts, particularly regarding wider social dynamics of power within which the double empathy problem resides.

**216.002** (Panel) Autistic Peer-to-Peer Communication Is Effective and Rewarding: Implications for the Social Deficit Model of Autism  
*C. J. Crompton, University of Edinburgh, Edinburgh, United Kingdom*

**Background:** The social deficit model of autism suggests that autistic social deficits underly difficulties in communication with others. Most research to date has focused on autistic deficits on clinical and lab-based social tasks, which in theory underpin difficulties in real-world communication. However, real-world communication requires a complex two-way exchange between interlocutors, relying on reciprocity and mutual understanding, and can be affected by the social context of the interaction.

If social cognition is impaired in autism, real-world communication between two autistic people should be especially challenging, and communication between autistic and non-autistic people should be more successful and easier. However, first-hand reports from some autistic people indicate that this does not align with their experiences. Our research uses experimental quantitative and qualitative methods to examine whether communicating with someone of a different neurotype (i.e. autistic people and non-autistic people interacting together) is more or less successful and rewarding than communicating with someone of the same neurotype (i.e. autistic people interacting together).

**Objectives:** To empirically examine (1) whether there are differences in information transfer accuracy when autistic people communicate with autistic people and non-autistic people (2) whether there are qualitative differences in how autistic people experience spending time with autistic and non-autistic people (3) what the theoretical and practical implications of this work may be.

**Methods:** Three studies will be presented. Study 1 uses a diffusion chain technique; a controlled, experimental form of “telephone” which probes cultural learning between individuals in (a) groups of autistic people (b) groups of non-autistic people (c) mixed groups of autistic and non-autistic

people. Study 2 uses semi-structured interviews to explore and contrast autistic experiences of spending time with autistic and non-autistic family and friends. Study 3 uses qualitative interviews to explore autistic needs and experiences following their diagnosis with a particular focus on autistic peer support.

**Results:** Study 1: Information transfer between groups of autistic people did not significantly differ in quality to information transfer between groups of non-autistic people. Mixed groups autistic and non-autistic people performed significantly more poorly, showing a steeper decline in detail sharing between participants. This indicates that autistic people effectively share information with each other, and information transfer selectively degrades within mixed groups. Study 2: Thematic analysis suggested strong benefits for autistic people creating and maintaining social relationships with other autistic people, with difficulties and exhaustion experienced selectively when interacting with non-autistic people. Participants highlighted a need for autistic-led social opportunities and peer support for autistic adults. Study 3: Autistic participants highlighted the benefits of spending time with other autistic people after receiving a diagnosis in adulthood, and indicated that autistic-specific peer support may be a useful mechanism for post-diagnostic support, offering unique opportunities not available through other support channels.

**Conclusions:** Taken together, these findings provide evidence that autistic peer-to-peer communication is effective and rewarding. They suggest that there may be selective bi-directional difficulties in communication between autistic and non-autistic people, in contrast to the social deficit model of autism. The theoretical and practical implications of this work will be discussed.

#### **216.003 (Panel) Double Empathy in the School Context: Observing Peer Interactions Among Autistic and Non-Autistic Youth**

**Y. L. Chen<sup>1,2</sup>** and **K. P. Koenig<sup>3</sup>**, (1)*Center of Outcomes and Assessment Research, Kessler Foundation, East Hanover, NJ*, (2)*Physical Medicine and Rehabilitation, Rutgers University New Jersey Medical School, Newark, NJ*, (3)*Occupational Therapy, New York University, New York, NY*

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##### **Background:**

Autistic youth often experience difficulties interacting with peers at school, resulting in greater feelings of loneliness and a higher incidence of bullying than non-autistic youth. As negative peer experiences can adversely affect autistic youth's mental health and quality of life, it is vital to identify factors contributing to autistic peer outcomes in school settings. Previous research on autistic peer interactions has primarily focused on individual factors, such as social-communicative and cognitive characteristics. The Double Empathy Problem (DEP) theory and its supporting research indicate, however, that individual factors may not fully explain autistic social difficulties. Rather, interpersonal similarity in neurotype and social disposition may be more influential on autistic social outcomes.

**Objectives:** To examine the peer interaction profiles of autistic youth when interacting with peers within and across neurotypes in an integrated education setting.

##### **Methods:**

This mixed methods research investigated peer interactions among 17 youth (age 12-14, seven were autistic) in an integrated school club over 5 months. The quantitative study observed and codified the characteristics and reciprocity of social behaviors among autistic and non-autistic youth. Based on the observed peer interactions, we plotted the social networks among the youth and examined the role of neurotype match on peer connections. The qualitative study explored the characteristics of peer interactions within and across neurotypes.

##### **Results:**

Rates of social interactions did not differ between autistic and non-autistic youth. Both autistic and non-autistic youth were more likely to interact with peers within their neurotypes, and this tendency strengthened over time. Social behaviors within neurotype, compared to those across neurotypes, were less likely to be based on functional purposes and more likely to be sharing thoughts, experiences, or items rather than requesting help or objects. Within-neurotype interactions were also more likely to be highly reciprocal than cross-neurotype social behaviors. Unlike typical social networks where individuals tend to interact with those sharing similar social statuses, youth in this study did not show greater connections with those of similar levels of social popularity or activity. Instead, the youth formed more and stronger connections with their same-neurotype peers, as indicated by their social interaction frequencies. Qualitative exploration found that interpersonal similarities in interests and social styles were a central theme in highly reciprocal peer interactions, particularly those among autistic youth. Openness to social profiles that were different from the norms played an important role in cross-neurotype interactions.

##### **Conclusions:**

This preliminary study examined real-world peer interactions in a school setting with equal numbers of autistic and non-autistic youth. Observations of social behaviors and interaction networks revealed better interaction outcomes among youth within than cross neurotypes. The positive outcomes in same-neurotype interactions support the DEP theory and suggest that autistic social difficulties may result from differences in the social expectations and profiles between autistic and non-autistic youth. This hypothesis implies that interventions to support peer engagement in autistic youth may focus on facilitating mutual understanding across neurotypes and promoting a culture of openness to non-normative social styles.

#### **216.004 (Panel) The Effects of Biases Toward Autism on Social Interaction and the Perception of Autistic Abilities**

**D. R. Jones, K. M. DeBrabander and N. J. Sasson**, *University of Texas at Dallas, Richardson, TX*

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Background:

Non-autistic (NA) people commonly hold biases toward autism. These biases can build exclusionary social environments that contribute to poor personal and professional outcomes for autistic adults.

#### Objectives:

To characterize biases about autism relative to other clinical conditions; to examine whether these biases include underestimating autistic cognitive abilities; and to assess the malleability of biases and their effect on interaction.

#### Methods:

Study 1: A thematic analysis was conducted on open-ended responses from 533 undergraduates on their ideas about diagnostic labels related to either autism, schizophrenia, or an unspecified clinical condition.

Study 2: 977 NA undergraduates predicted the performance of 42 autistic and NA adults on six standardized social cognitive and cognitive tasks after watching them in videos and completed questionnaires assessing their autism knowledge and stigma.

Study 3 (Jones, et al., 2021): 238 NA adults were randomly assigned to: 1) autism acceptance training (AAT); 2) mental health training (MHT), or 3) a control condition. After viewing the training, participants watched thin-slice videos of 40 autistic and NA adults and completed measures assessing their implicit and explicit biases toward autism.

Study 4 (Jones et al., 2021): 39 NA males randomly assigned to AAT or a no-training control condition participated in a 5-min conversation with an unfamiliar autistic partner (n = 39). Participants provided their perceptions of the interaction and their partner.

#### Results:

Study 1: The autism label showed the greatest variability in responses, with the most frequent code (poor social abilities) occurring in just 15% of responses. Responses to schizophrenia and the general clinical condition showed greater cohesion.

Study 2: NA raters were less accurate and underestimated autistic participants' cognitive performance more than NA participants. Underestimation for autistic adults was greater for social cognitive relative to general cognitive tasks. Greater autism knowledge was associated with greater accuracy in ratings of autistic social cognitive abilities but decreased accuracy for ratings of autistic cognitive abilities. For autism stigma, increased stigma was associated with less accuracy for ratings of autistic cognitive abilities and greater accuracy for autistic social cognitive abilities.

Study 3: Participants in the AAT condition were less likely to agree with misconceptions about autism and showed more favorable attitudes toward interactions with autistic people. However, AAT was not associated with reductions in implicit biases toward autism.

Study 4: Both autistic and NA partners reported a greater interest in hanging out with the partner in the future when the NA adult had first completed AAT. Other interaction outcomes, including first impressions and perceptions of the interaction, largely did not differ between training and no-training conditions.

#### Conclusions:

These studies suggest that biases about autism differ compared to other conditions and are associated with negative evaluations of autistic people and misconceptions about autistic abilities, including objectively measured cognitive skills. While interventions targeting autism knowledge and stigma may improve attitudes and reduce biases in the short-term, further evidence is needed to determine the extent of these effects in real-world environments.

## ORAL SESSION - 8A — SOCIAL COGNITION AND SOCIAL BEHAVIOR

### 314 - Innovative Measures of Autistic Social Behavior

#### **314.001** (Oral) Developing an Exploratory Novel Translational Social Habituation Task for Children

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#### Background:

Although difficulties in social communication is a core feature of autism, underpinning processes are multifaceted. These are suggested to range from diminished social reward sensitivity (Klin et al. 2003), to social cognitive processes or anxiety (Chevallier et al. 2012). Therefore, heterogeneity both between autistic people, and in terms of particular neurocognitive atypicalities, has impacted attempts to stratify the condition or to assess the



efficacy of particular therapies. The current study aimed to develop and validate a social novelty task for children by “back-translating” a behavioural assay used in animal models (Bariselli et al. 2018). Social novelty has a well-described neurobiological basis, including oxytocin signalling in dopaminergic neurons in the ventral tegmental area. A recent study showed that both molecular and behavioural responses could be ‘rescued’ by a specific MNK inhibitor that restored oxytocin signalling through resetting of translational regulation (Hörnberg et al. 2020). These findings point to the need for sensitive tests to assess social novelty responses either to specifically enrol a subset of individuals in clinical trials who show this pattern, and/ or to specifically measure the effect of treatments targeting social reward sensitivity.

#### Objectives:

Firstly, to develop a human version of the animal habituation task which creates a meaningful social interaction between the participant and the characters within the task. Second, to validate the task by measuring correlations between social novelty responses and ASD traits reflecting social reward sensitivity on clinical subscales.

#### Methods:

This task is part of the “Time Trekkers”: a behavioural task battery aimed at children aged 6-12. The participant plays quick-fire rounds of rock-paper-scissors with characters from the Trekkers. The first block of 20 trials is always against the same character. The subsequent four blocks are 10 trials, and begin with a choice between this familiar first character and a different character (see Figure 1 below for a schematic visualisation). Key dependent variables are 1) the participant’s first choice, and 2) the number of times a familiar character is chosen (0-4). Parents are asked to complete the SRS and SDQ for the child (results not reported).

To date 19 children aged 6-11 years (10 TD [8 boys], 9 ASD [8 boys]) took part in a pilot study.

#### Results:

Given the current small sample size, only descriptive statistics are reported. Figure 2 shows the pattern of responses for each participant across the four choices. Only the ASD group has 2 participants who choose the familiar character 100% of the time, and has fewer mixed patterns than the TD group. Qualitative feedback from parents indicate this task is well liked, easy to understand, and does elicit a social response from the child; 8 children like this task the most out of the battery.

#### Conclusions:

As a pilot of an exploratory novel task, results and feedback are promising, suggesting a sub-group of autistic individuals who may show a preference for social familiarity. Data collection is ongoing with a target of n=50. We will report on group findings and construct validity.

### **314.002** (Oral) The Social Attribution Task-Revised (SAT-R): Criterion-Oriented Validity and Feasibility of a Brief Spontaneous Theory of Mind Task in Children with Autism Spectrum Disorder

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#### Background:

A primary issue with laboratory-based theory of mind tasks is that they vary in their sensitivity to real-life social demands. To be successful in social situations, it is necessary to spontaneously identify relevant social information. However, only a few studies have examined spontaneous theory of mind by eliciting open-ended narratives, largely due to the time-intensive nature of coding open-ended responses. The Social Attribution Task measures spontaneous theory of mind but requires a significant amount of time for coding and administration. The Problem Solving Index from the Social Attribution Task represents a brief, feasible scale within the larger SAT task that could measure spontaneous theory of mind using quick and straightforward coding, but it has not yet been validated as its own stand-alone task.

#### Objectives:

To establish the feasibility and criterion-oriented validity of a spontaneous theory of mind task that is quick to administer and score but still retains the open-ended nature of eliciting spontaneous narratives about a geometric cartoon with social elements.

#### Methods:

Participants included 55 children between the ages of 7 and 12 years-old with an ASD diagnosis (based on ADOS-2, ADI-R, and DSM-5) and WASI-2 Full Scale IQ of 80 or above. Participants completed the Social Attribution Task (Klin, 2000), which produced open-ended narrative responses about a video of geometric shapes enacting a social scene. The Problem Solving Index was used as a stand-alone measure of spontaneous theory of mind that we propose should comprise the SAT-R (inter-rater reliability, .98). The Salience and Affective Theory of Mind Indices of the SAT were used as laboratory measures of spontaneous theory of mind and required extensive coding time. The Theory of Mind Test (TOM Test; Muris et al., 1999) and false belief video battery (Saxe, 2009) were used as laboratory measures of non-spontaneous theory of mind. The Social

Cognition subscale of the Social Responsiveness Scale (SRS-2) was used as a questionnaire measure of behaviors that require theory of mind in daily life.

#### Results:

The SAT-R was associated with (1) the two laboratory measures of spontaneous theory of mind (Saliency:  $r = .37, p = .01$ ; Affective Theory of Mind:  $r = .46, p < .001$ ); (2) the two laboratory measures of non-spontaneous, traditional theory of mind (TOM Test:  $r = .40, p < .001$ ; Videos:  $r = .35, p = .01$ ); and, (3) the caregiver-questionnaire measure of theory of mind (SRS-2 Social Cognition:  $r = .28, p = .04$ ). Moreover, becoming reliable on and administering the SAT-R was significantly quicker and easier than the full SAT, averaging two minutes per participant to code.

#### Conclusions:

Results demonstrated and feasibility and criterion-oriented validity of a brief spontaneous theory of mind task that is quick to administer and score but still retains the open-ended nature of eliciting spontaneous narratives about a geometric cartoon with social elements. This task provides a feasible and dimensional, lab-based measure of social cognition that more directly simulates the need to engage in ambiguous social problem solving in daily life than do traditional, non-spontaneous theory of mind tasks.

#### **314.003** (Oral) Empathic Accuracy and Empathic Synchrony: Developing a Novel Test with Autistic and Non-Autistic People

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#### Background:

Story-telling can be used as an experimental tool to measure empathic accuracy, i.e., the correspondence between a perceiver and the target of empathy. In this paradigm, an individual (the target) is videotaped, sharing autobiographical memories and is asked to report his/her emotions while story-telling. These reports are then used as a reference when measuring empathic accuracy (when perceivers are asked to infer the target's emotions) or empathic synchrony (when perceivers are asked to report their own emotions while observing the target's stories). Most research based on this paradigm in non-typical populations focuses on empathy deficits in perceivers from neurodivergent populations in relation to neurotypical targets, while the bidirectional nature of empathy is often overlooked. The Double Empathy Theory (Milton, 2012; Milton et al., 2018) challenges the traditional perception of empathy deficits in autism, offering a bidirectional lack of empathy between autistic and non-autistic people. This theory is gaining increased attention from the autism community and autistic researchers, but so far has yielded very little empirical research. Inspired by this theory and because of the need for research tools to investigate empathy towards neurodivergent individuals, we developed the Empathic Accuracy and Empathic Synchrony (EA-ES) set of stimuli as a new tool.

#### Objectives:

To build a new EA-ES set of stimuli, based on autistic and non-autistic targets.

Methods: Autistic ( $n=29$ [1]; 12 females, 15 males, 1 other) and non-autistic ( $n=16$ [2]; 13 females, 3 males) adults participants were video-recorded (using the Zoom platform), sharing emotional autobiographic memories. Each participant shared 3 different stories and then reported their emotions while telling these stories and rated continuously how positive or negative they felt at any moment whilst sharing each story. Participants also completed a demographic survey and questionnaires to measure autism traits (AQ-10), alexithymia (TAS-20), empathy (the EQ-40) and camouflaging of autistic traits (CAT-Q). Table 1 details the participants' characteristics.

[1] Due to the pandemic, testing has been delayed but this sample will be 30 participants

[2] This sample will be 30 participants

#### Results:

This procedure resulted in 135 video clips of targets sharing true stories from their lives (2-6 minutes in length), accompanied by self-reported feelings and emotions of the story-teller. Each story/clip is classified as: 1. conveying positive, negative or mixed emotions according to the targets' reports; 2. referring to a childhood memory, a memory from high-school/early adulthood, or to an event from adulthood; 3. the level of consent by the story-teller for future use of his/her clip. Table 2 details the clips' characteristics. Topics of stories include love stories and marriage, the birth of a child, loss of a close person, stressful social events, stressful events from school/college/university, references to the workplace, special connection to pets and animals.

#### Conclusions:

This invaluable new tool will allow us to examine research questions motivated by the double empathy theory. To accelerate research in the bidirectional nature of empathy, we will make the stimuli available to the research community (depending on each participating target's consent) and

invite researchers interested in collaborations to contact us.

**314.004 (Oral)** Developing New Touch Screen Tasks to Assess Social and Non-Social Reward Learning in Autistic and Non-Autistic Children  
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#### Background:

Learning from rewards is a fundamental process with a well-characterised neurobiological basis.<sup>1</sup> Differences in reward processing have been linked to features of autism. Whereas diminished sensitivity to specifically social rewards (people<sup>2</sup>, social-communicative cues<sup>3</sup>) has been posited as a primary difficulty, domain-general differences in reward processing may be related to restricted interests<sup>4</sup> and/or frequently co-occurring ADHD features. Most studies assess reward sensitivity using neuroimaging or eye-tracking. We developed two novel companion sets of behavioural social (SRL) and non-social reward learning (RL) tasks for children (including those with intellectual disability). Given increasing recognition of heterogeneity within autism, as well as cross-condition overlaps, we hypothesise that differences in reward sensitivity may help to identify subgroups.

#### Objectives:

- Design age-appropriate animations to develop and optimise comparable SRL and RL tasks
- Establish task reliability and construct discriminant validity
- Assess if diagnosis, age and/or IQ modulates performance.

#### Methods:

We developed two sets of SRL and RL tasks in an iterative way. The “Magic Boxes” RL and “Come Play with Me” SRL task are intended for pre-schoolers. The “Treasure Chests” and “Royal Feast” tasks were developed for children between 6-11 years. The preschool version was tested in  $n=21$  autistic and  $n=89$  non-autistic children aged 3-5.5 years, and the school version in  $n=6$  autistic and  $n=141$  non-autistic children aged 6-11 years. Tasks varied in difficulty level (100% reinforcement schedule in the preschool version, and in the school-going version 80%-20% probabilistic reinforcement schedules). Tasks were administered during lab visits or at home. Qualitative feedback from parents and testers was collected throughout.

#### Results:

The condition (lab or home) did not significantly affect performance in either version. In non-autistic children, there were no significant differences in accuracy or learning criterion between the RL and SRL on either version. On the preschool version, non-autistic children had significantly higher accuracy scores ( $p=0.02$ ) on the RL but not the SRL task than autistic children. In the school version, no group differences were observed for the RL and SRL tasks. However, the non-autistic children had significantly faster reaction times (RTs) ( $p<0.0001$ ) for the RL task than the SRL task, whereas for autistic children this was not observed. Age had a moderating effect on accuracy and learning criterion in both SRL and RL task in the preschool version. This effect was attenuated for older children, where age was a significant moderator of RTs only. IQ was not significantly correlated to any of the measures in the school-going sample.

#### Conclusions:

We were able to create comparable social and non-social reward learning tasks in preschool- and school-going children as indicated by similar performance levels across versions in non-autistic children. Contrary to the social motivation hypothesis of autism, no significant group differences in social reward learning were found on either version. Validation against social-communication features, restricted interests and ADHD is ongoing.

## POSTER SESSION — SOCIAL COGNITION AND SOCIAL BEHAVIOR

### 406 - Social Cognition and Social Behavior

#### **406.124 (Poster)** Adults with Autism Demonstrate Theory of Mind on a Child-Oriented Word Association Task

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**Background:** Theory of Mind (ToM) is the ability to attribute beliefs, interests, and knowledge to others and understand they may be different from our own.<sup>1</sup> Many individuals with autism spectrum disorder (ASD) have impaired ToM, which becomes more disruptive over the lifespan.<sup>2,3</sup> ToM is associated with a range of cognitive mechanisms, but the root cause of ToM deficits in ASD is not well understood.<sup>3,4</sup> Recently, we demonstrated that neurotypical (NT) adults produced shorter, more frequent words with earlier age of acquisition (AoA) during a word association task when instructed to respond as if they are engaging with a toddler. ToM deficits may make adults with ASD less sensitive to this manipulation.

**Objectives:** We investigated whether high-functioning adults with ASD can engage in perspective taking to modify their language in word association tasks.

**Methods:** One hundred neurotypical (NT) adults and 100 adults with ASD were recruited using Prolific and randomly assigned to two versions of a word-association task. Participants were instructed to either respond to cue words with the first three words that came to mind (standard condition) or make three responses as if they were engaging with a toddler (child-oriented condition). All participants responded to the same 60 cue words. We compared responses across groups and conditions on three dependent variables (DVs): age of acquisition (AoA), frequency, and length. Each DV was modeled in a separate repeated-measures ANOVA, with groups, conditions, and response order nested in cue. We expected group by condition interactions for all three DVs, such group differences would be larger in the child-oriented condition, and a strong condition effect in the NT group.

**Results:** The ANOVA analysis of AoA revealed a main effect of condition ( $F(1,236) = 271.89, p < .001$ ), but no group effect or interaction. The analysis of word frequency revealed a significant interaction ( $F(1,236) = 6.33, p = .013$ ) with surprising simple effects: the NT group produced more frequent words than the ASD group in the standard condition ( $F(1,118) = 22.14, p < .001$ ), but frequency did not differ between groups in the child-oriented condition. The effect of condition was significant and in the expected direction for both groups ( $F_{NT}(1,118) = 18.18, p < .001$ ;  $F_{ASD}(1,118) = 52.65, p < .001$ )—larger for the ASD group. The analysis of word length revealed a significant interaction ( $F(1,236) = 19.94, p < .001$ ) with expected simple effects: the NT and ASD groups produced similar length words in the standard condition ( $F(1,118) = 0.76, p = .38$ ) but the NT responses were significantly shorter than ASD responses in the child-oriented condition ( $F(1,118) = 29.98, p < .001$ ). The condition effect was significant for both groups ( $F_{NT}(1,118) = 116.28, p < .001$ ;  $F_{TD}(1,118) = 12.39, p < .001$ ).

**Conclusions:** Both NT and ASD groups shifted their perspective and produce child-oriented responses. Differences between NT and ASD participants varied across DVs. Future work will examine whether the group differences are driven by systematic differences in how the groups represent words and their relations, or a different strategy for completing the task.

#### **406.125 (Poster)** Affect and Autism Spectrum Disorder: Facial Expressivity in Response to Social Uncertainty

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**Background:**

Atypical affective expression contributes to core social impairments in Autism Spectrum Disorder (ASD). Prior research, including a recent meta-analysis (Trevisani et al., 2018) reported that spontaneous affective expressions are less frequent and less contextually congruent in individuals with ASD. Other research has demonstrated deficits in autistic individuals' ability to accurately perceive facial expressions or negative emotions. Research studying the intensity of spontaneous affective expression has yielded less consistent findings, but affective intensity can impact the clarity of communication. No recent work has investigated spontaneous facial expressions of autistic individuals during positive social interactions.

**Objectives:**

The present study evaluates differences in spontaneous expressions of facial affect in two groups of young adults with IQ scores in the average range (ASD vs. non-ASD). This study aims to compare group differences in affective presentation during a social interaction task intended to evoke social uncertainty.

**Methods:**

The sample includes pre-recorded videos of participants with ASD ( $n=19$ ; 13 males; Mean IQ: 103, sd: 20) and a non-ASD typically developing (TD) group ( $n=17$ ; 9 males; Mean IQ: 95, sd: 13). Participants were observed during four episodes: (1) Quiet baseline (5 min.); (2) Social engagement (conversation) with a female research assistant (3 min.); (3) Planned ignore (3 min.), and (4) Rejoining conversation (3 min.). Two raters blind to group coded the videos on a scale ranging from -3 (most negative) to +3 (most positive) with 0 representing neutral expressivity. Raters coded the peak absolute value of facial affect during 10 second advancing intervals. Mean intensity was defined as the number of each affect code divided by the total number of intervals in each episode.

**Results:**

The main effect of group was significant ( $p = 0.002$ ); the TD group displayed greater intensity of positive affect ( $M = 0.77$ ,  $SE = 0.10$ ) than the ASD group ( $M = 0.29$ ,  $SE = 0.10$ .) The main effect for episode was significant ( $p < 0.001$ ), with greater positive affect during the Engagement and Rejoin episodes than during the Baseline and Ignore episodes. There was also a significant group X episode interaction ( $F [3, 31] = 7.06$ ,  $p = 0.001$ ), where the mean affect intensity for ASD group was lower than TD during the Engagement and Rejoin episodes, but not different during Baseline or Ignore conditions (see figure).

#### Conclusions:

Both TD and ASD groups modified affective expression in response to a series of standardized social interactions, with reduced positive affect when a previously friendly interactive partner interrupted conversation and ignored them (a planned violation of social norms). However, the ASD group differed in intensity of facial expression and demonstrated less range of affect that was closer to neutral during episodes where the social partner engaged in friendly conversation. These results indicate that verbal, average-IQ individuals with ASD display less intense affective expressions during normative social interactions. Such reduced affective expression may impact social interactions. Measuring range of affect may provide an additional metric in individual impairment, provide possible targets for intervention, and could be a useful treatment outcome measure.

#### **406.126 (Poster)** An 'Autistic Communicative Style'? Exploring Autistic People's Social Communicative Style

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#### Background:

There is a wealth of literature on social communication in autism, which primarily focuses on the communication difficulties between autistic and non-autistic people. Recent research, however, has suggested that communication between autistic people is more successful. It is unclear why this might be the case, but these findings suggest that categorising autistic communication as a 'communicative style' rather than a 'deficit' may be appropriate.

Autistic people's perspectives on their natural social communicative behaviours and preferences (and how this differs from or conflicts with non-autistic people's) may provide valuable insights into this 'communicative style', offering novel avenues for research into autistic social communication and guidance for professionals supporting autistic people.

#### Objectives:

To explore autistic people's communicative preferences and natural communication styles, with both other autistic people and non-autistic people. To examine whether autistic people perceive differences between their communication with other autistic people and with non-autistic people, and what those differences are.

#### Methods:

9 autistic adults (4M, 1NB; age mean = 45, range 23-70) took part in an online, asynchronous, text-based focus group. Questions posed to the group focused on five topics: (1) how to signal interest in another person; (2) what feels rude, polite, natural, and unnatural during communication; (3) how communication with other autistic people feels different to communication with non-autistic people; and (4) what makes a social interaction a positive one. An additional free space for participants to address anything else they felt researchers should know about autistic communication was provided.

#### Results:

Thematic analysis of the focus group text is ongoing, with five indicative themes:

- Challenges to communication: a number of factors combine to make social interactions challenging – 'unwritten social rules', sensory issues, communication being energy-costly and potentially dangerous, and the lack of accommodation and communicative flexibility from non-autistic peers.
- Autistic social principles: the autistic social communicative style is characterised by a strong preference for absolute truthfulness, an emphasis on boundaries, routine, and purposeful communication, and a desire to accommodate others.
- Presence: difficulties with attention and staying mentally present during social communication were linked to some evidence of communication being experienced as a 'flow state'.
- The importance of social support: social connections with others is important, though the formats these connections take may be atypical. Of particular importance and comfort is contact with other autistic people, and with non-autistic people who are understanding and accommodative of the autistic social interactive style.
- Intellectualisation: participants had, even prior to the focus group, spent time thinking about how they communicated, and how this might be different to how other people communicate. This included time spent reading academic materials on autism.

Next steps include finalising these themes and member-checking before presentation at INSAR.

## Conclusions:

Several factors influence autistic adults' experiences of social communication: internal experiences, internalised social values, the behaviour of other people involved in the interaction, and the environmental and technical properties of the interaction. These findings offer novel avenues for exploring the features of autistic social communication.

### **406.127 (Poster)** Autistic Traits Modulate the Relation between Self-Perceived and Actual Social Cognitive Ability

**D. Romero Fajardo, N. S. Tucker, L. Sweeney and K. R. Warnell, Department of Psychology, Texas State University, San Marcos, TX**

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**Background:** In spite of growing literature on the nuances of mentalizing, or theory of mind, in autism (e.g., Livingston et al., 2019), little is known about whether autistic traits influence the relation between one's actual mentalizing ability and one's perception of that ability. One possibility is that higher autistic traits are linked to a decreased awareness of one's skills or even systematic overestimation. Alternatively, those with higher autistic traits may be hyperaware of possible social difficulties, potentially causing underestimates of performance. Effects may also vary with mentalizing ability. Understanding relations between perceived and actual ability has implications for understanding compensatory and camouflaging behaviors.

**Objectives:** We examined whether autistic-like traits influenced the relation between actual performance and self-estimated performance on a face-based mentalizing task.

**Methods:** American participants ( $N=247$ , aged 23-73, mean=39.69,  $N=141$  males) recruited from the general population via MTurk performed the Reading the Mind in the Eyes (Baron-Cohen et al., 2001a), in which they identified mental states from photographs, and then estimated their accuracy on the task. Participants also completed measures of autistic traits (Autism Quotient [AQ]; Baron-Cohen et al., 2001b), social anxiety (Social Interaction Anxiety Scale; Mattick & Clarke, 1998) and social motivation (Mind Reading Motivation; Carpenter et al., 2016).

**Results:** The relation between perceived and actual performance was significantly moderated by autistic traits ( $F(1,243)=6.98, p=.009$ ), even after controlling for social motivation and anxiety ( $p<.01$ ). Moderation was driven by the communication subscale of the AQ ( $F(1,243)=15.31, p<.001$ ; other subscales,  $ps>.15$ ). Follow-up Johnson-Neyman analyses found that the correlation between perceived and actual performance had two inflection points, at AQ-Communication scores of 2 and 5. The Low AQ-Communication group ( $n=67$ ) showed a significant positive correlation between perceived and actual ability, indicating that higher performers did estimate higher scores ( $r=.28, p=.02$ ; **Figure 1**). In contrast, the Middle AQ-Communication group ( $n=116$ ) showed no correlation ( $r=.02, p=.80$ ). The High AQ-Communication group ( $n=64$ ) showed a significant negative correlation such that low performers estimated the highest scores ( $r=-.37, p=.002$ ). For example, the bottom quartile of performers in the Low AQ-Communication group correctly estimated their scores, whereas the bottom quartile in the High AQ-Communication group overestimated by roughly 50 percentage points (**Table 1**). In contrast, when restricting analyses to those scoring above 80% correct, the High AQ-Communication group ( $n=21$ ) underestimated their performance significantly more than the Low AQ-communication group ( $n=36$ ;  $t(55)=2.16, p=.035$ ), despite performing equivalently. Within the High AQ-Communication group, greater social motivation and anxiety related to higher actual performance ( $ps<.001$ ) and a larger underestimation of this performance ( $ps<.06$ ).

**Conclusions:** Individuals vary widely in their capacity to estimate their own social cognitive skills and this capacity is moderated by autistic traits. Specifically, those with higher autistic traits show greater overestimation at levels of low performance and greater underestimation at levels of high performance. Those with high autistic traits and excellent mentalizing showed increased social motivation and social anxiety, suggesting potential mechanisms driving both compensatory skills and low confidence in those skills. Future research should include clinical populations and additional measures of self-perceived and actual abilities across domains.

### **406.128 (Poster)** Children's Autistic Traits and Peer Relationships: Do Non-Verbal IQ and Externalizing Problems Play a Role?

**N. Sari, Erasmus Rotterdam University, Rotterdam, Netherlands**

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**Background:**

Children with autism have difficulties in understanding relationships, yet little is known about the levels of autistic traits with regard to peer relationships.

**Objectives:**

This study examined the association between autistic traits and peer relationships. Additionally, we examined whether the expected negative association is more pronounced in children with a lower non-verbal IQ and in those who exhibit more externalizing problems.

**Methods:** Data were collected in a large prospective birth cohort of the Generation R Study (Rotterdam, the Netherlands) for which nearly 10,000 pregnant mothers were recruited between 2002 and 2006. Data collection is currently ongoing for early adolescent period. Information on peer relationships was collected with PEERS application, an interactive computerized task ( $M = 7.8$  years). Autistic traits were assessed among general primary school children by using the Social Responsiveness Scale ( $M = 6.1$  years). Information was available for 1,580 children.

**Results:**

Higher levels of autistic traits predicted lower peer acceptance and higher peer rejection. The interaction of autistic traits with externalizing problems (but not with non-verbal IQ or sex) was significant: only among children with low externalizing problems, a higher level of autistic traits predicted less peer acceptance and more peer rejection. Among children exhibiting high externalizing problems, a poor peer acceptance and high level of rejection is seen independently of the level of autistic traits.

#### Conclusions:

We conclude that autistic traits – including traits that do not classify as severe enough for a clinical diagnosis – as well as externalizing problems negatively impact young children's peer relationships. This suggests that children with these traits may benefit from careful monitoring and interventions focused at improving peer relationships.

**406.129 (Poster)** Developing and Maintaining Friendships: The Role of Anxiety, Social Engagement and Mentorship Among Youth with ASD  
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**Background:** It is well-established that youth with autism spectrum disorder (ASD) have fewer friends and encounter greater social exclusion in comparison to neurotypical peers. Many individuals with ASD have intrinsic social motivation, yet skill deficits and anxiety may interfere with friendship development. Growing research highlights the benefits of engagement in social and physical activities (e.g., greater feelings of social inclusion and opportunities to authentically practice social skills) and adult mentorship (e.g., decreased social anxiety and increased social connectedness) among youth with ASD. Research is needed to examine whether such constructs (i.e., anxiety, social engagement, and mentorship) relate to friendship success among youth with ASD.

**Objectives:** We investigated the role of social engagement, mentorship, and anxiety on the ability to develop/keep friends among youth with ASD in a population-based sample.

**Methods:** The current study examined nationally distributed data from the 2018-2019 National Survey of Children's Health (NSCH), a caregiver survey. Youth included in this analysis ( $n = 1380$ ) were 6 – 17 years of age ( $M = 12.28$ ). The sample was 79.9% male. Ability to make/keep friends was operationalized as "how much difficulty does this child have making/keeping friends?" ("no difficulty" versus "some/a lot of difficulty"). Comorbid anxiety was defined by whether the caregiver responded that their child "currently has the condition." Social engagement was defined by participation in organized activities outside of school (i.e., clubs or sports). Mentor status was the presence of at least one supportive adult in the school, neighborhood, or community the child can rely on for advice/guidance. Controlling for age, gender, and intellectual disability, binary logistic regression analyses were conducted with social engagement, mentor status, and current anxiety as predictors and difficulty in making friends as the outcome. We examined interactions to assess whether social engagement or mentor status moderated the relationship between co-occurring anxiety and friendships.

**Results:** Hosmer-Lemeshow goodness-of-fit tests showed an acceptable fit for all regression models. Comorbid anxiety was associated with 2.68 times greater odds that the individual encountered difficulty in making friends ( $p=.029$ ), mentor status was associated with .53 times lower odds ( $p=.042$ ) and sports participation was associated with .51 times lower odds ( $p<.001$ ) that the youth had difficulty developing/maintaining peer relationships. Club participation was not a significant predictor and there were no significant interactions.

**Conclusions:** Findings indicate that sports participation and the presence of an adult mentor may protect against social relationship difficulties. It may be helpful to incorporate authentic social experiences and mentorship components into future social skills interventions to enhance feelings of inclusion and skill-building. Results also indicate that anxiety may predict greater friendship difficulties, consistent with prior research highlighting an association between comorbid anxiety and social skill deficits among youth with ASD. More work must be done to better understand how to support individuals with ASD and anxiety in developing and maintaining friendships. Given the study's cross-sectional design, we also need further research to investigate the direction of these effects.

**406.130 (Poster)** Development of a Measure of Positive and Negative Emotions in Autistic Adults

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**Background:** Recent evidence suggests the underlying etiology and phenomenology of autism results in a fundamentally different autistic experience of emotions than non-autistic peers (Jaysane-Darr, 2020; Jones et al., 2001). In non-autistic perspectives, emotions are often thought of as static constructs (Dallman & Triplett, 2020). However, in autistics, it is likely that emotions are experienced as more complex phenomena (Thomas & Boellstorff, 2017). This might explain, to some extent, why autistic individuals express their emotions in their faces differently, which can make it difficult for non-autistics to identify autistic emotions (Brewer et al., 2016). Autistics also report their emotions differently, more commonly using metaphors to describe how they feel (Thomas & Boellstorff, 2017). Overall, these findings might explain why some measures typically used to characterize emotions among non-autistics fail to capture variability in negative affect among autistics (Dallman et al., 2021). As efforts to develop and evaluate treatments for mood disorders in this population increase, development of measures sensitive to change in response to treatment is an urgent concern.

**Objectives:** The specific aims of this project are to (1) characterize emotional experiences of autistics and (2) develop a self-reported measure of emotional experiences for autistic adults.

**Methods:** Autistic adults ( $n = 24$ ) participated in one of six Zoom focus-group interviews to discuss their emotional experiences. Topics for the interview included experiences of positive emotions, negative emotions, the influence of activity on emotion, and measuring emotions. Interviews were transcribed verbatim and then iteratively coded and analyzed using an interpretative phenomenological analysis framework. Two coders independently coded each transcript and discussed any coding discrepancies until consensus was obtained.

**Results:** A total of 54 codes were generated to describe autistic emotional experiences. Participants described disliking typical emotional words like “happy” or “sad” because these words felt like caricatures of their true emotional experiences. They described emotions using metaphorical and embodied language and problematized current efforts to measure emotions, because they rely on those aforementioned words. These codes were then organized into a thematic framework which was then translated into a self-reported measure of autistic emotion. The measure is a two-part measure of emotions: a clinical interview, and an individualized patient-generated ecological momentary assessment in which the participant’s language from the clinical interview is brought forward to create each individual’s unique measure of emotional experiences.

**Conclusions:** Current measures of emotion may be insufficient at capturing emotional variation among autistics. In this study, we characterized autistic emotion as embodied, metaphorical, and complex. We used that information to develop a novel patient-generated measure of emotion. This measure leverages autistics’ own words, metaphors, and experiences to understand emotional patterns that may be problematic such as long periods of self-described sad feelings or high variability in self-described emotions. Future research will validate this measure in a sample of autistic adults.

**406.131 (Poster)** Diagnostic and Sex-Based Differences in Behavioral Responses to Social Evaluative Threat Among Autistic and Neurotypical Adolescents

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**Background:** Adolescence is a developmental period characterized by social landscapes of increasing complexity and social evaluative threat, which may be challenging for autistic adolescents to navigate given social communication differences. Heightened stress is more prevalent, severe, and chronic in duration in autistic adolescents than their neurotypical peers and has been linked to social difficulties. Though stress may manifest uniquely in females, research on autistic females is limited. To understand stress responses in autism, observational techniques may help to identify behaviors associated with heightened stress/arousal and potential diagnostic- and sex-based differences.

**Objectives:** The primary objective of this study was to examine diagnostic-based differences in behavioral responses to social evaluative threat in 209 well-characterized autistic (ASD) and neurotypical (NT) early adolescents (10:0-13:5 years old). A secondary objective was to investigate sex-based differences in behavioral responses within and between diagnostic groups.

**Methods:** The sample included 118 autistic (85 male, 33 female) and 91 neurotypical (52 male, 39 female) early adolescents enrolled in a longitudinal study of pubertal development in autism (R01-MH111599; PI: Corbett). Data from the first year were analyzed in this study. In a study visit, participants were exposed to the Trier Social Stress Test (TSST-Child version) – a validated, experimentally-induced psychosocial stressor known to reliably activate a stress response during 5-minute speech and math tasks. A behavioral coding paradigm was used to code displacement (e.g., fidgeting, fumbling, grooming, etc.) and continuous (e.g., time spent in silence or talking on/off topic) behaviors during the TSST. As displacement behaviors were not normally distributed, nonparametric Mann-Whitney U tests were employed to examine diagnostic- and sex-based differences. For continuous behaviors that were normally distributed, independent samples t-tests were used to test for diagnostic- and sex-based differences.

**Results:** The NT group displayed significantly more lip presses ( $U = 4207.00, p = .006$ ) and grooming ( $U = 4668.00, p = .03$ ) behaviors during the TSST-Speech than the ASD group, yet distributions for other displacement behaviors were not different between groups. The NT youth spent more time on-topic during TSST-Speech ( $t(204.41) = 3.66, p < .001$ ), while longer periods of silence occurred in the ASD group ( $t(206.20) = -2.76, p = .006$ ). Diagnostic groups did not differ in displacement behaviors during TSST-Math, with the exception of face contact (more frequent in ASD). In TSST-Math, NT youth spent more time engaged in the task ( $t(195.17) = 3.51, p < .001$ ). Between sexes, females exhibited more grooming behaviors compared to males in both tasks, but continuous behaviors did not differ by sex. Within diagnostic groups, autistic females and neurotypical females exhibited more grooming behaviors than their respective male counterparts.

**Conclusions:** Compared to neurotypical peers, autistic youth exhibited fewer behavioral signs of stress in the TSST and were more likely to remain silent, rather than attempt to engage and complete the tasks, amidst social evaluative threat. This may indicate a decreased stress response to social evaluative threat, which has been frequently found in autistic youth evidenced by a blunted cortisol response.

**406.132 (Poster)** Differential Effects of Specific Anxiety Symptoms on Facial Emotion Recognition in Youth with Autism Spectrum Disorder: Examination By Stimulus Type

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**Background:** Individuals with autism spectrum disorder (ASD) often have difficulty with facial recognition (FER; Lozier et al., 2014), a key component to understanding social cues (Shanok et al., 2019). In typically-developing (TD) individuals, generalized anxiety (GAD) and social anxiety disorders (SAD) are associated with more accurate FER, owing to increased vigilance and enhanced threat monitoring (Rappaport et al., 2021; Torro-Alves et al., 2016). There is a high prevalence of co-occurring anxiety in ASD (Chang et al., 2012), and cross-sectional studies suggest improved FER with internalizing symptom in ASD (Rosen & Lerner, 2016), while others suggest no relationship (Wong et al., 2012). Yet, no studies have considered specific anxiety symptoms. The heterogeneity in anxiety in ASD calls for understanding the relationship between FER and anxiety subtypes. Findings in ASD also suggest difficulties in recognizing subtler (i.e., low-intensity) emotions (Wallace et al, 2011) and an own-age bias,



reflecting greater FER performance for child compared to adult faces (Hauschild et al., 2020), highlighting the importance of a fine-grained analysis of FER performance by stimulus type.

**Objectives:** This study examined the effects of co-occurring anxiety and FER in ASD youth, by considering specific anxiety symptoms as well as the differences by stimulus type (high- vs. low-intensity emotions; adult vs. child faces). We hypothesized that higher self-reported anxiety, specifically GAD and SAD, will relate to lower FER errors on child faces and high-intensity emotions.

**Methods:** Fifty-five autistic youth ( $M_{age}=11.96$ ,  $SD_{age}=2.99$ , 73% Male,  $IQ \geq 70$ ) participated in this study. They completed an FER task while viewing adult and child faces (DANVA-2; Nowicki & Duke, 2001) and a self-report measure of anxiety (MASC-2; March, 2013). Pearson correlation and multiple linear regressions were conducted to assess whether specific anxiety symptoms uniquely predict FER, depending on the stimulus type.

**Results:** Higher self-reported total anxiety were related to fewer FER errors on adult and child faces ( $r=-.28$  and  $-.32$ , respectively,  $p<.02$ ), as well as high- and low-intensity emotions ( $r=-.35$  and  $-.23$ , respectively,  $p<.05$ ). Specific anxiety symptoms did not uniquely predict FER errors on the high-intensity emotions, or child faces (all  $p>.14$ ). While physical symptoms negatively predicted FER errors, panic and tense-restless symptoms predicted more errors on low-intensity emotions as well as adult faces (see Table 1).

**Conclusions:** Results suggest that co-occurring anxiety in ASD are associated with enhanced FER (i.e., less errors) overall, regardless of stimulus type. However, relations differed by specific anxiety symptoms for subtler emotions and adults faces. Interestingly, physical symptoms predicted enhanced FER, whereas panic and tense-restless symptoms predicted poorer FER performance. These results suggest the differential role specific anxiety symptoms may play in FER, as well as in the well-documented differences in subtler emotions (Wallace et al., 2011) and the own-age bias (Hauschild et al., 2020) in ASD individuals. Our findings provide insight into different pathways of co-occurring anxiety symptoms on FER, which impacts the social deficits of ASD (Bauminger, 2002; Stichter et al., 2010) and may aid in informing future interventions.

#### **406.133 (Poster) Empathy in Autism: A Systematic Review and Meta-Analysis**

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**Background:** Empathy can be defined as the ability to understand (cognitive empathy) and to share (affective empathy) another person's emotional state (Gonzalez-Liencre et al., 2013). Empathy deficits are often regarded as a core attribute of autism and are part of the signs deemed relevant to diagnose autism by standardised diagnostic instruments. However, the scientific literature on the subject is mixed, as some studies indicate that autistic individuals have global empathy deficits whereas others suggest that they only have cognitive empathy deficits.

**Objectives:** The objective of this meta-analysis was twofold: 1) to establish whether autistic individuals have an empathy deficit and, if so, in which empathy component and 2) to examine whether the measure chosen to assess empathy has an impact on the studies' results.

**Methods:** This meta-analysis was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. A literature search was conducted in four online databases (PubMed, Scopus, PsycNet and Academic Search Complete). 2161 articles were retrieved and 137 met the inclusion criteria. Hedges'  $g$  was computed to assess the difference between the autistic and neurotypical groups' empathy scores. Then, to synthesize the studies' results regarding cognitive and affective empathy, a three-level model was used, whereas for the results of studies measuring empathy as a unidimensional construct, a random-effects model was applied. Finally, separate random-effects meta-analyses were conducted for the three most used empathy measures, namely the Empathy Quotient (EQ), the Reading the Mind in the Eyes Test (RMET) and the Interpersonal Reactivity Index (IRI). Heterogeneity and risk of bias across studies were assessed following each analysis.

**Results:** The results suggest that autistic individuals have significantly less cognitive empathy than neurotypical individuals ( $k=116$ ,  $g=-0.89$ , 95% CI [-0.99; -0.79],  $p<.001$ ), but overall equivalent affective empathy ( $k=71$ ,  $g=-0.19$ , 95% CI [-0.39; 0.01],  $p=.06$ ). Furthermore, when empathy was assessed as a unidimensional construct, autistic individuals had significantly lower scores than neurotypical individuals ( $k=52$ ,  $g=-1.70$ , 95% CI [-1.92; -1.48],  $p<.001$ ). However, the studies' results were greatly influenced by the measure used to assess empathy. Whereas the EQ consistently showed that autistic individuals had lower empathy scores than neurotypical individuals ( $k=30$ ,  $g=-1.72$ , 95% CI [-1.94; -1.50],  $p<.001$ ), the IRI showed a more nuanced picture. For instance, a closer look at the IRI's affective empathy subscales revealed that autistic individuals had significantly lower empathic concern ( $k=29$ ,  $g=-0.63$ , 95% CI [-0.79; -0.47],  $p<.001$ ), but significantly higher personal distress ( $k=22$ ,  $g=0.67$ , 95% CI [0.32; 1.03],  $p<.001$ ) compared to neurotypical individuals.

**Conclusions:** This meta-analysis suggests that autistic individuals do not have a global empathy deficit, but rather have a different empathy profile characterized by difficulties with cognitive empathy and specific affective empathy subcomponents. This underlines the importance of assessing empathy as a multidimensional construct, especially in an autistic sample. Furthermore, these results indicate that empathy deficits in autism are not as pervasive as what current diagnostic instruments imply.

#### **406.134 (Poster) Evidence of Girls with Autism Spectrum Disorder Camouflaging Autistic Traits**

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**Background:** Early childhood diagnosis of autism spectrum disorder (ASD) can lead to early intervention, which produces better outcomes for autistic individuals. Current diagnostic protocols can delay a diagnosis due to lack of sufficient qualified professionals and lengthy assessments. As a result, an active area of research in autism is how to provide the ability for early and accessible predictive tools to provide accurate diagnoses. We assert that any such tool should reflect documented differences in rate of diagnostic autism between boys and girls and also documented increase in likelihood of a diagnosis, if a family member already has a diagnosis of ASD. One tool approach is to use predictive algorithms based on machine learning (ML). The analysis of one such freely available dataset used in ML, showed that the dataset analyzed using Bayesian methods, did not reflect differences in diagnostic rates between boys and girls and between participants that indicated having at least a family member already diagnosed with ASD.

**Objectives:** The objective of this study to validate that the dataset provides classification of ASD that are consistent with those found in the published literature. In this study, we analyzed a dataset from a phone app-based application, which provides anyone with access to the free phone application with the ability to enter data. The app provides a binary likelihood for autism to the end user. Data from the selected app, ASDTests[1], can be used for machine learning analysis. Our study examined whether the data replicated well to perform a Bayesian analysis, and whether the data approximated documented differences in diagnostic rates between boys and girls and history of ASD in the family.

**Methods:** We used the ASDTests app dataset for for the 4-11 children, which was composed of 292 participants. We used multivariate-logistic regression analysis using Bayesian analysis, using priors for male-female ratio (80-20%) of diagnosis, and priors for having a history of family with ASD (3%). In addition to these two data points, we used the guidance of the author of the app (Thabath, 2019), to use the four most impactful data points.

**Results:** Our analysis showed that while the data replicated well and was suitable for Bayesian logistic regression analysis, when we applied informed priors, the results showed that neither sex nor history of autism in the family had an impact on the likelihood of predicting autism.

**Conclusions:** Access to early intervention for children who may be on the autism spectrum are typically linked to diagnoses. While earlier, more accessible and less time-consuming means to getting an ASD diagnosis could help to bring interventions at an earlier age than it is possible today, models relying on predictive need to reflect what we know about existing diagnosed population differences. In our study, we find that more work of predictive analytics is promising, but as of yet has limitations based on scant freely available datasets.

[1] Thabtah, F. (2019). An accessible and efficient autism screening method for behavioural data and predictive analyses. *Health informatics journal*, 25(4), 1739-1755

#### **406.135 (Poster)** Exploring Attention Networks and Social Functioning in Autism Spectrum Disorder

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**Background:** Attentional deficits within Autism Spectrum Disorder (ASD) are common, and may lead to more global sociocommunicative deficits later in development (Dawson et al., 2004). For example, sociocommunicative deficits in ASD may originate with the inability to disengage and shift attention (Keehn et al., 2013; Oberwelland et al, 1988). The functionally and neuroanatomically distinct alerting, orienting, and conflict networks (Petersen & Posner, 2012) may underlie attentional modulation differences in ASD. Further, deficits in these networks may be associated with social dysfunction in ASD.

**Objectives:** This study explored the relation between attentional network scores and social functioning in children with and without ASD.

**Methods:** Participants included children with ASD without intellectual disability (n=20, 4 females, 13.66% racial minority, age: 10.92±1.2; IQ: 109.52±12.1) and typically developing (TD) children (n=12, 10 females, 28.57% racial minority, age: 10.62±1.1; IQ: 112.69±12.7). Parents completed the Social Responsiveness Scale, Second Edition (SRS-2) Social subscales and Child Behavior Checklist (CBCL) Social Problems subscale. Children completed the Attention Network Test (ANT). Analyses included *t*-tests comparing the groups on social functioning and ANT performance, and Pearson correlations between ANT performance and social functioning by group.

**Results:** Results indicated significant group differences for social functioning, with ASD performing more poorly than TD (Table 1). Both groups performed the ANT accurately. Individuals with ASD had significantly lower orienting scores than TD. Within the ASD group, orienting scores were not significantly associated with social functioning, increased alerting scores were associated with more SRS-2 Awareness problems, and increased conflict scores were associated with more SRS-2 Cognition problems (Table 2). Within the TD group, increased alerting scores were associated with problems across social domains (significant for SRS-2 Motivation and CBCL Social Problems).

**Conclusions:** Consistent with the literature (Keehn et al., 2010; Mutreja et al., 2016), children with ASD benefited less from spatial cuing (lower orienting scores) than TD. However, these orienting deficits were not associated with social functioning. As found by Keehn et al. (2010), higher alerting scores were associated with poorer social functioning. In the ASD group this was specific to the ability to pick up on social cues, but in the TD group this was observed across domains (i.e., ability to pick up on social cues, ability to interpret social cues, expressive social communication, extent of motivation to engage in social behavior, general social challenges). This was somewhat unexpected. Being good at achieving and maintaining sensitivity toward incoming information should be associated with better social performance. However, our results indicate that individuals with poorer social functioning may have an exaggerated alerting effect such that they may be overly receptive to rapid changes in their attention field that may disrupt social processes. Better conflict resolution was associated with poorer ability to interpret social cues in the ASD group. Again, this may be due to individuals with ASD being overly disrupted by conflicting information which affects social processing. Studies

show that substituting social stimuli in the ANT negatively impacts alerting and positively impacts conflict in TD children (Federico et al., 2017). Additional research is warranted.

**406.136 (Poster)** Implicit Social Attribution in Preschool- and School-Aged Children with Autism Spectrum Disorder

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**Background:** Previous research has shown that implicit social attribution—or the spontaneous tendency to attribute social meaning to ambiguous displays—is diminished even in individuals with autism spectrum disorder (ASD) who have high verbal skills and “pass” advanced tests of theory of mind skills (Klin, 2000; Burger-Caplan et al., 2016). In the current study we use a passive viewing paradigm to assess implicit social attribution in school-aged children and preschoolers with and without ASD. We showed children scenes from the classic film, *The Red Balloon*, in which a young boy finds a balloon that comes to life. Because the agency of the balloon is dynamic during the film—at times an ordinary balloon, at times an animate character—patterns of social visual engagement across these scenes may be sensitive measures of the tendency to make implicit social attributions. Such measures may be used in monitoring and evaluating outcomes of educational programming and interventions aimed at increasing social functioning in ASD.

**Objectives:** This study aims to develop objective, quantitative measures of implicit social attribution for use in monitoring social functioning and change in children with ASD.

**Methods:** Eye-tracking data were collected while children viewed eight short clips from *The Red Balloon*. In four of the clips, the balloon was inanimate, and in the other four clips, the balloon was an animate character. Data were quantified in terms of percent fixations to regions of interest (ROIs) in animate and inanimate balloon scenes. Two participant groups are presented here: an older cohort of school-aged children with ASD ( $n=60$ ,  $M_{age}(SD)=10.4$  (2.4) years) and their TD peers ( $n=28$ ,  $M_{age}(SD)=9.4$  (2.3) years); and a cohort of preschool-aged children with ASD ( $n=9$ ,  $M_{age}(SD)=4.29$  (1.09) months) and TD peers ( $n=16$ ,  $M_{age}(SD)=4.55$  (1.06) months), currently enrolled in the Marcus Autism Center Preschool Program.

**Results:** In both cohorts, children with and without ASD decreased looking to human characters and increased looking to the balloon in animate, compared to inanimate balloon scenes (all  $p<0.05$ ). Within animate balloon scenes, school-aged TD children looked significantly more to human characters than did children with ASD ( $p<0.001$ ). Preschoolers with and without ASD also differed in their allocation of visual attention to animate balloon scenes ( $p=0.013$ ), although in this age cohort, trends were such that TD children looked less to human characters' faces and bodies and more to the balloon than children with ASD.

**Conclusions:** Our preliminary analyses suggest differences in visual attention to ambiguous social displays, that may change over development, in children with and without ASD. Next steps will quantify finer-grained, time-varying measures of social monitoring between the boy and the balloon in animate vs. inanimate balloon scenes, and associations between these measures and clinical or classroom-based measures of social functioning. The preschool cohort will also be followed longitudinally and assessed for changes over the course of their educational programming.

**406.137 (Poster)** Improving University Students' Attitudes Towards Individuals with Autism

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Background:

University students with autism may face challenges at university with making and maintaining friendships, despite a desire to do so. One reason for this is that college students with autism experience social exclusion more so than their typically developing (TD) peers who tend to evaluate individuals with autism negatively. While exposure to individuals with autism can improve TD individuals' attitudes towards autism, this contact is not always possible. Investigating ways to improve TD university students' attitudes using simulated interactions may be effective.

Objectives:

Our first goal of this study was to examine whether simulating contact with individuals with autism would improve attitudes towards this group. Labeling people engaging in atypical behavior associated with autism can lead to more positive perceptions, as perceivers have an explanation for these behaviors. Therefore, we examined whether imagining an interaction with someone displaying behavior stereotypically associated with autism and labeled as having autism would affect subsequent attitudes. Our second goal was to test whether this would differ if participants imagined contact with a student of color compared to a White student.

Methods:

TD university students read vignettes in which they imagined interacting with another university student who depicted behaviors associated with ASD (i.e., perseveration) or not and with a label of autism or not. Participants then completed a Feelings Thermometer which measured their attitudes towards individuals with autism. In Study 1 ( $n = 130$ ), participants imagined interacting with a White student. In Study 2 ( $n = 234$ ), participants imagined interacting with either a White or Black student.

## Results:

In Study 1, a 2 (Label: ASD vs. non-ASD) x 2 (Behavior: Perseveration vs. No Perseveration) analysis of covariance (ANCOVA) with prior contact as a covariate was conducted. In Study 2, the same analysis was conducted with the addition of a between-subjects variable representing the race of the person with whom participants imagined contact (Black vs. White). Study 1 revealed a significant Label x Behavior interaction,  $F(1, 111) = 4.53$ ,  $p = .036$ ,  $\eta_p^2 = .039$ , such that there was a significant effect of Behavior for the non-ASD condition but attitudes towards individuals with ASD were higher in those in the Perseveration condition than the No Perseveration condition. In Study 2, as with Study 1, there was a Label x Behavior interaction,  $F(1, 226) = 4.97$ ,  $p = .027$ ,  $\eta_p^2 = .022$ , but no interaction with Race.

## Conclusions:

This research suggests that a short, online exercise can improve TD university students' attitudes towards individuals with ASD, when the person with whom they are imagining the interaction is labeled as having autism and shows behavior consistent with autism. Furthermore, our findings suggest that the race of the person with whom the participant imagines this interaction does not moderate the effect of labeling or behavior. These findings suggest that the imagined contact procedure may be useful for improving attitudes toward individuals who display some behaviors of ASD that may otherwise be viewed in a more negative manner.

### **406.138 (Poster)** Investigating the Role of Emotion Regulation and Physiological Arousal in Anxiety in Children Diagnosed with Autism Spectrum Disorder

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**Background:** Up to 84% of children with ASD experience clinically significant anxiety, which negatively impacts academic achievement, employment outcomes, and physical and mental health. Despite the prevalence and significance of anxiety, very few evidence-based interventions exist. A key challenge to developing such treatments is that the biological, physiological, and emotional factors contributing to anxiety in ASD remain largely unknown. Two mechanisms suggested to underlie anxiety in ASD are physiological arousal and emotion regulation (ER); however, the nature of their contribution remains largely unknown. This knowledge is critically needed to inform targeted treatment approaches for anxiety in ASD populations.

**Objectives:** To examine the role of emotion regulation and physiological arousal in anxiety in ASD.

**Methods:** The study sample consisted of children with ( $n=26$ , 20 male, age:  $11.6 \pm 2.06$ ) and without ASD ( $n=32$ , 17 male, age:  $9.9 \pm 1.73$ ). All children had full-scale IQ greater than 85. The experiment consisted of participants playing video games in between two baseline movie-watching sessions. For short intervals, the video game controls were inverted/unresponsive to elicit frustration. During the protocol, electrocardiogram (ECG) data was collected, and respiratory sinus arrhythmia (RSA) reactivity was computed for each game relative to baseline. ER ability was measured via the Emotion Dysregulation Inventory (EDI), a 64-item parent-reported questionnaire validated in samples of children with ASD, in which a higher score reflects lower ER ability. Anxiety symptoms were characterized using the Screen for Child Anxiety Related Disorders (SCARED), a 41-item parent-report survey. The Social Communication Questionnaire (SCQ), a 40-item parent-report questionnaire, was utilized to measure ASD symptoms. Age, sex, and full-scale IQ (WASI) were included as per significant linear regressions. Structural equation modelling was utilized to examine two potential theoretical models explaining the associations between ASD symptoms, ER ability, RSA reactivity, and anxiety symptoms.

**Results:** Our results revealed a significant positive association between emotion dysregulation and anxiety symptoms in both models ( $p = 0.046$ , Figure 1;  $p = 0.045$ , Figure 2). RSA reactivity did not significantly mediate the relationship between ASD symptoms and emotion dysregulation ( $p < 0.0001$ , Figure 1). However, ASD symptoms mediated the association between RSA reactivity and emotion dysregulation via positive significant associations between RSA reactivity and ASD symptoms ( $p = 0.03$ , Figure 2) as well as between ASD symptoms and emotion dysregulation ( $p < 0.0001$ , Figure 2).

**Conclusions:** Our results confirmed positive associations between emotion dysregulation and anxiety symptoms. Additionally, our results provide preliminary evidence supporting the contribution of emotion dysregulation, ASD-like traits, and physiological arousal to anxiety in ASD.

### **406.139 (Poster)** Lack of Left Gaze Bias to Faces in Adults with High Levels of Autistic Traits

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**Background:** Typical face processing is characterized by left gaze bias, defined as increased looking to the left side of the face (e.g., Guo et al., 2011), and thought to relate to greater right hemisphere recruitment in the processing of configural stimuli such as faces. Autistic individuals show differences both in configural processing and face processing (e.g., Behrmann et al., 2006), and have been found to show a lack of left bias (e.g., Dundas et al., 2012). Autistic traits are present in varying degrees in the general population, known as the broader autism phenotype (BAP; e.g. Hurley et al., 2007), but little work has looked at left bias alongside the BAP.

**Objectives:** The current study aimed to examine left gaze bias in face processing in nonautistic individuals with varying levels of autistic traits.

**Methods:** Seventy-eight participants ( $M_{age} = 20.32$  years,  $SD = 4.65$ ) viewed 24 faces from the NimStim database (Tottenham et al., 2009) and 24 houses (control stimuli) for 3 seconds per image. Gaze data were collected with an SMI RED 120 Hz eye-tracker. Areas of interest (AOIs) were drawn on the left and right sides of each image, and net dwell time (NDT) was calculated for the AOIs. A left bias measure was then calculated as NDT Left divided by the sum of NDT Left and NDT Right, and this bias was averaged separately for faces and houses. To capture initial attentional responses, gaze data for each image were extracted in a 500 ms window starting at 350 ms after stimulus onset, with 350 ms reflecting the average onset of participants' initial shift from the pre-image central fixation point. Autistic traits were measured with the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012). Left side biases were examined in relation to BAP categorically (participants high vs. low on autistic traits based on SRS-2 cutoff t-score of 59) and continuously.

**Results:** Across the full sample, a one-sample  $t$ -test examined left bias to faces against chance (0.5) and found a significant bias for faces,  $t(77) = 2.76$ ,  $p = .008$ , but no bias for houses ( $p = .582$ ). When examining participants high ( $n = 17$ ) and low ( $n = 61$ ) on autistic traits separately, the left bias held only for the low traits group,  $t(60) = 2.77$ ,  $p = .007$  (Figure 1). Neither group showed a left bias for houses ( $ps > .70$ ; Figure 2). No correlations between left bias and SRS-2 t-scores were found in the full sample or the traits groups ( $ps > .30$ ).

**Conclusions:** In a group of nonautistic participants, we found a left side bias for faces for those with low levels of autistic traits, but no bias for participants with high levels of autistic traits (and neither group showed a left bias for houses). These findings parallel past research which has found a lack of left bias in face processing in autistic adults (e.g., Dundas et al., 2012), showing a similar lack of bias in nonautistic individuals with elevated levels of autistic traits.

**406.140 (Poster) Maternal Perinatal Depression and Risk of Neurodevelopmental Disorders in Offspring: Updated Results from the SOS Mood Project.**

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**Background:**

Perinatal period represents a crucial phase for the neurodevelopment of the foetus and the intra-uterine environment plays a main role in the etiology of Neurodevelopmental Disorders including Autism Spectrum Disorder (ASD), with recent evidence suggesting that the prenatal immune environment may be a particularly promising area for ASD research. In this context, the latest research is attempting to define whether there may be an association between maternal Perinatal Depression (PD), the use of psychotropic medications during pregnancy, and a higher risk of neurodevelopmental disorders in children.

**Objectives:**

A. To evaluate possible long-term effects of maternal PD on the socio-communicative and behavioral phenotype of the offspring with a specific focus on the possible increase of ASD risk.

B. To characterize the clinical phenotype of Offspring of Perinatal Depressed women pharmacologically treated during pregnancy in comparison to Offspring NOT exposed to drug treatment during pregnancy.

**Methods:**

This study has been developed in the context of the SOS MOOD project - a mental health safeguard project aiming to support women during pregnancy and post-partum, and to early detect child warning signals of a derailed development. Women were screened during pregnancy for perinatal depression - categorized as affected (PD) or not (NPD) through the administration of the questionnaire EPDS (Edinburgh Perinatal Depression Scale) - and if necessary were prescribed pharmacological therapy. Offspring of both groups of women (PD and NPD) underwent, at a mean age of 43 months, a standardized neuropsychiatric evaluation of: developmental or cognitive skills, behavioral problems, autism symptoms (Autism Diagnostic Observation Schedule-Second Edition) and parental stress (Parental Stress Index Short Form).

**Results:**

Preliminary results on 59 women (mean age 36 years; 31 PD, 28 NPD) and 59 children (39 males; 20 females; age range 11 months-9 years, mean age 3.5 years) reported no significant difference in the offspring's clinical phenotype (developmental/cognitive, behavioral, autism symptoms) of women with perinatal depression (O-PD) in comparison to children not exposed to maternal perinatal depression (O-NPD) at a mean age of 3.5 years (Fig). However, even if not significantly ( $\chi^2 = 0.790$ ;  $p = 0.674$ ), the group of mothers with PD was characterized by a higher number of children diagnosed - according to the ADOS2- with ASD (6 vs 3) or at risk for ASD (2 vs 1) in comparison to NPD mothers. Interestingly, an increased stress related to parenting emerged within mothers affected by perinatal depression in comparison to women not affected ( $t = 3.8$   $p < 0.001$ ). No

statistically significant difference was found between children of mothers with PD exposed or not exposed to maternal psychopharmacological treatment during pregnancy.

#### Conclusions:

The SOS MOOD project's preliminary results on a limited sample size suggest that maternal perinatal depression, whether pharmacologically treated or not, did not weigh on diagnosis or risk of autism in offspring, and does not significantly impair children's cognitive and behavioral development. The early clinical characterization of children born from mothers affected by perinatal depression represents an important health issue, aimed to support pregnant women diagnosed with PD and for their offspring.

#### **406.141 (Poster)** Mimicry and Social Affiliation with Virtual Partner Are Decreased in Autism

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**Background:** Mimicking other people's mannerisms and gestures occurs spontaneously and contributes to social affiliation and interaction quality. While mimicry of emotional facial expressions is known to be impaired in autism spectrum disorders (ASD), we do not know if non-facial mimicry is also impaired and if so, what this means for autistic individuals' social affiliation.

**Objectives:** In a novel naturalistic interaction setting, this study examined how often children with ASD and neurotypical (NT) peers mimicked a virtual partner's non-facial mannerisms, and how mimicry was associated with self-reported affiliation with the partner. We predicted that: (i) ASD children would mimic their partner's mannerisms less than NT children, and (ii) Mimicry frequency and affiliation would be positively associated in the NT group. We explored whether this association would be different within the ASD group and the association of mimicry with core autism symptoms.

**Methods:** Sixty children (32 ASD, 28 NT) aged 8-12 years participated in a storytelling task, in which they viewed pre-recorded videos of a narrator tell them a story, who scratched her head and arm throughout the task. Using post-hoc frame-by-frame coding, we assessed how often the children scratched their head and arm upon seeing the narrator perform these actions. Subsequently to the storytelling task, the children filled out a questionnaire where they indicated how much they liked the narrator, wanted to play with her again and attributed positive qualities to her, e.g., kindness, friendliness etc. Core autism symptoms were examined using the Autism Diagnostic Observation Schedule (ADOS-2) for children in the ASD group and parent-report of the Social Responsiveness Scale (SRS-2) for all children.

**Results:** Results revealed reduced mimicry,  $p=.001$ ,  $\phi=.38$ , Figure 1A, and less affiliation with the partner,  $p=.01$ ,  $\phi=.33$ , Figure 1B, in ASD relative to NT children. Mimicry was associated with affiliation in the NT,  $r(23)=.64$ ,  $p=.0009$ , but not in the ASD, ( $r(31)=.07$ ,  $p=.72$ , Figure 1C, group. Across groups, mimicry was negatively associated with SRS-2,  $r(53)=-.39$ ,  $p=.004$ , yet this likely reflects the strong clustering of the SRS-2 data based on diagnosis alone; Figure 1D. No significant association was found between mimicry and ADOS-2 scores.

**Conclusions:** This study shows that while autistic children mimic others less, their degree of mimicry is unrelated to their feelings of affiliation. Our findings of reduced mimicry of non-emotional, non-facial gestures in ASD is a novel contribution to the literature and supports the view that basic visual-motor integration deficits, rather than social context, may account for autism-associated differences in motor imitation. Future studies should address how sensorimotor mechanisms are associated with mimicry, affiliation and what, if any, alternative mechanisms for affiliation autistic individuals adopt.

#### **406.142 (Poster)** Nuanced Multimodal Measurement of Pragmatic Communication, Gaze and Accuracy on the Rmet

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**Background:** Children with autism spectrum disorder (ASD) have differences in the way they perceive and understand social stimuli. These differences are reflected on measures of social cognition, including recognizing other's emotions and mental states (ToM, Theory of Mind) and in social behaviors like pragmatic communication. Pragmatic communication skills, which require ToM to successfully relate to a conversation partner are expected to relate to children's social cognitive processes and performance on a ToM task. A measure of social cognition, Reading the Mind in the Eyes Task (RMET, Baron-Cohen et al., 2001) has been used with eye tracking technology to capture cognitive processes. This could be confounded by age, IQ, and diagnosis on accuracy of identifying emotional states (Peñuelas-Calvo et al., 2019). Evidence from family studies of autism suggest that scores on the RMET segregate with social and pragmatic features that may distinguish meaningful autism phenotypes (Losh & Piven, 2007). Measures of gaze patterns and attention can offer more nuanced insight into social cognitive determinants that inform autism phenotypes. The complexity of pragmatic communication skills, variations in ASD presentation, and differences in development and IQ further complicates the relationship.

**Objectives:** To investigate the relationship between RMET, PRS-SA, and IQ in a sample of children with ASD, enrolled in a randomized clinical trial (RCT) of oxytocin augmentation of social cognitive skills training.

**Methods:** 40 children (37 M, 3 F), between the ages of 8 and 11 ( $M=9.25$ ,  $SD=1.10$ ), with confirmed ASD, enrolled in an RCT (NCT02918864) were evaluated at baseline on RMET, and measures of pragmatics, Pragmatic Rating Scale-School Aged (PRS-SA) and the Children's Communication Checklist-2 (CCC-2) and IQ (WAIS-I, WISC-V). A Tobii T60 XL was used for eye-tracking visual patterns and attention. The PRS-SA was coded by trained, reliable clinicians from the Autism Diagnostic Observation Schedule-2. Subjects' baseline data was collapsed across conditions for this analysis. These preliminary analyses focused on correlations between gaze, an observed pragmatics measure, and caregiver report of social language use.

**Results:** Participants' NVIQ positively correlated with accuracy, latency to response, and time spent looking at the image, and negatively correlated with time spent looking at words. Verbal IQ followed the same fixation pattern. Accuracy but not gaze metrics significantly related to Total Pragmatic Impairment on the PRS-SA (Table 1). However, dwell time on image negatively correlated with several CCC-2 subscales, meaning more looking time related to less communicative impairment. These results must be interpreted with caution as NVIQ also related to CCC-2.

**Conclusions:** We found that certain responses on the RMET related to IQ, but IQ was not related to PRS-SA. Specific profiles of social communication impairment may emerge from the PRS-SA and uniquely relate to RMET performance. Further analysis will investigate RMET accuracy and measures of social communication. These relationships may identify bidirectional mechanisms between social communication behaviors, i.e. pragmatic impairment, and social cognitive impairments.

#### **406.143 (Poster)** Parent Report of Nonverbal Joint Attention Symptoms in School Aged Children with ASD

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**Background:** Joint attention symptoms are a feature of preschool children with ASD (Mundy, 2018). It is not clear if those symptoms remain present in childhood, especially among verbal children with ASD. The Childhood Joint Attention Rating Scale (C-JARS) is a parent report measure of joint attention developed to examine this issue. The C-JARS is a 60-items parent report measure that provides a 46 item Prosocial Scale Score (PSC) that measure children's verbal and nonverbal spontaneous sharing of a point or reference and experience, a 14 item Asocial Scale Score (ASC) that primarily measures non-verbal problems in sharing attention and experience, and a total Joint Attention Score. Prior research has only examined the total score (Mundy et al., 2017).

**Objectives:** **1)** To examine the test-retest reliability of the ASC and PSC scores. **2)** To determine if a verbal sample of 8-16-year-olds with ASD differ from neurotypical (NT) peers on the nonverbal ASC scale. **3)** To examine the discriminant validity of the ASC for identifying verbal children with ASD versus age matched NT peers. **4)** To test convergent-divergent validity and the hypothesis that C-JARS score will be related to the Social Affect but not Repeated Repetitive Behavior (RRB) dimension score of the Autism Diagnostic Observation Scale-2 (ADOS-2).

**Methods:** Sixty-nine children with ASD ( $M_{FIQ} = 95.32$ ,  $SD = 17.46$ , range = 56-132) and 36 NT children ( $M_{FIQ} = 115.06$ ,  $SD = 13.88$ , range = 88-150) between the ages of 8-16 years old participated at Time 3 of a 30-month longitudinal study. C-JARS data were gathered for across a 15-month interval. See Table 1. Parent report of joint attention abilities was collected with C-JARS. Participants completed Module 3 of the ADOS-2 and the Wechsler Abbreviated Scale of Intelligence-2 full-scale IQ (FIQ) assessment 15 months before C-JARS data were collected.

**Results:** Pearson correlation analyses indicated significant Pearson test-retest reliability for the ASC and PSC scores for ASD ( $r_s = .83$  and  $.79$ ) and NT ( $r_s = .82$  and  $.88$ ) children, respectively. A 2 (Diagnostic Group) ANCOVA controlling for FIQ revealed significant between-group differences on the ASC scale,  $F(1, 105) = 93.61$ ,  $p < .001$ , partial- $\eta^2 = .48$ , wherein the ASD group demonstrated higher nonverbal joint attention symptom scores ( $M = 31.01$ ,  $SD = 8.35$ ) than the NT group ( $M = 12.80$ ,  $SD = 7.75$ ). See Figure 1. Group differences remained after excluding children with ASD and comorbid IDD ( $FIQ < 74$ ),  $F(1, 95) = 102.72$ ,  $p < .001$ , partial- $\eta^2 = .53$ . A discriminate analysis revealed that the ASC score correctly identified 88.4% of the ASD sample and 88.9% of the NT sample. Finally, initial ADOS-2 Social Affect scores predicted parent report C-JARS ASC scores ( $r = .29$ ,  $p = .02$ ) but not RRB did not ( $r = .07$ ,  $p = .60$ ).

**Conclusions:** These data support the hypothesis that parents can provide reliable and meaningful information about childhood nonverbal joint attention development in verbal children with ASD that is related to their objective clinical ratings of social symptoms.

#### **406.144 (Poster)** Quantifying Behavioral Inhibition to Unfamiliar Social and Non-Social Stimuli in Toddlers with ASD

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**Background:** Studies of emotional reactivity to salient novel social and non-social stimuli in toddlers with autism spectrum disorder (ASD) revealed lower intensity of negative emotions and lower physiological reactivity to novel non-social stimuli (e.g., spider toy) than non-ASD peers (Macari et al., 2018, Vernetti et al., 2018), but more intense negative emotionality to novel social stimuli (Macari et al., 2020; Scherr et al., 2017). Physical movement and proximity also indicate a child's appraisal of novel stimuli, with less motor activity, closer proximity to parent, and decreased proximity to the stimuli indicating greater behavioral inhibition (BI) or reticence. Here we examined BI to unfamiliar social (stranger) and non-social (gorilla) stimuli in toddlers with and without ASD.

**Objectives:** (1) To examine BI to novel social and non-social stimuli in 3-year-olds with ASD and typically development (TD) as indexed by overall motor activity, proximity to parent, and proximity to the stimuli. We hypothesized greater BI to the social stimulus alongside lower BI to the non-social stimulus by ASD compared to TD children. (2) To explore associations between BI to novel stimuli and severity of autism symptoms.

## Methods:

3-year-olds (37 ASD, 27 TD) were administered two 3-minute free play tasks in social (unfamiliar adult seated in the corner of the room; Stranger) and non-social (stuffed gorilla propped in the same chair; Gorilla) conditions, adapted from the Laboratory-Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999). Proximity to each novel stimulus was coded offline and we derived: 1) %Time\_In\_Motion (%time spent moving around the room), 2) %Time\_Near\_Parent (%time spent <2 feet from parent), and 3) average distance from stimuli. Group differences were examined using diagnosis (2) by condition (2) linear mixed-effect models followed by planned t-tests. We examined associations between BI measures and autism symptom severity using ADOS calibrated social affect (SA) severity scores.

Results: Toddlers with ASD and TD both exhibited lower levels of motor activity (%Time\_In\_Motion) in the Stranger vs. the Gorilla condition ( $p<0.001, d=-0.57$ ), with no significant effects of diagnosis ( $p=0.35, d=0.09$ ) or interaction ( $p=0.07, d=-0.46$ ). Both groups spent more time near parents (%Time\_Near\_Parent) in the Stranger vs Gorilla condition ( $p<0.001, d=0.84$ , Fig.1A), with no main effects of diagnosis ( $p=0.06, d=0.23$ ) or interaction ( $p=0.83, d=0.05$ ). While children with ASD and TD maintained a similar distance from the gorilla ( $p=0.462, d=0.19$ ), those with ASD maintained closer proximity to the stranger than TDs ( $p=0.011, d=0.65$ , Fig.1B). Within the ASD group, higher ADOS SA severity was associated with less time near parent and lower distance from both the stranger (%Time\_Near\_Parent: $r(35)=-0.453, p=0.005$ , Distance: $r(35)=-0.474, p=0.003$ ) and the gorilla (%Time\_Near\_Parent: $r(35)=-0.396, p=0.015$ , Distance: $r(35)=-0.363, p=0.027$ ).

Conclusions: Contrary to our hypotheses, both groups exhibited more BI in the social compared to the non-social condition, and toddlers with ASD displayed similar BI as TD toddlers when faced with the gorilla. However, children with ASD remained closer to the stranger than TD peers, with increased proximity to both types of novel stimuli and decreased proximity to parent correlated with greater autism severity. Findings reveal a complex picture of young children's appraisal of novel stimuli, which may be affected by the severity of their autism symptoms.

## **406.145 (Poster)** Recognition of Emotions in People with Autistic Traits and Comorbid Anxiety: A Behavioural Study

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Background: Atypical emotion processing has been widely reported in autism spectrum disorder (ASD). The co-occurrence of anxiety with ASD has been frequently reported, but the evidence for anxiety modulating emotion recognition in ASD is still lacking.

Objectives: The current research was therefore designed to explore emotion recognition in individuals with significant autistic traits, considering uni- and multimodal presentations as well as the co-occurrence of anxiety, which is not included in the ASD criteria, but which is frequently associated with ASD.

Methods: Fifty individuals were recruited for the study and were divided into two groups according to their Autism Quotient score based on a criterion of scores 31 and above for the high levels of autistic traits group (HAQ) and 18 and below for the low levels of autistic traits group (LAQ). Half the participants had AQ scores higher than criterion (HAQ) and half the participants had AQ scores lower than criterion (LAQ). Every participant also performed a state trait anxiety inventory (STAI). In a single experimental session, recognition of six basic emotional states (happiness, anger, surprise, sadness, disgust, fear) and one neutral state were assessed using unimodal (face or voice) and multimodal (face-voice) pairs. The face stimuli were short 3 second videos of expressions induced in typical participants and the voice stimuli were obtained from the Montreal Affective Voice dataset. The proportion of correct responses and the response times were recorded.

## Results:

Results suggested that individuals with high levels of autistic traits were able to recognise emotions displayed across different modalities, suggesting a lack of general deficit in emotion perception.

However, the presence of comorbid anxiety appeared to counteract the effects of autistic traits in the recognition of emotions (e.g., fear, surprise, anger), and this effect tended to be different for the LAQ and HAQ groups. More specifically, for the recognition of fear expression, greater anxiety was associated with less probability of correct responses in the HAQ but more probability of correct answers in the LAQs.

As for the reaction times in other emotions, anxiety tended to be significantly associated with longer response latencies in the HAQ group, but shorter response latencies in the LAQ group for the recognition of emotional expressions, for negative emotions (e.g., anger, fear, and sadness), and this effect of anxiety was not restricted to specific modalities.

Conclusions: The research concludes that more needs to be done to investigate the effect of comorbid anxiety in individuals with ASD. It is possible that the cause of the differing results with comorbid anxiety in the HAQ group compared to the LAQ group is likely due to an underlying difference in emotion recognition processing and it is worth investigating further the role of anxieties effect on emotional processing, possibly with a functional MRI study.

## **406.146 (Poster)** Regulatory Strategies, Emotional Expression, and Physiological Responses during a Frustration Eliciting Task in Toddlers with and without ASD



**Background:** Effective regulation of negative emotions is important for well-being in children with and without autism spectrum disorder (ASD) (Mazefsky et al., 2014). When faced with a frustrating task, young children with ASD and typical development (TD) show similar intensity of emotional expression (EE) and physiological responses (Jahromi et al., 2012; Macari et al., 2018; Vernetti et al., 2020). However, toddlers with ASD use fewer constructive emotion-regulation (ER) strategies than TD peers when frustrated (Jahromi et al., 2012; Zantinge et al., 2017), suggesting different developmental patterns of ER (Nuske et al., 2017). Links between specific strategies and emotional and physiological responses to frustrating situations, however, remain poorly understood.

**Objectives:** To examine: 1) whether 3-year-olds with ASD show different patterns of EE-frustration, physiological responses, and ER strategies in response to frustrating events than TD peers, and 2) links between frustration (EE and physiological) and specific ER strategies in toddlers with ASD compared to TD controls.

**Methods:** 125 chronological age-matched toddlers (67ASD, 58TD;  $M_{age}=38.9mo$ ) were given a locked clear box containing attractive toys along with an incorrect key for 60 seconds, an adaptation of the “lockbox” task from the Laboratory Temperament Assessment Battery (LabTAB, Goldsmith&Rothbart, 1999). Intensity of EE-frustration (facial anger, bodily sadness, distress vocalization) and presence of ER strategies (Table 1) were coded offline. Skin conductance level (SCL), an index of physiological arousal, was measured using AffectivaQ-Sensors worn on the ankle. Change in SCL ( $\Delta SCL$ ) between the first 10s and the rest of the task was computed. T-tests assessed group differences in EE and  $\Delta SCL$ , and chi-square analyses assessed group differences in ER strategy use. Differences in EE and  $\Delta SCL$  by ER strategy use and diagnosis were tested using two-way ANOVAs.

**Results:** Toddlers with ASD and TD showed similar intensity of EE-frustration ( $p=0.860, d=0.048$ ) and  $\Delta SCL$  ( $p=0.803, d=0.506$ ) during the task. More toddlers with ASD than TD used physical comfort-seeking ( $X^2(125)=10.559, p=0.001$ ; ASD:29.8%; TD:6.9%) and fewer toddlers with ASD than TD used directed ( $X^2(125)=6.596, p=0.010$ ; ASD:64.2%; TD:93.1%) and undirected social bids ( $X^2(125)=6.723, p=0.010$ ; ASD:76%; TD:93.1%; Figure1a). There were no group differences in use of disengagement or self-soothing strategies (all  $p>0.271$ ). ANOVAs revealed greater EE-frustration in toddlers who used physical comfort-seeking than toddlers who did not ( $p=0.019$ ) and greater  $\Delta SCL$  in toddlers who disengaged ( $p=0.037$ ) and made undirected social bids ( $p=0.023$ ) than those who did not (Figure1b).

**Conclusions:** Three-year-olds with ASD and TD exhibited similar intensity of emotional and physiological responses to a frustrating task. While toddlers with ASD used a range of ER strategies to regulate their frustration, significantly more of them sought physical comfort with their parents and fewer used either directed or undirected social bids compared to TDs, suggesting differences in use of ER. Furthermore, in both groups, physical comfort seeking was associated with greater behavioral expression of frustration, while disengagement and undirected social bids were associated with greater physiological expression of frustration. We established associations between specific regulatory strategies and behavioral and physiological responses to frustration, however to best support ER skills in children with ASD, further work should investigate causal relationships.

#### **406.147 (Poster) Sex Differences in Social-Emotional Insight in Youth with Autism Spectrum Disorder**

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**Background:** Historically, autism spectrum disorder (ASD) has been diagnosed primarily in males, with females accounting for approximately 1 in 4 cases or – in highly verbal subgroups – as few as 1 in 20 cases (Boorse et al., 2019). However, recent research suggests that many girls and women with ASD do not receive a diagnosis until much later in life, which may be due to differences in the way that autism symptoms present in males vs. females. In this study, we examine differences in social-emotional insight between girls and boys with autism spectrum disorder and neurotypical (NT) controls by measuring how they talk about social and emotional topics during semi-structured clinical evaluations. In previous research observing differences in insight of social and emotional topics, an elevated insight has been present in girls compared to boys. This study is observing for if this elevation in girls is still present in the autism population even with deficits in social understanding typical in individuals with autism.

**Objectives:** Assess potential differences in social-emotional insight between children and adolescents with autism spectrum disorder vs. NT controls, with a focus on sex differences.

**Methods:** Sixty-four child and adolescent participants with ASD or NT development were selected from a larger study that included ASD diagnostic assessments, IQ testing and behavioral tasks. All participants were administered the Autism Diagnostic Observation Scale, 2<sup>nd</sup> Edition (ADOS-2), Module 3 or 4, which were recorded for future use with consent and orthographically transcribed. Two reliable coders read each transcript and analyzed insight levels based on four scales measuring: emotion understanding, relationships and relationship roles, perspective taking, and ability to recall past experiences including these topics (Five Levels of Emotional Awareness in Children, Social Cognition and Object Relations Scale, Emotional Investment in Relationships, and Understanding of Social Causality). Four general mixed model 2x2 ANOVAs were conducted to assess diagnostic group differences on each of the four insight scales, with additional ANOVAs were conducted to assess sex differences in the ASD group specifically.

**Results:** Significant sex differences were revealed on two of the four insight scales in the autism group: the social cognition and object relations scale  $F(1,31)=6.03$ ,  $p=.020$ ,  $\eta^2=.17$ , girls ( $M=3.31$ ,  $SD=.63$ ) and boys ( $M=2.60$ ,  $SD=.97$ ) and understanding of social causality scale  $F(1,31)=4.55$ ,  $p=.041$ ,  $\eta^2=.13$ , girls ( $M=3.44$ ,  $SD=.68$ ) and boys ( $M=2.88$ ,  $SD=.81$ ).

**Conclusions:** Elevated insight has previously been observed in NT child and adolescent girls compared to NT child and adolescent boys. Until now, sex differences in social and emotional insight have not been assessed in autism. The current results, while preliminary, provide evidence for sex differences in social-emotional insight in autism, and indicate a need for further research in this area. While not conclusive, our results provide potentially critical insight into the unique challenges and strengths faced by girls with autism and may partially explain why girls are under-diagnosed relative to boys.

**406.148 (Poster)** Sharing Joy during Puppet Shows: Toddlers with Autism Spectrum Disorder Share Positive Affect as Frequently as Typically Developing Controls

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**Background:** Shared positive affect (SPA), the coordination of positive affect and gaze towards a social partner, is a key component of early social development (Parlade et al., 2009). Previous research has shown that young children with autism spectrum disorder (ASD) display SPA less frequently than typically developing (TD) peers, though this has only been examined in the context of activities such as an interaction with a caregiver during snack time (Dawson et al., 1990) or during a developmental assessment (Ozonoff et al., 2010). Inconsistent with these results are two studies that examined emotional reactivity in response to standardized tasks aimed specifically to elicit joy. The studies demonstrated that toddlers with ASD display similar intensity of joy as TD toddlers on the behavioral (Macari et al., 2018) and physiological arousal (Vernetti et al., 2020) levels. Here we examine whether in this context toddlers with ASD not only experience joy, but also share it with their parents to the same extent as TD toddlers.

**Objectives:** Determine whether (1) duration of positive affect and (2) rate and duration of SPA differ between toddlers with ASD and TD controls during a standardized joy-eliciting task.

**Methods:** Participants included 75 toddlers, 45 with ASD ( $M_{age}=22.5mo$ ,  $SD=3.08$ , 84% male) and 30 TD ( $M_{age}=21.5mo$ ,  $SD=3.72$ , 57% male). Toddlers viewed a one-minute puppet peek-a-boo show while seated next to a parent, adapted from the Laboratory Temperament Assessment Battery (LabTAB; Goldsmith & Rothbart, 1999). Frequency and duration of toddler attention (e.g., looking at the parent) and affect (positive, negative, neutral) through facial, vocal, and bodily channels were coded without knowledge of diagnoses. The (1) proportion of time the child expressed positive affect (%PositiveAffect: positive affect duration/trial duration), (2) proportion of time the child looked at parent with positive affect (%SPA: SPA duration/trial duration), and (3) SPA occurrences per minute (SPA\_Rate) were computed. Two-sample t-tests assessed group differences in %PositiveAffect, %SPA, and SPA\_Rate.

**Results:** Descriptive statistics and graphical representations are presented in Table 1 and Figure 1, respectively. Diagnostic groups did not differ in %Positive Affect ( $p=.484$ ), %SPA ( $p=.447$ ), or SPA\_Rate ( $p=.261$ ).

**Conclusions:** Although toddlers with ASD shared positive affect slightly less frequently than TD peers, differences were not significant and associated effect sizes were small. The present study extends our prior work (Macari et al., 2018; Vernetti et al., 2020) and suggests that toddlers with ASD not only express similar levels of joy, but also reference their parents while expressing joy as frequently as TD peers. Results of the three studies fail to replicate previous research that measured positive affect during task-oriented interactions with adults. This discrepancy shows that differences in affective responses in ASD are context dependent. The use of playful puppets (Macari et al., 2021) and non-demanding task setup may promote experiencing and sharing joy in toddlers with ASD. Given the role of positive emotions in learning, memory, and social development, such activities could be used to harness shared enjoyment during early intervention programs and in educational settings to create optimal environments for children with ASD to thrive and learn.

**406.149 (Poster)** Social Cognition and Social Anxiety in Neurodevelopmental Disorders

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**Background:** Relative to neurotypical peers, youth with Autism Spectrum Disorder (ASD) present with heightened rates of social anxiety and sociocognitive impairment. Prior work has theorized how these overlapping impairments may interact during adolescent development, and recent studies have explored these overlapping symptom profiles in youth with ASD (Pearcey et al., 2021; Zukerman et al., 2021). However, research has yet to parse out the effects of comorbid symptom profiles on adaptive functioning in youth with ASD. Attention Deficit-Hyperactivity Disorder (ADHD) and ASD are characterized as Neurodevelopmental Disorders (NDs) and often diagnosed together. Youth with ADHD similarly present with both social anxiety and sociocognitive impairments. To date, social anxiety and sociocognitive impairment have not been studied conjointly in order to examine how these impairments may differentially impact adaptive functioning in ASD compared to ADHD.

**Objectives:** We examined the unique effects of sociocognitive impairment and social anxiety on functional impairment in children with ASD. We hypothesized 1) both sociocognitive impairment and social anxiety would explain significant variance in adaptive functioning. We then examined whether differences emerged in the relative influence of social anxiety and sociocognitive impairment on adaptive functioning between youth with

ASD and ADHD. We hypothesized 2) sociocognitive impairment would account for relatively more variance than social anxiety in predicting adaptive functioning in youth with ASD, but not in youth with ADHD.

**Methods:** Participants were referred to a university-affiliated clinic for comprehensive diagnostic assessment services. The present study included caregiver-reported data collected from 34 youth (ages: 7-17 years), half of whom had ASD, and half without ASD but with ADHD. Participants were matched on parent-reported degree of social anxiety, as part of a comprehensive clinical assessment. Participants were primarily male (70.6%) and Caucasian (91.2%), ranging in age from 7 – 17 ( $M = 12.35$ ;  $SD = 2.77$ ). Caregivers completed measures of social anxiety, sociocognitive impairment, and adaptive functioning. Linear regression was used to examine the predictive weight of social anxiety and sociocognitive impairment on adaptive functioning. Effect sizes were calculated for all predictors (Cohen's  $f$ ).

**Results:** In youth with ASD, sociocognitive impairment and social anxiety each significantly predicted adaptive functioning impairment, controlling for FSIQ; in youth with ADHD and not ASD, only sociocognitive impairment significantly predicted adaptive functioning (Table 1). Partial correlations controlling for FSIQ revealed sociocognitive impairment was significantly associated with adaptive functioning impairment in both ASD and ADHD samples (Table 2): social anxiety was significantly associated with adaptive functioning impairment only in youth with ASD.

**Conclusions:** Findings suggest social anxiety compounds functional impairment in youth with ASD, but not those with ADHD who do not have ASD. Future research may explore social anxiety in the context of both understanding patterns of social impairment in ASD and targeted interventions for this population. Moderate to large effect sizes, noted across both samples, emphasize the importance of social cognition in predicting outcome. Findings build on prior work examining social impairments and deficits in adaptive functioning in youth with ASD and ADHD and may inform future mechanism-based treatment research for youth with NDs.

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**406.150 (Poster)** Social Motivation Predicts Behavioral Compensation in Autistic Adolescents

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**Background:** According to the extant literature (Hull et al., 2018), camouflaging can be broken up into three categories: masking, compensation, and assimilation, depending on the type of behavior. Examples of masking behaviors include monitoring facial and body language to appear more relaxed and interested during social interactions. Assimilation behaviors include feeling a need to “put on an act” or pretend to be “normal” during social interactions. Camouflaging, compensation, masking, and assimilation have been studied extensively in autistic adults (Cage & Troxell-Whitman, 2019; Hull et al., 2017; Perry et al., 2021). For example, autistic adults have reported social motivations for engaging in camouflaging behaviors such as avoiding negative social experiences, making friends, and fitting in (Bernardin et al., 2021). In contrast, little is known about camouflaging behaviors in autistic adolescents, and even less is known about relationships between parent perceptions of their adolescent children's social motivation and the adolescent's own experiences of social compensation (i.e., actively working to maintain social relationships or interactions). Greater understanding of the relationship between parent-reported social motivation and self-reported social compensation could illuminate novel pathways for intervention aimed supporting autistic adolescent's social goals.

**Objectives:** Examine the relationship between parent-reported social motivation as measured by the Social Responsiveness Scale, 2<sup>nd</sup> Edition (SRS-2; Constantino, 2012) and self-reported social compensation as measured by the Camouflaging Autistic Traits Questionnaire<sup>4</sup> (CAT-Q) in autistic adolescents.

**Methods:** Nineteen autistic adolescents aged 13-17 years (16 male, 3 female) completed the CAT-Q which includes 25 questions related to three categories of camouflaging: compensation (9), masking (8), and assimilation (8). Parents completed the SRS-2, which includes 65 questions across five domains: social awareness, social cognition, social communication, social motivation, and restricted interests/repetitive behaviors.

**Results:** A linear model was used to predict adolescents' self-reported CAT-Q social compensation subscale scores using parent-reported SRS-2 social motivation scores. Results revealed that adolescents who were perceived by parents as having lower social motivation (i.e., higher parent-reported SRS-2 scores) engaged in significantly less self-reported social compensation (i.e., lower CAT-Q scores; estimate  $-.05$ , SE:  $.02$ ,  $t=-2.84$ ,  $p=.02$ ). Conversely, adolescents with greater perceived social motivation (based on parent-report) had higher social compensation scores, indicating greater efforts to support and maintain social interactions. In comparison to the larger adult samples reported in the extant literature<sup>4</sup>, autistic adolescents in our small sample had lower overall CAT-Q scores (adults:  $4.79$  ( $0.99$ ); adolescents: ( $3.61$  ( $0.73$ )), which may reflect differential social and occupational demands and supports experienced by adolescents vs. adults.

**Conclusions:** This preliminary exploration of the relationship between parent-reported social motivation and self-reported social compensation in autistic adolescents revealed that greater motivation to engage with others predicts active compensation to maintain social interaction. Thus, internal social motivation could be one mechanism that drives social compensatory behaviors, such as repeating statements, copying body language, and using learned scripts during conversation. Data collection is on-going, with a sample of 50+ participants anticipated by May 2022. Future analyses with a larger sample will examine whether and how social motivation and social compensation vary by participant sex, age, and cognitive ability.

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**406.151 (Poster)** Social Performance - but Not Social Knowledge - Predicts Autism Spectrum Disorder Among Adolescents

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**Background:** Social interaction difficulties in autism spectrum disorder (ASD) may arise from either a lack of social knowledge (knowing what to do; Mesibov, 1982), challenges with social performance (inability to reliably enact this knowledge; Lerner, 2013), or both. Recent work has examined how the individual contributions of each may give rise to ASD symptoms (Keifer et al., 2020); however, few studies have examined whether patterns of difference *between* social knowledge and social performance (knowledge-performance discrepancy; Rudolph et al., 1997) may uniquely predict ASD. Furthermore, studies that have examined this difference utilize measures that do not capture consonance across constructs (i.e., social knowledge and performance measures describing the same behaviors; Dissanayake & Macintosh, 2003; Livingston et al., 2018). Thus, utilizing measures and methods that more directly capture the knowledge-performance discrepancy is a crucial aim for refining both the characterization and treatment of ASD.

**Objectives:** 1) To explore the relationship between social knowledge and social performance in ASD via more directly-aligned constructs. 2) To examine whether patterns of knowledge-performance discrepancy predict ASD diagnostic status.

**Methods:** 147 adolescents with and without ASD (Table 1) completed two established measures of social knowledge (Michelson & Wood, 1982; Laugeson & Frankel, 2006) to create a composite score. Adolescents' social performance was evaluated via blinded, double-coded measurement of positive social behavior (all ICC > 0.70; Social Interaction Observation Scale, SIOS; Bauminger, 2002) during an observed semi-structured social interaction with novel peers, as well as by parent-report (Gresham & Elliott, 2008). Moderated logistic regression models (Laird, 2020; Table 1) were run to assess whether patterns of knowledge-performance discrepancy predicted ASD diagnostic status.

**Results:** Adolescents with ASD displayed reduced observed ( $t(145) = 3.01, p < .01$ ) and parent-reported ( $t(145) = 4.41, p < .001$ ) social performance compared to adolescents without ASD. No differences in social knowledge were found between the two groups (Table 1). A main effect of social performance was identified in each moderated logistic regression model, such that observed (Model 1;  $b = -0.07; p < 0.05$ ) and parent-reported (Model 2;  $b = -0.04, p < 0.001$ ) social performance significantly predicted ASD diagnostic status, but the knowledge-performance discrepancy (interaction term) did not (Table 1; Figure 1). No main effects of social knowledge were found.

**Conclusions:** Findings indicate that ASD diagnostic status is best predicted by measures of social performance, rather than by social knowledge or their discrepancy. Indeed, this furthers past work (Lerner & Girard, 2019), indicating that – despite being a common, primary emphasis for intervention (Gates et al., 2017) – challenges in social knowledge do not drive the social interaction difficulties associated with ASD, nor do they enhance what can be learned from an individual's social performance. Thus, future interventions may shift their focus away from didactic methods that aim to improve adolescents' social knowledge and toward the provision of peer interaction opportunities that aim to improve adolescents' social performance through naturalistic practice (Gates et al., 2017).

#### **406.152 (Poster)** Subtypes of Spontaneous Empathic Facial Expression Production in Autistic Adults

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**Background:** It is unclear whether atypical patterns of facial expression production metrics in autism reflect the dynamic and nuanced nature of facial expressions or a true diagnostic difference. Further, the heterogeneity observed across autism symptomatology suggests a need for more adaptive and personalized social skills programs. For example, it would be useful to have a better understanding of the different expressiveness profiles within the autistic population and how they differ from neurotypicals (NTs) to help develop systems that train facial expression production and reception.

**Objectives:** Our primary objective was to explore whether the atypical patterns of facial expression production metrics in autism reflect the dynamic and nuanced nature of facial expressions or a true diagnostic difference

**Methods:** We collected facial expression recordings of 84 adult participants (ages 18-59) while they completed a computerized empathy task. We then derived a set of automated facial expression features from the recordings using the iMotions affect recognition toolkit, and applied an exploratory unsupervised learning approach (K-means clustering) on the feature sets for ASD (n=27) and NT (n=57) participants separately to derive interpretable clusters. Group comparisons were conducted on the two more stable clusters from each analysis (ASD=19, NT=29) using the robust nonparametric Cliff's delta ( $\delta$ ) effect size statistic on the basis of expressiveness and emotive congruence to emotionally charged stimuli.

**Results:** Within the ASD and NT groups, there was a larger and more stable cluster and a smaller, highly variable cluster that differed significantly in mean peak expressiveness scores (ASD clusters:  $\delta = 0.934, p < .001$ ; NT clusters:  $\delta = 0.940, p < .001$ ) and in average emotive congruence (ASD clusters:  $\delta = -0.434, p = 0.035$ ; NT clusters:  $\delta = -0.220, p < .001$ ). The smaller clusters in each group were therefore characterized as having more exaggerated spontaneous facial expressions that were not always congruent with the stimuli's emotional valence. When comparing the two more stable groups, our main finding was that autistic adults show heightened spontaneous facial expressions in response to negative emotional images ( $\delta = -0.009, p = 0.032$ ). The group effect did not extend to positive emotional images, and we did not find evidence for greater incongruous (i.e., inappropriate) facial expressions in autism.

**Conclusions:** These findings point to the highly nuanced and variable nature of facial expression production in autism and neurotypical controls. When we consider the more stable emoters in our group comparisons, these findings build on previous work suggesting valence-specific effects of autism on emotional empathy and suggest the need for intervention programs to focus on social skills in the context of both negative and positive emotions.

#### **406.153 (Poster)** Utilizing Eye Tracking Methodology to Delineate Social Attention Profiles in Fragile X Syndrome and Autism Spectrum Disorder

**Background:** Social attention deficits are a hallmark characteristic within autism spectrum disorder (ASD) and fragile X syndrome (FXS) and have been hypothesized to have cascading effects on emotion recognition (Reisinger et al., 2020; Farzin et al., 2009). Eye tracking methodology has emerged as a potentially reliable, feasible, and sensitive biomarker for examining core phenotypic features of ASD and FXS; however, these findings are mixed with regards to measuring treatment change in clinical trials. Further, delineation of syndrome-specific social attention profiles will expand the current literatures understanding of how these two etiologically distinct, but clinically similar phenotypic profiles of ASD and FXS overlap or differ.

**Objectives:** The present study assesses the utility of an eye tracking paradigm to discriminate between two clinical groups (FXS and ASD) and typically developing controls in their social attention through visual face scanning.

**Methods:** Participants included 24 participants with ASD (91.7% male), 15 participants with FXS (66.7% male), and 39 typically developing (TD) participants (74.4% male) ranging from 6 to 22 years of age ( $M=15.37$ ,  $SD=3.33$ ). Participants completed an eye tracking paradigm with one of two randomized variations of emotional faces as part of a larger study. Stimuli consisted of 12 colored photographs of adult human faces (equal numbers of males and females) from the NimStim Face Stimulus Set, each showing a calm, happy, or fearful facial expression. Eye tracking data were collected using a Tobii T120 infrared binocular eye tracker sampling at a rate of 120 Hz. Areas of interest (AOI) for the eyes (including eyebrows), nose, and mouth, were created on each of the faces and utilized for the present study. Proportion of looking time and latency to first fixation were utilized as the dependent variables.

**Results:** MANOVAs were utilized to examine differences in proportion of time spent looking at the three AOIs for each emotion across groups. For calm faces, the ASD group spent significantly more time looking at the mouth region in comparison the TD group ( $p=0.045$ ). There were no significant differences found between the groups for the AOIs of the fear faces ( $ps>0.05$ ). For the happy faces, the ASD group spent significantly less time looking at the eye region in comparison to the TD group ( $p=0.012$ ). The FXS group was not significantly different in their proportion of looking time for any of the AOIs across of the three emotional faces in comparison to the ASD and TD groups ( $ps>0.05$ ). Similarly, MANOVAs were utilized to examine the differences in latency to first fixation for the three AOIs for each emotional face across groups. No significant group differences were found. ( $ps>0.05$ ). Between group differences for ASD and FXS while controlling for IQ will also be examined.

**Conclusions:** These findings build on the promise of eye tracking as a feasible and reliable biomarker for identifying social attention deficits in ASD and FXS. Detecting differences in emotion recognition explicitly through facial scanning was not as clear and varied by emotion. Specific mechanisms within the eye tracking paradigm may be viable options for assessing treatment-specific outcomes.

**406.154 (Poster) Why Social Motor Synchrony Matters: The Implications of Social Motor Synchrony on Adaptive Behavior of Children with ASD**  
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**Background:** Social motor synchrony is a universal phenomenon that occurs in various social settings, but its role in shaping adaptive capacities in other domains is still undocumented. Furthermore, the developmental trajectory of social motor synchrony is understudied, with research focusing on early childhood and adulthood, overlooking the development path throughout childhood. Preliminary leads suggest that Autism Spectrum Disorders (ASD) exhibit social motor dis-synchrony, however it is unclear if this is a delayed development or pervasive deficit. As children with ASD experience deficits in multiple domains of adaptive behavior, we set out to explore if social motor synchrony in children with ASD promotes adaptive behavior.

**Objectives:** To assess typical and atypical development of social motor synchrony and explore its effect on adaptive behavior, postulating that children with ASD will show deficits in social motor synchrony and adaptive behavior, and that the ASD deficit in adaptive behavior will be moderated by social motor synchrony.

**Methods:** 62 children (ASD=39), ages 8.15-17.08 ( $M=12.28\pm2.65$ ) divided into mid-childhood (8-11 years-old) and late childhood (12-17 years-old) participated in the study. Children were paired to same age and diagnostic group dyads, and preformed a social turn taking task in two structured conditions: simultaneous drumming, where follower joins into the leader's rhythm at same time, and mirroring leader's rhythm upon completion of their turn. Prior to the experiment parents filled out the adaptive behavior assessment scale (ABAS-II). Children were screened for IQ (WISC-IV<sub>HEB</sub>).

**Results:** Validity checks: Task main effect was significant ( $p=.012$ ), yielding higher synchrony while mirroring compared to drumming simultaneously, supporting that as expected motor synchrony with no lag is a less complex capacity than mirroring (Fig. 1.). The developmental hypothesis was also supported ( $p=.018$ ), with late childhood group demonstrating higher social synchrony compared to mid-childhood, in line with a developmental trajectory (Fig. 1). An expected diagnosis effect was found for adaptive behavior, with ASD scoring lower than typically developing children ( $p<.001$ ).

**Hypotheses testing:** Social motor synchronizing tasks' performance was affected by group ( $p=.008$ ), with ASD demonstrating overall diminished synchrony (Fig. 1). There was no interaction effect of diagnosis and age ( $p=.834$ ) suggesting a pervasive deficit in ASD that does not seem to wane with age. Finally, to assess the impact of social motor synchronization on adaptive behavior in both populations two moderation models were

conducted. Only social motor synchrony, but not mirroring, moderated the effect of group on adaptive behavior ( $p=.031$  and  $p=.672$  respectively). Exploration of the moderation effect using Johnson-Newman technique revealed a significant ASD deficiency in adaptive behavior when social motor synchrony is lower than  $r_c=.64$ , demonstrating the importance of social motor synchrony as a scaffold for the development of adaptive behavior in ASD (Fig. 2).

**Conclusions:** The results suggest social motor synchrony as an important social construct that underlines adaptation, one of the most prominent and pervasive deficits in ASD.

**406.155 (Poster)** Examining Conversational and Prosodic Abilities of Adolescents with ASD through Computerized Acoustic Analysis

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**Background:** Adolescents with ASD experience various social communication difficulties, including difficulties engaging in reciprocal conversations and difficulties appropriately using prosody to express themselves. However, their assessment has relied mostly on behavioral coding, which is time-consuming, resource-intensive, and prone to reliability issues. The use of computerized acoustic analysis (CAA) to evaluate conversational and prosodic abilities in ecological social interaction contexts can shed light on adolescents' social communication skills in a swift, objective, and ecological manner.

**Objectives:** to use CAA to 1. characterize conversational and prosodic abilities of adolescents with ASD, compared to their typically developing (TD) peers; 2. test if conversational and prosodic abilities of adolescents with ASD improve following social skills training.

**Methods:** To test the first question, we compared 60 male adolescents with ASD to 32 TD male adolescents on the contextual assessment of social skills (CASS; Ratto et al., 2011). To test the second question, we compared 34 male adolescents with ASD who participated in the PEERS® social skills intervention to 35 ASD waitlist controls. Participants took the CASS with different unfamiliar confederates before and after a 16-weeks intervention/wait period. All interactions were recorded, videotaped, and analyzed through CAA, and by human coding of behaviors. The CAA consisted of manual labeling of speakers, which was processed by inhouse software developed in Matlab, its outputs being acoustic features (e.g., pitch and energy of the speaker in each segment) as well as turn-taking quantification (i.e., subject responding to the confederate within 2 seconds).

**Results:** CAA in ASD-TD comparison revealed differences in conversational and in prosodic abilities. In conversational abilities, adolescents with ASD had longer, and less consistent turn-taking time compared to their TD peers. In prosodic abilities, compared to their TD peers, adolescents with ASD expressed less variability in pitch and stressful emotional state, and used higher and less consistent volume.

Furthermore, positive associations were found between conversational abilities as measured by CAA to social skills as measured by human coding of behaviors, while only specific prosodic abilities were associated.

CAA analyses for the intervention trial indicated that following the PEERS® intervention, adolescents improved their conversational abilities, including the number of speech segments they had in the conversation. They also showed intervention-related improvements in prosodic abilities such as voice quality, emotional state, and volume variability used during conversation. These indicate that the adolescents took a more active part in the conversations, and as such, support the well-documented effectiveness of PEERS®. Positive associations were found between the improvement in social skills as measured by human coding of behaviors and the improvement in the variability of the conversational rate of the adolescents as measured by CAA.

**Conclusions:** Our results support previous findings relating to conversational and prosodic deficits in individuals with ASD and extend the understanding of these differences to the age group of adolescence. The use of CAA for the purpose of evaluating improvement following an intervention has been scarcely used (Cabibihan et al., 2017). In the present study we have shown how using this objective method can complement behavioral coding.

**406.156 (Poster)** Associations between Intervention Hours and Attention to Faces in ASD: An Exploratory Analysis from the Autism Biomarkers Consortium for Clinical Trials

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**Background:** Research has identified associations between social attention, as qualified by eye gaze patterns during dyadic bid eye-tracking (ET) paradigms, and validated clinical outcome measures used to assess social communication.<sup>1</sup> With evidence implicating ET as a potential biomarker for social communication,<sup>1</sup> researchers have traditionally been interested in examining how ET measures associate with controlled exposures to specific interventions targeting social skill development.<sup>2,3</sup> However, there is little work examining how changes in ET measures may reflect effects of naturally occurring intervention use.

**Objectives:** To investigate how interventions used with children with ASD might be associated with an ET-derived outcome measure, the Oculomotor Index of Gaze to Human Faces (OMI).<sup>4</sup>

**Methods:** Data were acquired from the Autism Biomarkers Consortium for Clinical Trials. The sample included 280 participants (M=215, F=65) aged 6-11 years with ASD. ET data was collected at three timepoints (T1: baseline, T2: 6 weeks, T3: 6 months). OMI was calculated per timepoint by averaging percent of valid looking at faces during Activity Monitoring, Social Interaction and Static Social Scenes ET paradigms.<sup>4</sup> Change in OMI from T1 to T3 ( $\Delta$ OMI) was calculated controlling for effects of T1 OMI, age, and IQ. Intervention data were collected per timepoint through caregiver interview and total hours of intervention between T3 and T1 minus six weeks were estimated. Interventions that were used by at least 5% of the sample were included in analyses (12 specific and 3 aggregate interventions). Intervention hours were transformed by  $\log(x+1)$  before being passed through Lasso variable selection for predicting  $\Delta$ OMI. Linear regression modeled lasso selected variables as predictors of  $\Delta$ OMI.

**Results:** Lasso retained 4 intervention variables: cognitive behavioral therapy, parent training, supportive therapy, and the aggregate of evidence-based practice (EBP) interventions. Entering these into a linear regression identified EBP (standardized  $\beta = .146$ ,  $p=.022$ ) and supportive therapy ( $\beta = .125$ ,  $p=.045$ ) as significant but weak predictors of  $\Delta$ OMI. The overall fit of the model was relatively weak ( $R=.204$ ) (Table 1).

**Conclusions:** The results of this analysis suggest that interventions qualifying as evidence-based practices<sup>5</sup> and supportive therapy may be associated with changes in OMI over time, even when controlling for IQ, age, and OMI at baseline. However, as a data-driven machine learning approach, this work requires additional validation and verification. Looking at the composition of the EBP intervention aggregate (Table 2), the more frequently-used interventions, targeting social skills specifically, might logically associate with increased attention to faces. Future analyses could investigate each component to further define the effect of EBP outlined by the regression model. Targeting efforts to contextualize the supportive therapy variable might also broaden our interpretation of this model. The heterogeneity of ASD elicits a wide array of individual challenges; better understanding the nature of supplemental therapies that impact face looking may provide insight into general treatment factors impacting social attention.

1.Murias et al.2017.Autism Research.

2.Bradshaw et al.2019.Autism Research.

3.Greene et al.2020.JADD.

4.Webb et al.2020.Frontiers in Integrative Neuroscience.

5.Sridhar et al.2021.Submitted.

**406.157 (Poster)** Cluster Analysis of Social Competence Profiles of Autistic Children, Using the Parent Report Version of the Multidimensional Social Competence Scale (MSCS)

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**Background:** There is marked variability in the presentation of core diagnostic features across autistic individuals, which poses a significant obstacle for research design and interpretability, as well as for understanding clinical outcomes. Subtyping methods such as Cluster Analysis (CA) can be used to divide large autistic populations into smaller, more homogeneous subgroups according to their scores on select variables. Social Competence (SC; an individual's ability to effectively integrate and adapt social skills to fit a given social context) is a promising variable for identifying autistic subtypes within the domain of social impairment.

**Objectives:** To extract dimensionally-homogenous SC-based subgroups from a sample of autistic youth.

**Methods:** Participants were 91 autistic youth (16 females) aged 6-14 (mean = 9.78, SD = 1.85) with a minimum IQ of 71 points, from the lower mainland region of British Columbia. Within this sample, 44.00% self-identified as Asian, 38.50% as "Canadian", 3.30% as European, 2.20% as African American, and 11.00% self-identified as "Multicultural".

Two K-means Cluster Analyses (CA) were conducted on the participant's Multidimensional Social Competence Scale (MSCS) profiles, requesting three- and four-cluster solutions. One-way Analysis of Variance (ANOVA) procedures were then conducted to determine the variance in each MSCS domain that was accounted for by individual clusters, and to determine if clusters differed significantly from one another with respect to each MSCS variable. Clusters were interpreted by examining the average MSCS domain scores for each cluster.

In order to assess cluster differences beyond the variability that was observed in MSCS profiles, additional one-way ANOVAs were conducted for both CA solutions, with Social Responsiveness Scale, 2<sup>nd</sup> Edition (SRS-2) scores, IQ and age as the respective dependent variables. Chi-square analyses were also conducted for each CA solution, with gender as the dependent variable. Variability in SRS-2 scores was examined to determine if the clusters differed significantly on an alternative measure of social functioning. IQ, age, and gender were examined across clusters to inquire into the influence of these variables on distinguishing SC profile clusters.

**Results:** For both K-means CAs, all 7 MSCS domains contributed meaningfully to cluster determinations. The 3-cluster solution resulted in an overall high-scoring cluster, a moderate-scoring cluster with the lowest levels of social motivation, and a low-scoring cluster with the lowest verbal conversation skills and emotional regulation scores. The 4-cluster solution resulted in two higher-scoring clusters that differed from each-other on the verbal conversation skills, nonverbal sending skills, and emotional regulation skills domains, and two lower-scoring clusters, that differed from each-other on the verbal conversation skills and emotion regulation domains. In follow-up analyses, SRS-2 scales varied significantly across the 3- and 4-cluster solutions, whereas age and IQ scores did not vary significantly across clusters, and no significant association was found between gender and cluster membership.

**Conclusions:** Results show that heterogeneous autistic populations can be divided into more homogeneous subgroups based on similarities in social competence profiles. The continued conceptualization of more homogeneous autistic subgroups may advance the development of individualized interventions, and further our understanding of between-group differences within autism.

**406.158 (Poster)** Evaluating Effects of Caregiver Anxiety and Emotion Regulation on Child Emotional Functioning in Autism Spectrum Disorder  
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**Background:** Children with ASD present increased difficulty in emotion regulation (ER), the ability to evaluate and react to emotional stimuli, which can lead to negative social and academic outcomes (Mazefsky et al., 2013). Parents play a critical role in the development of child ER. In neurotypical populations, parent factors, such as ER strategies and anxiety, have been shown to impact parenting behaviors and ER development in children (Bariola et al., 2011). However, limited research exists in the field of ASD examining the influence of parent factors on early child development of ER.

**Objectives:**

1. Evaluate the effects of parent anxiety and ER on ER in toddlers with ASD.
2. Explore changes in parent anxiety and ER as well as child ER over a 6-month period of time.
3. Examine influence of baseline parent factors on changes in child ER.

**Methods:** Participants included 42 toddlers with ASD ( $M_{age}=30.81$  months,  $SD_{age}=8.81$ ) and their caregivers ( $M_{age}=38.98$  years  $SD=6.24$ ). Parents completed self-report measures of ER (cognitive reappraisal and expressive suppression from Emotion Regulation Questionnaire) and anxiety (Beck Anxiety Inventory) and parent report measures of child executive function abilities related to ER (Shift, Inhibition, Emotional Control subscales from the BRIEF-Preschool Version). A subset of families ( $n=13$ ) completed all measures 6-months later. Three regressions predicting child ER were run with three parent predictor variables: parent anxiety, cognitive reappraisal and suppression. There were no significant correlations between child non-verbal IQ/age and any child ER outcome measure and thus, these child factors were not included as covariates in the regressions. Paired-sample t-tests were run to examine changes in parent and child ER over 6-months. Finally, correlations between baseline parent ER and anxiety and child change scores were examined.

**Results:** When predicting child inhibitory control, parent anxiety ( $\beta=.38, p=.02$ ) and cognitive reappraisal ( $\beta=-.34, p=.024$ ) were significant predictors, such that higher parent anxiety and lower use of cognitive reappraisal were associated with increased difficulties in child inhibitory control. Parent anxiety was a significant predictor for child emotional control ( $\beta=.39, p=.01$ ), such that higher parent anxiety corresponded with higher child emotional difficulties. For the subset of families with two timepoints, no significant changes were noted in regard to parent or child factors. Higher use of emotion suppression at baseline was significantly correlated with increases in child inhibitory challenges over time ( $r^2=.56, p=.038$ ).

**Conclusions:** In the current study, parent anxiety and use of adaptive ER strategies played a key role in their child's ability to modulate emotions, behavior, and responses. Thus, incorporating parent factors when studying child ER development in ASD is important. Exploratory analyses revealed high stability in parent and child ER over a 6-month period of early childhood although this was based on a smaller sample. Additionally, findings within a subset showed that parent maladaptive ER use could influence child ER development. Results should be replicated with larger, more diverse samples to further explore the impact of additional parent and child factors, such as depression and stress on child ER strategies.

**406.159 (Poster)** Investigating Sex Differences in Friendship Quality and Loneliness in Autistic and Neurotypical Children  
*N. Libster<sup>1</sup>, A. Knox<sup>2</sup>, C. Lord<sup>3</sup>, D. Geschwind<sup>1</sup>, J. Parish-Morris<sup>2</sup> and C. Kasari<sup>1</sup>, (1)University of California, Los Angeles, Los Angeles, CA, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)UCLA Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA*

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**Background:** Compared to neurotypical children, autistic children are less accepted by their peers and have fewer reciprocal friendships (Chamberlain et al., 2007). However, autistic boys report qualitatively different friendships than autistic girls, who have been reported to have similar friendship quality to neurotypical girls and boys (Head et al., 2014; Sedgewick et al., 2019). Autistic boys are also less likely than neurotypical boys to define friendship in terms of companionship, affection, and intimacy (Bauminger & Kasari, 2000). Autistic boys report higher degrees of loneliness than neurotypical boys (Bauminger & Kasari, 2000) – but few if any studies have examined sex differences in loneliness among autistic children.

**Objectives:** Examine differences in self-reported friendship quality and loneliness in autistic boys and girls compared to neurotypical boys and girls.



**Methods:** The current mixed-methods study was a secondary analysis of transcribed clinical evaluations from 58 autistic children (29 girls) matched to 42 neurotypical children (21 girls) on age ( $M=10.19$ , range: 6-15y) and IQ ( $M=105.07$ ). As part of the ADOS-2 (Module 3; Lord et al., 2012), children were asked to describe their relationships with friends, define what a friend is, and answer the question “Do you ever feel lonely?”. Logistic regression analyses examined whether definitions of friendship and perceived loneliness differed by diagnosis and sex. Thematic analyses were conducted to identify themes related to friendship quality and loneliness.

**Results:** Autistic boys and girls were as likely as neurotypical boys and girls to define friendship in terms of character, companionship, and dependability. The odds of incorporating character increased by 2.37 for girls compared to boys ( $p=.04$ ), but there were no sex differences for companionship and dependability. Only 7% of children (mostly neurotypical girls) incorporated intimacy in their definitions. Meanwhile, 8% of autistic children and 2% of neurotypical children (girls and boys) were unclear when asked if they had friends. Furthermore, 12% of autistic children (girls and boys) reported having friends but did not play or spend time with them, and 3% of autistic children (girls) reported being bullied by their friends. Autistic boys and girls were also as likely as neurotypical boys and girls to feel lonely at times. However, 17% of autistic children (girls and boys) reported that they were often lonely because they had few friends.

**Conclusions:** This study revealed that autistic boys and girls provided similar definitions of friendship compared to neurotypical boys and girls. However, a thematic analysis revealed that autistic children had qualitatively different friendships than their neurotypical peers. Autistic boys and girls were as likely as neurotypical boys and girls to feel lonely at times, but it is important to note that the loneliness measure on the ADOS does not address degree of loneliness – rather, participants are asked if they ever feel lonely. A thematic analysis revealed that autistic boys and girls experienced greater loneliness compared to their neurotypical peers. Qualitative methods therefore suggest that the friendship and loneliness experiences of autistic children differ from those of neurotypical children but may not differ greatly by sex.

#### **406.160 (Poster) Sex Differences in Peer Conflict in Autistic and Neurotypical Children**

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**Background:** Autistic adolescents experience higher rates of peer conflict, specifically overt conflict, than neurotypical adolescents. While adolescent boys – both autistic and neurotypical – report more overt conflict than girls, autistic girls report higher rates of overall peer conflict and relational conflict than autistic boys and neurotypical girls and boys (Sedgewick et al., 2019). Meanwhile, few if any studies have examined sex differences in peer conflict among school-aged autistic children. School-aged autistic boys experience higher rates of peer conflict than neurotypical boys (Maiano et al., 2016), but it is unclear whether school-aged autistic girls also experience more conflict with their peers. Autistic boys tend to be isolated or rejected by their peers, while school-aged autistic girls tend to be overlooked or ignored (Dean et al., 2017). Although autistic girls are more motivated than autistic boys to interact with peers, putting them at higher risk for peer conflict, school-aged autistic girls may have difficulty recognizing subtle forms of aggression.

**Objectives:** Examine differences in self-reported peer conflict in autistic boys and girls compared to neurotypical boys and girls.

**Methods:** The current mixed-methods study was a secondary analysis of transcribed clinical evaluations from 58 autistic children (29 girls) matched to 42 neurotypical children (21 girls) on age ( $M=10.19$ , range: 6-15y) and IQ ( $M=105.07$ ). As part of the ADOS-2 (Module 3; Lord et al., 2012), children were asked if they ever had problems getting along with peers at school and if they had ever been teased or bullied. Transcripts were coded for problems with peers and bullying victimization, and logistic regression tested whether reported problems differed by sex and/or diagnosis. Thematic analyses were conducted to identify themes related to personal experiences of victimization.

**Results:** Autistic boys and girls were as likely as neurotypical boys and girls to experience problems with peers. However, the odds of having been bullied increased by 4.87 for autistic children compared to neurotypical children ( $p=.002$ ). There were no sex differences in bullying victimization among autistic and neurotypical children. Thematic analyses revealed that autistic children were more likely than neurotypical children to experience verbal and physical aggression but were as likely to experience relational aggression. Among autistic children, causes of peer conflict included trouble with interaction (boys), difficulty with flexibility (girls), and peers initiating conflict (girls). Both autistic and neurotypical boys and girls further attributed peer conflict to their personalities or to being “different.”

**Conclusions:** Autistic boys and girls were as likely to report experiencing problems with peers as neurotypical boys and girls. However, autistic children were more likely to have been overtly bullied compared to neurotypical children. A possible explanation for this discrepancy is that autistic children have difficulty perceiving subtle problems with peers, which can be less perceptible than being bullied. Similarly, they may have greater difficulty perceiving relational conflict compared to overt conflict, such as verbal and physical aggression. While there were no sex differences in the types of aggression experienced by autistic boys and girls, boys and girls reported different underlying causes of peer conflict.

#### **406.161 (Poster) Effects of Creative Movement Interventions on Praxis, Imitation, and Interpersonal Synchrony Skills in Children with ASD**

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**Background:** Children with Autism Spectrum Disorder (ASD) have primary impairments in social communication skills and comorbid deficits in imitation and interpersonal synchrony (IPS). In the past, our research group reported greater improvements in imitation and IPS performance in children with ASD after receiving rhythmic and yoga-based interventions compared to a fine motor-based (FM), standard of care intervention.

**Objectives:** In the current study, we combined music, dance, and yoga activities to develop a Creative Movement (CM) intervention and compare its effects to that of an FM intervention.

**Methods:** Thirty children with ASD between 5 and 14 years were recruited and randomly assigned to the CM or FM groups. Both groups received 16 training sessions (2 sessions/week), over 8 weeks. The CM group engaged in whole-body movements using music, dance, and yoga to promote IPS, imitation, coordination, and balance; whereas the FM group engaged in tabletop activities such as reading, building, and art-craft to promote social interactions and fine-motor skills. Two tests were administered before and after the intervention: a) The postural praxis and bilateral motor coordination subtests of Sensory Integration and Praxis Tests (SIPT-PP and SIPT-BMC)4 and b) IPS performance during drumming actions. We also assessed their task-specific performance during the yoga task and the amount of time in sync/out of sync with the trainer/caregiver during an early and a late training session.

**Results:** Our preliminary data from 21 children with ASD (13 in CM and 8 in FM) suggests positive findings that differ between the CM and FM groups. The CM group showed reduced SIPT-PP directness errors (Mean $\pm$ SE Error #): Pre = 10.58 $\pm$ 0.75, Post = 7.18 $\pm$ 4.09;  $p < 0.01$ ) and SIPT-BMC temporal errors after intervention (# of errors, Pre = 11.92 $\pm$ 3.44, Post = 6.31 $\pm$ 1.65;  $p < 0.05$ ); while the FM group only showed reduced SIPT-BMC temporal errors, post-intervention (# of errors, Pre = 11.25 $\pm$ 1.92, Post = 3.13 $\pm$ 1.17;  $p < 0.05$ ). In terms of task-specific tests, there was a trend for increased imitation accuracy during yoga poses (# of error, Pre = 13.15 $\pm$ 1.68, Post = 10.85 $\pm$ 1.55;  $p = 0.07$ ), and less time spent out of synchrony with the trainer/caregiver during the late compared to the early training session (mean duration in minutes (mean $\pm$ SE): Early session = 28.17 $\pm$ 7.35; Late session: 21.10 $\pm$ 5.40,  $p = 0.09$ ).

**Conclusions:** The CM intervention developed in this study has positive effects on imitation and IPS, therefore, could be used to promote synchrony/imitation skills in children with ASD which may increase social connections with peers and caregivers.

**406.162 (Poster)** "Social Pain Is Feeling Unwanted, When Nobody Wants You Around": Perceptions of Social Pain Among Adults with Autism. **M. Levi<sup>1</sup>, N. Schreuer<sup>2</sup>, Y. Granovsky<sup>3</sup>, I. Weissman-Fogel<sup>4</sup>, T. Bar-Shalita<sup>5</sup>, T. Hoffman<sup>4</sup> and E. Gal<sup>6</sup>,** (1)Occupational therapy, University of Haifa, Haifa, Israel, (2)Occupational Therapy, University of Haifa, Haifa, Israel, (3)Department of Neurology, Rambam Health Care Campus and the Laboratory of Clinical Neurophysiology, Faculty of Medicine, Technion, Haifa Israel, Haifa, Israel, (4)University of Haifa, Haifa, Israel, (5)Occupational Therapy, Tel Aviv University, Tel Aviv, Israel, (6)Department of Occupational Therapy, University of Haifa, Haifa, Israel

**Background:** The DSM-5 definition of Autism includes the existence of deficits in social interaction as a core feature. One manifestation of this diagnostic criterion is the absence of interest in peers. Another Autism diagnostic criterion is repetitive and restricted behaviors and interests, including abnormal reactions to sensory input, such as indifference to physical pain.

While physical pain has been widely investigated, research addressing emotional pain, particularly social pain in Autism, is scarce. However, there is a growing body of literature concerning social pain, its neural mechanism, and its behavioral expression. It is often assumed that autistic people do not experience social pain. It has long been questioned whether, and how they experience social pain and the answer to this question is still vague. Research in neurotypical population examines social pain, as it manifests in various emotions, while in autistic people, research is limited and focuses mainly on aspects of empathy. Such research suggests that while autistic people can empathize with another's physical pain, they have significant deficits in sharing representations of emotions. There is currently no research that relates to all aspects of the term "social pain" among autistic people.

Insight into the inner world of autistic people regarding social pain may promote a better understanding of their experience, which in turn may facilitate better integration into society and an enhanced quality of life.

**Objectives:** This study aims to shed light on how autistic people experience and perceive social pain and will explore the implications of social pain on their lives.

**Methods:** Using a phenomenological approach, 15 autistic adults participated in face-to-face in-depth interviews. The audio-taped interviews were transcribed verbatim and analyzed using thematic analysis to develop themes inductively.

**Results:** Three themes emerged relating to the experience of social pain: (1) Communication challenges as the source of social pain, i.e., difficulties in understanding others, difficulties in expressing oneself, and a sense of rejection by others; (2) The experience of social pain throughout the lifespan (anguish of social rejection, and sense of loneliness/ isolation) and (3) Responses and coping strategies with social pain.

**Conclusions:** While previous studies suggest that autistic people do not face social pain, the current results, based on first-hand accounts, demonstrate that, in fact, social pain is a significant challenge in their lives, markedly affecting participation and wellbeing. Interviews echo that the sense of isolation and feelings of solitude experienced by the participants are not based on their free choice but rather a byproduct of difficulties with social interaction and rejection by others. Moreover, interviews revealed examples of strategies autistic people use to cope with the social obstacles they face.

The results highlight the crucial need to listen to the point of view of autistic people, especially when it comes to subjective experiences such as pain. They also clarified the need to develop and improve intervention programs, which would assist them in dealing with their social pain.

**406.163 (Poster)** Social Engagement in Children with ASD in Inclusive Urban Classrooms

**Background:** There has been an increase of students with special needs that are served under the Individuals with Disabilities Education Act (2004) who are enrolled in general education (Hussar et al., 2020). This shift in inclusion for students with disabilities, including students with autism spectrum disorders (ASD), provides more opportunities for students with ASD to be educated with their typically-developing (TD) peers and increases the opportunities for social interaction. However, it is unclear whether the shift in more inclusionary practices in schools has impacted social engagement between students with ASD and their peers over time.

**Objectives:** This study is a secondary cross-sectional data analysis of three cohorts of elementary students with ASD who were fully included in urban schools. The study examined baseline data of social engagement between students with ASD and their peers.

**Methods:**

The study included 141 participants from three cohorts of students with ASD (2003-2007; 2008-2011; 2011-2014) from the Greater Los Angeles area. Participants were elementary students with ASD (ages 5-12) who were fully included in general education. Across cohorts of students, students' IQ ranged from 87 to 102. Students from ethnic minority backgrounds ranged from 53% to 85% across cohorts.

The Autism Diagnostic Observation Schedule (ADOS; Lord, et al., 2001) is a semi-structured, standardized assessment designed to assess the clinical presentation of ASD or other pervasive developmental disorders.

Playground Observation of Peer Engagement (POPE; Kasari et al., 2005) is a 15-minute observation of children's social engagement with peers during recess or lunchtime. Data was collected in one-minute intervals for 15 minutes. Each minute, independent blind observers coded for engagement states (e.g., solitary, proximity, onlooking, parallel, parallel aware, joint engagement, and games). Reliability was estimated with Kappa statistic and averaged .91.

**Results:** ANCOVAs were conducted to examine how engaged the children were on the playground. Generally, engagement was less than 50% of time observed. There were no differences among the cohorts in the percentage of time children spent isolated (33.66%, 28.11%, 29.24%), ( $F(2, 124) = 0.484, p = 0.617$ ) or engaged (40.92%, 43.09%, 52.56%) with their peers,  $F(2, 124) = 1.803, p = 0.169$ .

**Conclusions:** The study demonstrated that over the three cohorts of students spanning a decade, there were no significant differences in children's joint engagement with their peers in school. However, the data did show a positive trend of improvement in joint engagement from the first cohort (2003-2007) to the third cohort (2007-2014) of students. There was a 10% increase in time spent in joint engagement. Although this increase is not statistically significant, it is promising that there was a positive trend in joint engagement between students with ASD and their peers, perhaps with the increase of inclusionary practices. Future studies should examine the inclusionary practices implemented in schools and whether they impact joint engagement in students with ASD and their peers.

#### **406.164 (Poster) The Impact of Stress in Experimental Measures of Gaze Perception in Adults with ASD**

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**Background:**

In a previous research project, we investigated the effect of repetitive transcranial magnetic stimulation (rTMS) on social perception in typically developing individuals and in individuals with autism spectrum disorders (ASD). We used eye-tracking to measure looking behavior to the eyes during visualization of social movies at 3 time points after both active TMS and sham stimulation applied to the superior temporal sulcus. In healthy volunteers, results showed a significant decrease in the number of fixations to the eyes of characters after active inhibitory TMS (cTBS), but not after sham condition (Saitovitch et al. 2016). In the ASD group, we observed no significant effects of active excitatory TMS (iTBS). Strikingly, we observed a great variation of gaze pattern after sham condition, contrary to results from typically developing individuals (Figure 1).

**Objectives:**

In this study we aimed to better understand the impact of experimental conditions on gaze perception in individuals with ASD. For that purpose, we measured gaze pattern to the eyes during successive visualizations of the same stimuli set as the TMS protocol, but without any intervention.

**Methods:**

Seven male adults with ASD (mean age =  $27.2 \pm 2.9$ ), who have participated in the previous TMS study, were included in this study. All participants watched the same stimuli set, displaying scenes with characters engaged in social interactions, seven successive times. Eye-tracking data was processed with Tobii-Studio® software and number of fixations to the eyes were calculated for each visualization and for each participant. We used a linear regression analysis with repeated measures to investigate whether the number of fixations to the eyes would be impacted by the consecutive visualizations.

## Results:

We observed no statistically significant variations on the number of fixations to the eyes over the successive visualizations ( $F_{1,6} = 0.09$ ;  $p = 0.76$ ), indicating within-subject stability in gaze pattern across time in individuals with ASD.

## Conclusions:

Contrary to the behavior they presented in the previous TMS study, participants showed a great stability of gaze pattern to the eyes (Figure 2). These results suggest that, without any intervention, gaze behavior towards socially relevant stimuli is stable over time in individuals with ASD, as was previously described in typically developing individuals (Saitovitch et al., 2019). This strongly suggest that stress brought up in the experimental conditions of research protocols, even if they are minimum, can have a major impact on the data. Therefore, this should be acknowledged and taken into account when designing and interpreting results from research, particularly in protocols that inherently present a stressful environment, such as fMRI or TMS protocols.

## VIRTUAL POSTER SESSION — SOCIAL COGNITION AND SOCIAL BEHAVIOR

### 506 - Social Cognition and Social Behavior --- (V)

**506.072** (*Virtual Poster*) Alexithymia, Emotional Intelligence and Adjustment to College in Students with and without Autistic Traits  
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## Background:

Alexithymia is a personality construct characterized by difficulties in describing emotions in oneself and in others (Bagby et al., 1994). Alexithymia may be inversely related to emotional intelligence (EI), or the clusters of traits that comprise emotion knowledge. In fact, alexithymia may underlie difficulties with socio-emotional functioning in autism spectrum disorder (ASD; Bird & Cook, 2013), although existing research is limited.

## Objectives:

Research questions were: (1) Do adults with autistic traits present higher levels of alexithymia and lower levels of EI than neurotypical adults? (2) Does alexithymia or autistic traits better predict EI? and (3) What predictive roles do alexithymia, autism symptomatology and EI play in adjustment to college?

## Methods:

Following IRB approval, 144 college students participated. Students with autistic traits ( $n = 57$ ;  $M_{age} = 19;10$ , range 18;04 – 25;02) and without autistic traits ( $n = 87$ ;  $M_{age} = 19;08$ , range 18;10 – 22;07) were determined using T-scores from the Social Responsiveness Scale (SRS-2). The SRS-2 is a robust instrument for detecting the presence and severity of social impairment and restrictive/repetitive behaviors associated with autism (Constantino & Gruber, 2012). As shown in Table 1, students did not differ on gender (72% female), race (65% Caucasian), year in school (first, second), or GPA ( $M = 3.3$ ). Measures included the Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994), the Trait Emotional Intelligence Test (TEI-SF; Petrides, 2009), and the Student Adaptation to College Questionnaire (SACQ; Baker & Stryk, 2017). The SACQ was used to assess academic adjustment (beliefs about adequacy of academic efforts), social adjustment (successful social integration), and personal-emotional adjustment (psychological and physical well-being).

## Results:

**Research Question 1:** Students with autistic traits displayed significantly higher levels of alexithymia ( $M = 58.0$ ;  $SD = 8.61$ ) than those without autistic traits ( $M = 40.74$ ;  $SD = 9.73$ ),  $t(142) = -11.03$ ,  $p < .001$ . They also scored lower on EI,  $t(142) = 8.46$ ,  $p < .001$ . **Research Question 2:** With alexithymia and autistic traits as predictors of EI, the overall model and both predictors were significant (see Table 2). **Research Question 3:** With alexithymia, autistic traits and EI as predictors, the overall models were significant for social and personal-emotional adjustment (Table 2). However, only EI was a significant predictor in these models (Table 2). The overall model was not significant for academic adjustment,  $F(3, 134) = 0.25$ ,  $p = .863$ .

## Conclusions:

College students with autistic traits showed greater alexithymia and lower EI than those without autistic traits. However, *both* alexithymia and autistic traits were significant predictors of EI. Additionally, alexithymia and autistic traits were not significant predictors of social or personal-emotional adjustment in college beyond the significant, predictive role of EI. These findings suggest that the cluster of traits comprising emotion understanding (EI) may be particularly important for successful socio-emotional functioning and adjustment in college. Wider implications of these findings include the need to understand how these co-occurring aspects of emotion processing in ASD affect socio-emotional functioning.

**506.073 (Virtual Poster)** Amount and Timing of Attention to the Eyes Are Differentially Associated with White Matter Maturation

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**Background:** Attention to eyes—a critical skill that guides typical socialization—is already in decline by the second month of life in infants later diagnosed with Autism Spectrum Disorder (ASD). In contrast, typically developing (TD) children *increase* their attention to eyes throughout infancy and specialize their attention patterns *to look to social stimuli at the right time (i.e., relative salience)*, establishing a foundation for continued social visual engagement and brain specialization. The neural systems associated with these basic mechanisms of social adaptive action are currently unknown, even in typical development. Identifying associations between trajectories of social visual engagement and trajectories of brain maturation in typical infancy is an important step towards understanding how deviations from these trajectories may contribute to the emergence of social disability in ASD.

**Objectives:** To identify associations between trajectories of white matter microstructure and trajectories of eye-looking and relative salience from 0-6 months in TD infants.

**Methods:** Diffusion MRI and eye-tracking data were collected prospectively and longitudinally in the same infants ( $n=71$ , 29 female) at 3 and 6 pseudorandom time points, respectively, between birth and 6 months. All participants were full-term, healthy infants with no family history of ASD or developmental delay and no known medical or genetic conditions. Atlas-based tractography was used to delineate 11 major white matter (WM) tracts including the pyramidal tract (PT) and corpus callosum splenium (CCs). Fractional anisotropy (FA) values were generated for each tract to index maturation. Eye-tracking data were collected while infants viewed scenes of actress caregivers engaging in naturalistic interaction and percentage of time spent fixating on the eyes was calculated. Relative salience values were computed to measure how similarly infants watched these scenes relative to an age-matched reference sample. Growth curves were fit using functional principal component analysis and Functional Linear Regression tested associations between longitudinal trajectories.

**Results:** Functional linear regression revealed a robust association ( $R^2 = .06, p < .02$ ) between growth curves of FA in the PT and total amount of eye-looking, such that higher FA in the PT contributes to greater eye-looking from 80-120 days (Fig. 1). Parametric multivariate analyses between features of variance from trajectories of FA in the CCs and relative salience reveal higher FA in the CCs is associated with greater relative salience values ( $R^2 = .06, p < .04$ ), meaning infants who learn to attend to social stimuli at the right time faster than other infants also have a more mature CCs (Fig. 2). No other relationships were observed between measures and WM tracts.

**Conclusions:** This study demonstrates critical associations between trajectories of WM microstructure and social visual engagement in the first months of life. Eye-looking and relative salience are associated with the maturation of the PT and CCs, tracts involved in sensorimotor development and efficient goal-direct orienting, respectively. These findings suggest that developing sensorimotor and visual networks may be particularly responsive to experiential input involving the eyes of social partners and suggest a process by which early divergence from normative experience may lead to and/or result from atypical patterns of white matter development in ASD.

**506.074 (Virtual Poster)** Are Developmental Trajectories from Toddlerhood to Adolescence in ASD Related to Social Relationship Competence?

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**Background:** The ability to establish social relationships evolves early in life and becomes increasingly important with age, especially during early adolescence. Evidence shows that social relationships impact children's development, well-being, and adaptive development in adulthood. Considering the known social difficulties of children and adolescents with autism spectrum disorder (ASD), they may be particularly at risk for experiencing challenges in establishing crucial social relationships. However, to date, there is a paucity in follow-up studies assessing the relationship between developmental trajectories and outcomes in social relationships among those with ASD.

**Objectives:** The current study examines the relationship between developmental trajectories, including cognitive ability, autism severity, and adaptive skills, and social relationship competence of adolescents with ASD.

**Methods:** Our follow-up study included 43 adolescents (5 females) with a mean age of 13:06 years ( $SD = 2:0$ ) who were diagnosed with ASD during toddlerhood. Participants underwent comprehensive assessment of cognitive ability, adaptive skills [Vineland Adaptive Behavior Scales-VABS], and autism severity [Autism Diagnostic Observation Scales (ADOS (calibrated severity score (CSS))] during toddlerhood (T1) and adolescence (T2). We generated a social relationship competence construct score based on three variables: 1. adolescent self-report and identification of friendship(s), 2. parental report regarding whether their child has a friend, and 3. adolescent social insight (based on ADOS Module 3 "Insight into Typical Social Situation and Relationships" item). Participants with a self-declared friend, whose parents report them having a friend, and who evidence insight into social relationships including their own role, were included in the higher social relationship competence (HSRC,  $n = 19$ ) group. Participants who did not fulfil all these criteria were included in the lower social relationship competence (LSRC,  $n = 25$ ) group.

**Results:** To examine change in cognitive ability, ASD symptom severity, and adaptive behavior skills from T1 to T2, a series of 2X2 (2 groups X 2 times) ANOVAs with repeated measures were performed.

For the ADOS social affect CSS, a significant Time X Group interaction was noted. Only the LSRC group showed an increase from T1 ( $M = 6.59$ ,  $SD = 2.30$ ) to T2 ( $M = 8.08$ ,  $SD = 2.23$ ) ( $p < .05$ ) in symptom severity. For VABS subdomains, a significant Time X Group interaction was found. Examining each subdomain separately, Time X Group interactions were significant for VABS socialization and daily living skills subdomains. In both measures, the HSRC group showed an increase from T1 ( $M = 71.70$ ,  $SD = 7.53$ ;  $M = 69.05$ ,  $SD = 5.71$ , respectively) to T2 ( $M = 93.18$ ,  $SD = 14.28$ ;  $M = 91.18$ ,  $SD = 14.81$ , respectively). No significant Time effect or Time X Group interaction was found for IQ, ADOS Restricted and Repetitive Behaviors CSS, and VABS communication scores.

**Conclusions:** This long-term follow-up study's findings suggest that a portion of toddlers diagnosed with ASD can develop social relationships during adolescence. Better trajectories over the years for social-communication autism severity, and social and daily living adaptive skills are important for achieving better outcomes in social relationships and should be the focus of interventions.

**506.075 (Virtual Poster)** Assessing Contribution of Pragmatic Impairments and Executive Dysfunction to Theory of Mind Deficits in School-Aged Children with High-Functioning Autism

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**Background:**

Impairments in theory of mind (ToM) and executive function (EF) explained core behavioral symptoms of autism. Impairment of EF subcomponents, e.g., cognitive flexibility, inhibition and planning, accounts for ToM deficits in autism (Demetriou et al., 2019). Individuals with high-functioning autism (HFA) also impaired in pragmatic skills, from recognizing emotions of words (i.e., emotional prosody perception) to narratives. Advanced ToM tasks were categorized with two factors, social reasoning (e.g., eyes task) and transgression recognition (e.g., faux pas task) (Osterhaus et al., 2016). Few studies investigated relative contribution of EF and pragmatic skills to factors of advanced ToM in school-aged children with HFA.

**Objectives:**

To investigate whether subcomponents of EF and pragmatic skills would account for higher-order ToM deficits in HFA children.

**Methods:**

*Participants.* HFA ( $n=73$ , mean age=10.11 years) and TD ( $n=65$ , mean age=10.03 years) in Taiwan. Inclusion criteria of HFA: CAST (Childhood Autism Spectrum Test) score  $\geq 15$  and FSIQ of WISC-IV  $> 85$ .

*Tasks and Measures*

*Pragmatic skills.* Children's Communication Checklist-2 (CCC-2) assessed social communication and pragmatic skills in children.

*Emotional prosody perception.* Children judged emotion of each word, varied with emotional prosody (angry, sad, happy, and neutral).

*Advanced ToM task.* (1).Reading the Mind in the Eyes Task (*Eyes task*). Children matched mental state of a person with one of four mental state words, based on only an image of their eyes. (2). *Faux Pas Task*. Children listened to a story, then determined whether they detected the faux pas in the story.

*Executive Function*

*Tower of London (TOL)* task assessed the ability of spatial planning. *Wisconsin Card Sorting Task (WCST)* assessed cognitive flexibility.

**Results:**

*HFA vs. TD group.* Compared with TD group, HFA group showed significant impairments (one-way ANOVA,  $p < .01$ ) in advanced ToM tasks, cognitive flexibility, planning, and emotional prosody perception.

*Pragmatic skills, EF and advanced ToM.* Hierarchical liner regression models were conducted for each child group (Table 1). Verbal or non-verbal IQ and age were control variables (Model 1). EF subcomponents with additional contribution on  $R^2$  were included in Model 2. CCC-2 scores were added to final model (Model 3).

*HFA group.* On social reasoning, WCST significant contributed to eye task, after controlling verbal IQ and age. Regarding to recognize transgression, stereotyped restricted language (SRL) of CCC-2 was weighted more than verbal IQ to faux pas task. Both social communication ability (SCA) of CCC-2 and WCST score predicted variances of emotional prosody perception.

*TD group.* Compared with HFA group, results (Table 1) showed that language skills predicted variances of eyes task and faux pas task. However, WCST did not account for variances in advanced ToM tasks. Spatial ability (PRI of WISC) accounted for variance of emotional prosody perception.

## Conclusions:

Among EF subcomponents, cognitive flexibility weighted more than pragmatic skills to social reasoning but not detecting social transgression in HFA group. Pragmatic skills were weighted more than cognitive flexibility to recognize transgression during social interactions in HFA group. In brief, pragmatic skill and cognitive flexibility account for different dimensions (social reasoning and transgression) of ToM impairments in HFA children.

### **506.076** (Virtual Poster) Associations of Emotion Dysregulation and Heart Rate Variability in Adolescents with and without Autism Spectrum Disorder

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**Background:** Although not a defining feature of the disorder, emotion regulation (ER) deficits are increasingly seen as a risk factor linked to the problematic behavioral and affective problems observed in individuals with autism spectrum disorder (ASD). Heart rate variability (HRV), which refers to the variation in heart beats, is a physiological indicator of autonomic flexibility. Past studies in combined samples of children and adults with and without ASD have separately shown that HRV is associated with ASD symptomatology (Cai et al., 2019), anxiety (Guy et al., 2014), internalizing and externalizing symptoms (Neuhaus et al. 2014). Nevertheless, it remains unclear whether HRV is linked to levels of emotion dysregulation, particularly in samples of adolescents with and without ASD.

**Objectives:** To investigate whether emotion dysregulation in adolescents with and without ASD is associated with HRV.

**Methods:** Fifteen adolescents with ASD (male = 66.7%,  $M_{age} = 16.60$ ,  $SD = 2.32$ ) and thirty-five without ASD (male = 25.7%,  $M_{age} = 16.34$ ,  $SD = 1.28$ ) completed a 6-minute resting electrocardiogram (ECG) in the laboratory. HRV indices were derived from the ECG, including, standard deviation of the NN interval (SDNN), root mean square of successive interbeat intervals (RMSSD), percentage of number of interbeat intervals that differ in more than 50ms (pNN50) and high frequency component of HRV (HF).

All participants completed the Autism Quotient (AQ), while participants' caregiver or parents completed the 30-item Emotion Dysregulation Inventory (EDI), an informant-report questionnaire that measured emotional distress and problems with ER. Each participant was scored on the two EDI sub-scales measuring Reactivity (rapidly escalating, intense negative affect) and Dysphoria (sadness and anhedonia). All scales were administered in Chinese.

**Results:** Independent samples *t*-tests indicated that ASD adolescents scored significantly higher on scores of Reactivity and Dysphoria, compared to adolescents without ASD. Furthermore, ASD adolescents showed lower RMSSD than adolescents without ASD. Correlational analyses in the combined sample of participants revealed significant associations between HRV indices and the EDI. Specifically, Reactivity showed negative correlations with RMSSD and pNN50. Dysphoria was not associated with any of the HRV indices.

**Conclusions:** The findings indicate that ASD adolescents experience greater emotion dysregulation and show lower autonomic flexibility than their typically developing peers. More importantly, the finding that lower HRV was significantly related to higher levels of emotion dysregulation, lends support to HRV as a biomarker of ER. This study suggests that disruptions in ANS functioning may underlie emotion dysregulation in adolescents with ASD. Future research will be required to examine the potential for interventions that improve autonomic balance in ASD populations.

### **506.077** (Virtual Poster) Development of Helping Behavior in Children at Elevated Likelihood for Autism Spectrum Disorder

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**Background:** According to the social motivation hypothesis of autism spectrum disorder (ASD), decreased social motivation may result in less attention to and thus fewer experiences with social sources of information, negatively influencing the development of social cognition and social-communicative abilities (Chevallier et al., 2012). Given the etiological nature of this reduction in social motivation, we expect this difference to be detectable early in life. As younger siblings of children with ASD have a 10 to 20 times higher chance of developing ASD themselves (Szatmari et al., 2004), the current study focused on intrinsically socially motivated behavior of elevated likelihood (EL) siblings, by administering helping tasks.

**Objectives:** The current study aims to answer the following research questions:

1. Is there a difference in helping behavior between EL children and children at typical likelihood (TL) for ASD?
2. Is helping behavior associated with social-communicative abilities?

**Methods:** Fifty EL siblings and 41 TL siblings (i.e., siblings of typically developing children), participating in a prospective study design, were tested in six helping tasks (Warneken & Tomasello, 2006) at 14, 24 and 36 months of age. In the **experimental condition** (3 tasks) the researcher accidentally encountered a problem that he/she could not solve himself/herself without the child's help. In the **control condition** (3 tasks, counterbalanced) a similar situation was created intentionally by the researcher and thus no help was needed. All sessions were videotaped and coded with regard to helping behavior and eye contact. Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al., 2013) and Mullen Scales of Early Learning (MSEL; Mullen, 1995) were administered.

**Results:** All participants at all ages helped more frequently in the experimental compared to the control condition, which suggests that the experimental manipulation was successful. Second, EL siblings helped less in the experimental condition than TL siblings at the ages of 14 and 24, but not at 36 months. Furthermore, at 24 months TL siblings, but not EL siblings, made more eye contact with both researcher and parent in the control condition compared to the experimental condition. Finally, within the total sample, more frequent helping behavior at 14 months was associated with lower ADOS-2 Social Affect and total scores at both 14 and 36 months, but not with MSEL scores. At 24 months, only a cross-sectional association with ADOS-2 scores was found. Within the EL group, outcome status was related to helping behavior at 14 months: EL siblings with later ASD characteristics (BAP or ASD outcome at 36 months) helped less than EL siblings without later ASD characteristics.

**Conclusions:** Children at EL for ASD seem to experience a delay in the development of helping behavior, which might be indicative of lower levels of (pro)social motivation. Moreover, the difference in helping behavior at the age of 14 months is predictive of later ASD symptomatology. Finally, at the age of 24 months we found evidence for less social referencing in the ambiguous control conditions in the EL group, as TL siblings checked more often with the parent and researcher during this awkward social situation.

**506.078 (Virtual Poster)** Interpersonal Contexts Predict Interaction Reciprocity: How Autistic, Non-Autistic, and Mixed-Neurotype Peer Interactions Unfold in an Inclusive School Environment

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Background:

Youth on the autism spectrum learning in inclusive education commonly experience difficulties in peer interactions and relationships, associated with a higher level of loneliness and bullying victimization rate among these students than their non-autistic peers. Previous studies on peer interactions of youth on the spectrum primarily investigated individual factors (e.g., social-communicative or cognitive traits), presenting a knowledge gap in the effects of interpersonal contexts on social outcomes. However, the Double Empathy Problem Theory emphasizes the role of interpersonal alignment in social expectations and interests on social outcomes, which is supported by other theoretical and empirical evidence.

Objectives:

This study aimed to investigate the effects of interpersonal contexts on the reciprocity and progress of real-world peer interactions in inclusive education. We defined interactive contexts as the neurotype composition among students participating in an interaction.

Methods:

This mixed-methods study investigated peer interactions among 12 students (six on the spectrum, age 12-14) over eight 45-min club sessions across 5 months, codifying a total of 1,174 social behaviors in 188 peer interaction series. For each interaction, we coded the interpersonal context (autistic, non-autistic, or mixed-neurotype dyad/group), interaction reciprocity (the total number of social turns in the interaction), and the characteristics of each social behavior. We further categorized interactions as *functional* or *relational* (the former reflected an instrumental purpose, e.g., seeking help, while the latter included all other initiations), based on the purpose of the initial social behavior. For all social turns following the initial social behaviors, we categorized each behavior as *extending*, *relevant*, or *tangential* depending on whether it expands or is relevant or tangential to the prior social behavior.

Results:

Regardless of the initiation purpose, autistic interactions showed the highest average and variance in reciprocity ( $M=7.22$ ,  $SD=7.57$ ), followed by non-autistic students ( $M=5.47$ ,  $SD=4.28$ ) and mixed-neurotypes ( $M=5.00$ ,  $SD=3.85$ ) dyads/groups. Figure-1 reveals the distinct reciprocity distributions of interactions by interpersonal contexts, initiation types, and initiator neurotypes. Poisson regression shows that autistic interactions had significantly higher reciprocity than non-autistic interactions (estimate=0.25,  $SE=0.07$ ,  $p<.001$ ), and relational interactions had higher reciprocity than functional interactions (estimate=0.40,  $SE=0.07$ ,  $p<.001$ ).

Figure-2 plots the characteristic of social behaviors against the sequence of social turns, illustrating the progress of peer interactions by interpersonal context and interaction purpose. Compared with non-autistic interactions, autistic interactions demonstrated a similar mixture of relevant and extending responses as well as increased tangential turns. Such tangential turns, however, did not interrupt the progress of autistic interactions, which reciprocated further than non-autistic and mixed-neurotype interactions. Mixed-neurotype interactions showed earlier instances of tangential responses than other interpersonal contexts. To explain these findings, an ongoing qualitative analysis of interactions across interpersonal contexts will be presented.

Conclusions:

This study provided preliminary findings on the effects of interpersonal contexts on interaction reciprocity and progress. Within-neurotype interactions showed higher reciprocity than cross-neurotype ones, which aligned with the Double Empathy Problem Theory. Findings on the progress of autistic interactions demonstrated the unique characteristics of autistic sociality.



**506.079 (Virtual Poster)** Investigation of Autism Spectrum Disorder Diagnosis and Social Anxiety Symptoms As Predictors of Visual Attention to Faces and Eyes

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**Background:** Up to 34% of adolescents with autism spectrum disorder (ASD) have co-occurring social anxiety (SA; Kreiser & White, 2014), but this association has not been fully explored (Spain et al., 2018). Eye-tracking (ET) provides an objective measurement of social attention that could clarify relationships between ASD and SA characteristics. In previous studies, individuals with ASD and individuals with SA both looked less at eyes than typically developing (TD) individuals; however, ASD participants also looked less at faces, while participants with SA showed an early attentional bias towards negative faces compared to neutral stimuli (Hessels et al., 2018; Chita-Tegmark, 2016; Günther et al., 2021).

**Objectives:** The current study investigated predictors of percent looking time (%looking, measured by ET) at different facial regions of interest (ROIs). It was predicted that (1) higher SA scores and (2) ASD diagnosis would each predict less %looking at eyes. Additionally, exploratory analyses were conducted to look for interaction effects among diagnostic group, SA score, and stimulus valence on %looking at ROIs.

**Methods:** Fifty-four children with ASD (22.22% female;  $M=13.27\pm2.94$  years) and 35 TD children (54.29% female;  $M=12.45\pm2.61$  years) completed the Multidimensional Anxiety Scale for Children—Child Version (MASC-C). The Social Anxiety (SA) subscale was used for the current analyses. Eye-tracking data were collected during a gaze-contingent emotional faces paradigm, in which neutral faces became happy or fearful after participants directed their gaze to the eyes. ROIs were created for the face, eyes, nose, and mouth, and %looking at each ROI for each emotional face was averaged across trials for each participant and logit transformed. Multiple linear regressions were performed to examine whether ASD group, SA score, and/or stimulus valence predicted %looking at ROIs.

**Results:** Emotional valence did not predict %looking for any ROI ( $ps>.05$ ). Regression models with ASD group and SA score as predictors were significant for faces ( $F(3,164)=13.08, p<.001, R^2=17.83\%$ ) and eyes ( $F(3,164)=3.23, p=.024, R^2=3.86\%$ ). Children with ASD looked less at faces than TD children ( $\beta=0.04, t=4.12, p<.001$ ) but not less at eyes ( $p>.05$ ). Children with higher SA scores looked less at eyes ( $\beta=-.050, t=-2.74, p=.007$ ) than those with lower SA scores. Additionally, there was a significant diagnostic-group-by-SA-score interaction for %looking at faces; ASD participants with higher SA scores looked more at faces than ASD participants with lower SA scores, a pattern not seen in the TD group ( $\beta=-.002, t=-2.04, p=.043$ ).

**Conclusions:** Partially replicating previous findings, results indicated distinct contributions of SA and ASD characteristics to visual attention. Though children with ASD looked less at faces overall, their levels of eye fixation did not differ from TD children; however, higher levels of SA predicted less looking at eyes. Furthermore, children with ASD looked more at faces when they had higher SA scores, which could indicate either increased social motivation or increased hypervigilance to faces compared to children with ASD who have lower SA levels. These findings suggest that it is important to consider both ASD and SA when studying face gaze in children.

**506.080 (Virtual Poster)** Links between Perceived Dissimilarity, Loneliness and Internalizing Symptoms in Autistic Children and Adolescents  
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**Background:** Loneliness, or the lack of desired social relationships, increases during adolescence as children experience greater social needs as well as increased risk of social isolation or rejection (Whitehouse et al., 2008). The relation between loneliness and other psychological variables in autistic children is not fully understood. Prior research in autistic children has found that higher levels of internalizing symptoms relate to increased loneliness (Deckers et al., 2017; White & Roberson-Nay, 2008; Whitehouse et al., 2008). However, less is known about how loneliness in autistic children is affected by their perceptions of themselves in relation to others. Perceiving oneself as similar to others predicts feelings of connectedness in relationships (Montoya et al., 2008; Murray et al., 2002; Pinel et al., 2006). Conversely, perceiving oneself as dissimilar to others—as autistic individuals may be especially likely to do—may lead to difficulty in forming high-quality social connections, in turn leading to increased loneliness.

**Objectives:** This study explores relations between loneliness and 1) self- and parent-reported internalizing symptoms and 2) perceived dissimilarity in autistic and neurotypical children aged 8–14 years.

**Methods:** 31 autistic children (ages 8–14,  $mean_{age} = 10.73$ ,  $n_{female} = 9$ ) with a confirmed diagnosis of autism participated in this study. A group of 31 neurotypical children (ages 8–14,  $mean_{age} = 10.73$ ,  $n_{female} = 9$ ) were matched on age and gender. All children had an IQ of at least 80. For internalizing symptoms, children and parents each completed the Screen for Child Anxiety Related Emotional Disorders (Birmaher et al., 1995, 1997), and parents also completed the internalizing subscale of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). In addition, children answered six original questions about perceived dissimilarity and three original questions about loneliness developed by the researchers. Separate multiple linear regression analyses were run for each group. Each model controlled for participant age and gender and included self- and parent-reported anxiety (SCARED total scores), parent-reported internalizing (CBCL), and perceived dissimilarity as predictors of loneliness. We hypothesized that in both groups, internalizing symptoms and perceived dissimilarity would positively predict loneliness.

**Results:** The autistic group showed significantly higher self- and parent-reported internalizing symptoms, as well as significantly higher perceived dissimilarity than the neurotypical group. Self-reported loneliness did not significantly differ between the autistic and neurotypical groups. In the

autistic group, perceived dissimilarity was the only significant predictor of loneliness ( $p < 0.01$ ), whereas in the neurotypical group, parent-reported anxiety was the only significant predictor ( $p < 0.05$ ).

**Conclusions:** Results of the study expand upon prior research that levels of internalizing symptoms are significantly higher in autistic children when compared to neurotypical children but failed to replicate studies that show a relation between internalizing symptoms and loneliness in autistic children, instead highlighting perceived dissimilarity as a correlate of loneliness. Furthermore, parent-reported anxiety and not perceived dissimilarity predicted loneliness in the neurotypical group; thus, predictors of loneliness may differ between autistic and non-autistic children. Future research should continue to investigate measures of perceived dissimilarity as a predictor of increased loneliness among autistic child and adolescent populations.

**506.081 (Virtual Poster) Loneliness in Autistic Children: In Relation to School Recess Time**

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**Background:**

Loneliness is the cognitive awareness of the deficiency in one's interpersonal relationships (Asher & Paquette, 2003). Previous research using self-reports showed that the feeling of loneliness becomes more pronounced when autistic children enter adolescence, experiencing an elevated level of loneliness compared to their non-autistic peers (Bauminger & Kasari, 2001; Bottema-Beutel et al., 2019; Deckers et al., 2017).

School recess time is when children can have child-led, unstructured activities and interactions, which makes it a crucial part of school life for children to develop interpersonal relationships. While observational studies have revealed that autistic children more often engage in solitary or peripheral activities on the school playground (Gilmore et al., 2019), it remains unknown to what extent the activities during school recess contribute to autistic children's feeling of loneliness in school.

**Objectives:**

Using self-reports and sensor technology, this study aimed to assess (1) the extent to which the level of loneliness in school is related to their enjoyment of recess activities, and to social interactions during recess, and (2) the extent to which these relations differ between autistic and non-autistic children.

**Methods:**

Autistic children ( $n = 47$ ) and their non-autistic classmates ( $n = 52$ ) aged 8 to 14 years from two special education primary schools participated in this study ( $M = 10.84$  years,  $SD = 1.21$ ; 34 girls and 65 boys). Children completed the Children's Loneliness Scale to assess levels of loneliness in school (Maes et al., 2015); and the Lunchtime Enjoyment of Activity and Play Questionnaire to assess their enjoyment of activities during school recess (Hyndman et al., 2013). Also, children wore proximity sensors (Radio Frequency Identification Devices, RFID) at the schoolyard to assess their social interactions during recess in terms of (a) time spent in interaction with peers, (b) number of partners, and (c) centrality in a social network.

**Results:**

We found no differences in self-reported levels of loneliness and enjoyment of recess activities between autistic and non-autistic children. At the schoolyard, autistic children spent shorter time interacting with peers ( $U = 634, p = .002$ ) and were in contact with fewer peers ( $U = 635, p = .002$ ) compared to their non-autistic classmates. Also, in autistic children, higher levels of loneliness in school were correlated with fewer interaction partners ( $\rho = -.37$ ) and lower levels of enjoyment ( $\rho = -.44$ ) during recess. In children without autism, higher levels of loneliness were only correlated with shorter time spent in interaction ( $\rho = -.32$ ).

**Conclusions:**

Although autistic and non-autistic children reported similar levels of loneliness in school, different factors during recess may affect their perception of loneliness. While the duration of contacts was important for the peers without autism, the number of contacts and the active participation in play activities during recess seemed more important for autistic children. These findings show that autistic children may have different expectations about their interpersonal relationships, which should be taken into account for a better inclusion of these children in schools.

**506.082 (Virtual Poster) Relationships between Social Responsiveness and Visual Attention to Faces in a Transdiagnostic Sample of Adults with Autism, Schizophrenia, and a Non-Clinical Comparison Group**

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## Background:

Atypical visual attention to faces is reported in individuals with autism and schizophrenia spectrum disorders (ASD, SZ) and is thought to contribute to social communication difficulties in both clinical populations. Understanding points of convergence and divergence in processing facial communication is needed to understand the mechanisms of social communication to inform intervention development.

## Objectives:

Examine between-group differences in visual attention during reception of facial communication as it relates to social responsiveness.

## Methods:

Participants were adults aged 18-35 years (ASD  $n=31$ ; SZ  $n=24$ ; non-clinical comparison participants [NCC]  $n=42$ ). Diagnoses were confirmed with gold standard instruments administered by experienced clinicians. A novel gaze-contingent paradigm examined visual attention during reception of facial communication. Participants passively viewed counterbalanced fixation cues followed by a neutral face; contingent upon participant gaze, the face responded with either a happy or fearful expression. The eye tracking measure of interest was percentage of time looking (%looking) at informative regions of the face (RoF). The Social Responsiveness Scale (SRS-2) and Broader Autism Phenotype Questionnaire (BAPQ) assessed self-reported autistic traits.

## Results:

For each RoF (Right Eye, Left Eye, Between Eyes, Nose, Mouth), separate univariate repeated measures ANOVAs assessed differences in %looking, with face valence (fearful, happy) as a within-subjects factor and diagnostic group (ASD, SZ, NCC) as a between-subjects factor. Post-hoc  $t$ -tests evaluated contrasts between emotion and between groups. Significant between-group differences in %looking were detected for Nose ( $F(2,94)=4.73$ ,  $p=0.01$ ) and Mouth ( $F(2,94)=4.60$ ,  $p=0.01$ ): ASD and SZ looked more to Nose and Mouth compared to NCC (post hoc  $p$ 's  $<0.05$ ). Only within Right Eye, the valence  $\times$  group interaction was significant ( $F(2,94)=4.99$ ,  $p<0.01$ ): SZ looked less to Right Eye during fearful compared to happy faces ( $t(94)=-3.30$ ,  $p=0.02$ ), a pattern absent in ASD and NCC. Across all groups, %looking did not differ based on valence of the face.

Given sparsity in %looking across RoFs, subsequent analyses examined associations between social responsiveness and %looking to the whole face. Higher SRS-2 and BAPQ total scores (higher levels of autistic traits) were negatively associated with %looking to the face (BAPQ  $R^2=0.24$ , SRS-2  $R^2=0.23$ ). Linear regressions were applied to evaluate group by social responsiveness interactions. The relationship between autistic traits and %looking differed by group (SRS-2  $\times$  group:  $t(89)=-2.28$ ,  $p=0.03$ ; BAPQ  $\times$  group:  $t(89)=-2.91$ ,  $p<0.01$ ): NCC exhibited a negative relationship between social responsiveness and other autistic traits and %looking, while ASD exhibited a positive relationship (Figure 1); SZ did not exhibit a significant relationship between social responsiveness and %looking.

## Conclusions:

Findings inform visual attention differences during face processing in ASD and SZ. Results replicate and extend previously reported visual attention biases to the mouth in ASD and SZ. Notably, the relationship between social responsiveness and %looking to the face differed across diagnostic groups such that greater social difficulties related to lower %looking to the face. Future research should confirm these findings and investigate response to facial communication in ASD and SZ in more naturalistic contexts.

**506.083 (Virtual Poster)** Self-Determination, Body-Related Self-Conscious Emotions, and Physical Activity Levels in College Students with and without ASD Traits

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## Background:

Although the benefits of physical activity are well known, research has shown that individuals with autism spectrum disorder (ASD) are less active and are less engaged in physical activity (PA) than those without ASD traits (Hiller et al., 2020; Pan & Frey, 2006; Stanish et al., 2017). Of interest in the present study is whether certain factors influence participation in PA in ASD, such as self-determination and body-related self-conscious emotions.

## Objectives:

Two major research questions were addressed: (1) do young adults with and without ASD traits differ in terms of self-determination and body-related self-conscious emotions, and (2) do young adults who meet and do not meet PA levels differ on these same variables. Additionally, we explored these questions in young adults with and without ASD traits who met PA guidelines and those who do not.

## Methods:

Following IRB approval, 126 college students participated (60.3% Caucasian, 79% female). Students with autistic traits ( $n = 27$ ;  $M_{age} = 19.32$ ) and without autistic traits ( $n = 99$ ;  $M_{age} = 19.28$ ) were determined using T-scores from the Social Responsiveness Scale (SRS-2). The SRS-2 is a robust instrument for detecting the presence and severity of ASD symptomatology (Constantino & Gruber, 2012). PA level was determined through self-report. According to the World Health Organization (2010), recommended levels include at least 150-300 minutes of moderate-to-vigorous intensity or at least 75-150 minutes of vigorous intensity physical activity during a 7-day span. The Behavioral Regulations in Exercise Questionnaire – 3 (BREQ-3; Cid et al., 2018) measured self-determination and includes 6 subscales: amotivation, external, introjected, integrated, and intrinsic regulation, ranging from external to more intrinsic determination. The Body and Appearance Self-Conscious Scale (BASES; Castonguay et al., 2014) measured body-related self-conscious emotions including guilt, shame, and pride (authentic, hubristic).

#### Results:

Individuals with ASD traits had higher levels of external and introjected regulation (self-determination), higher scores of body-related guilt and shame, and lower scores of both authentic and hubristic pride than those without ASD traits. Also, in our overall sample, young adults meeting guidelines had higher scores on internal self-determination regulations, lower body-related guilt scores and higher authentic pride than young adults not meeting physical activity guidelines. See Table 2 for results and all statistical values.

#### Conclusions:

Young adults with ASD traits scored higher in behavioral regulations that were more extrinsic in nature than those without ASD traits, suggesting that they are more motivated by external rewards or pressure from external sources. Interestingly, young adults who met PA guidelines scored higher in intrinsic regulations, suggesting that they are motivated by pure enjoyment or confirming one's sense of self. They also reported less proneness to body-related guilt but more body-related pride. The results suggest opposite findings for young adults with ASD traits and young adults who meet PA recommendations. Therefore, future research should examine the combined effect of ASD symptomatology and of individuals meeting PA guidelines on self-determination regulations and body-related self-conscious emotions.

#### **506.084** (Virtual Poster) The Moderating Effect of Sex on Autistic Trait Emotional Intelligence and Alexithymia

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Background: Differences in trait emotional intelligence (TEI) and alexithymia relate to differential social communication (Boily et al., 2017; Gerber et al., 2019), which is a hallmark of autism spectrum disorder (ASD; American Psychiatric Association, 2013). TEI describes emotional intelligence as factors that affect how one interacts with emotional information (Pardeller et al., 2017). Sex differences in TEI are well established in typically-developing (TD) samples, but results are mixed as to whether males (Shahzad & Bagum, 2012) or females (Joseph & Newman, 2010) are higher in TEI. Although ASD is associated with impaired TEI (Robinson & Petrides, 2020), few studies have examined sex differences in TEI in ASD. One such study found higher TEI in TD than ASD participants, and in males than females across both groups (Petrides et al., 2011). In TD samples, males appear to have higher rates of alexithymia (Garaigordobil, 2013), but no analyses considered the intersection of ASD and sex in alexithymia. Given the dearth of research about outcomes for autistic adults, particularly autistic women, this analysis may offer much-needed insight into these populations' emotional processing and social communication.

Objectives: We sought to examine the moderating effect of sex on the relationship between autism symptomatology, TEI, and alexithymia amongst adults. We hypothesized that higher autism symptomatology would be associated with lower TEI and higher alexithymia, and that these relationships would be moderated by sex such that differences would be more pronounced in males.

Methods: Eighty-six adults with and without ASD (54.7% female;  $M_{age}=22.80$ ,  $SD_{age}=6.34$ ; 55.8% White;  $M_{IQ}=102.42$ ,  $SD_{IQ}=15.18$ ) participated in the current study. Participants completed measures of autism symptomatology (SRS-2; Constantino & Gruber, 2012), TEI (SEIS; Schutte et al., 1998), and alexithymia (TAS-20; Bagby et al., 1994). The relationship of SRS-2 with SEIS and TAS-20 was examined with Pearson correlations. Moderation analyses were conducted to investigate the contribution of sex in these associations.

Results: SRS-2 was negatively correlated with SEIS ( $r=-.81$ ;  $p<.001$ ) and positively correlated with TAS-20 ( $r=.71$ ;  $p<.001$ ). Furthermore, SEIS was negatively correlated with TAS-20 ( $r=-.72$ ;  $p<.001$ ). Sex substantially moderated the relationship between SRS-2 and SEIS ( $ab=-.70$ ,  $p=.002$ , see Figure 1), with higher SRS-2 being associated with lower TEI in males compared to females (see Figure 2). However, sex did not moderate the relationship between SRS-2 and TAS-20 ( $p=.26$ ).

#### Conclusions:

These results suggest that more severe autism symptoms are associated with lower levels of TEI and higher levels of alexithymia across ASD and non-ASD adults, and negative associations between autism symptoms and TEI are more pronounced in males. Conversely, males with less severe autism symptoms seem to have higher TEI than males with more severe autism symptoms or women with fewer autism symptoms. Autistic adults may benefit from interventions targeting TEI and alexithymia, with additional TEI support given to males, to improve recognition of their own emotions and functioning in the social world. These findings contribute to a growing body of work in an understudied area of autism research regarding adult outcomes and support the provision of lifespan support to autistic people.

#### **506.085** (Virtual Poster) The Neurobiological Map of Theory of Mind and Pragmatic Communication in Autism

**Background:** Children with autism spectrum disorder (ASD) often have difficulty with Theory of Mind (ToM), the ability to infer mental states of oneself and others and pragmatic language skills (PS), the contextual use of language in communication.<sup>2</sup> Neuroimaging research suggests ToM and PS largely overlap, arguing the ability to understand another's mental state is a prerequisite to successful interpersonal communication.<sup>6</sup> The medial prefrontal cortex (MPFC)<sup>1</sup>, dorsal MPFC,<sup>3</sup> and bilateral temporo-parietal junction (TPJ)<sup>3</sup> have been implicated in ToM and PS. In addition, a meta-analysis indicated significant functional and anatomical overlap between brain regions underlying ToM and narrative comprehension.<sup>4</sup> However, no study in the last decade has examined this further.

**Objectives:** To assess the emerging consensus across neuroimaging studies of ToM and PS in ASD, the current study used coordinate-based activation likelihood estimation (ALE) analysis of 45 functional magnetic resonance imaging (MRI) studies.

**Methods:** This ALE meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A comprehensive literature search of published scientific papers was conducted using *PubMed*, *Web of Science*, *PsychInfo*, and *Google Scholar*, yielding 79 PS articles and 124 ToM articles. Combinations of search terms involving ASD, fMRI, pragmatics, theory-of-mind etc. were used. Papers were excluded for comorbid ASD samples, lack of whole brain coordinates, and no official ASD diagnosis, resulting in 45 papers (13 PS, 32 ToM). This resulted in a meta-analysis of 1,037 participants (534 ASD, 503 typically developing (TD) individuals). Participants ranged from 7 to 49 years of age and were of average IQ. Peak activation coordinates from all studies were extracted into text files and converted to MNI coordinates. The text files were used to conduct a separate ALE analysis of ToM and PS using the GingerALE software for TD and ASD groups.

**Results: *ToM:*** Both TD and ASD participants had significant activity in the left precuneus and right superior temporal gyrus (RSTG); and direct group comparison revealed reduced activity in precuneus in ASD,  $p < .05$ . Comparison of children to adults resulted in ASD children and ASD adults showing reduced activation in the left inferior frontal gyrus (LIFG) and in RSTG, respectively, compared to TD children and adults,  $p < .05$ .

***Pragmatics:*** Both TD and ASD participants had significant activity in the RIFG, LSTG, and; and direct comparison showed reduced activation in ASD, relative to TD, participants in the RIFG, left superior frontal gyrus (LSFG), LMTG, and LMPFC,  $p < .05$ . There were no areas in which ASD participants showed greater activation relative to TD participants. Further, ASD children showed greater activation in the RIFG and lesser activation in the LMTG and LSTG relative to TD children.

**Conclusions:** The left temporal and medial prefrontal underactivation in ASD in PS may reflect linguistic differences as well as differences in understanding contextual cues in pragmatic language. Overall, the findings of this study underscore the cognitive and neural similarities between ToM and PS, and the neurobiological differences in core regions underlying ToM and PS in ASD.

#### **506.086 (Virtual Poster)** The Relation between Social Anxiety and Meta-Perception during Peer Interaction in Children with and without Autism Spectrum Disorder

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**Background:** Previous studies have shown a high co-occurrence of autism spectrum disorder (ASD) and anxiety in children, with up to 40% of children with ASD meeting criteria for an anxiety disorder (Adams et al., 2019; Baribeau et al., 2020). Generally, individuals with social anxiety (SA) disorder evaluate themselves more negatively, and believe others judge them negatively during a social interaction (Hezel & McNally, 2014). SA in children with ASD can cause social withdrawal and social skill deficits, which may result in negative peer interactions (Bellini, 2006). While previous research has studied the behavioral and physiological characteristics of anxiety in children with ASD, less is known about how SA relates to meta-perception (how they felt their peer viewed them) in a peer interaction.

**Objectives:** 1) to investigate whether SA symptoms are associated with one's perception of how their peer viewed them during a social interaction across all participants (with and without ASD); 2) to determine if diagnosis moderates this relation; 3) to determine if an association between SA symptoms and meta-perception exists *within* each group.

**Methods:** The sample consists of 65 children aged 8-16 years. 31 children were diagnosed with ASD ( $M = 12.90$  years,  $SD = 2.30$  years, 7 females) and 34 were typically developing (TD) based on parental report ( $M = 13.12$  years,  $SD = 2.12$  years, 19 females). Children were age- and gender-matched with another participant (ASD-ASD, TD-TD or ASD-TD) and completed unstructured and semi-structured interactions. Following the peer interaction, participants individually responded to 25 questions about meta-perceptions of their peers (i.e. "how happy/insecure/shy/confident did [Partner] think you were?") on a 5-point Likert scale (Usher et al., 2018). An overall meta-perception score was calculated by summing all responses, reverse scoring negative characteristics. SA symptoms were measured using the social anxiety subscore from the Screen for Anxiety-Related Emotional Disorders parent report (Birmaher et al., 1997).

**Results:** SA significantly negatively predicted meta-perceptions, such that a one-unit increase in SA symptoms was associated with a .88-unit decrease in meta-perception ( $p = .01$ ). Diagnosis was not a significant moderator in the relation between SA and meta-perception ( $p > .05$ ). However, when running separate models for each group, the relation between SA and meta-perception was found to be significant in the TD group ( $B = -.45$ ,  $p = 0.12$ ) but not in participants on the autism spectrum ( $B = -.064$ ,  $p > .05$ ).

**Conclusions:** Across a sample of children with and without ASD, higher levels of SA were associated with the belief that their partner viewed them more negatively during a social interaction. While we did not find a significant moderation by diagnostic group, SA was not significantly associated with meta-perception in the ASD group alone, and the latter may be due to being underpowered. The study supports previous literature in which SA

may cause children to view themselves more negatively during a social interaction, but this relation may be stronger in TD children. Future studies should continue to investigate whether and why this relation may be different in those with ASD.

**506.087** (Virtual Poster) Understanding the Social Functioning Profile in NGLY1 Deficiency Using the Stanford Social Dimensions Scale (SSDS)  
**A. Revanur<sup>1</sup>, M. Uljarevic<sup>2</sup>, C. Frater<sup>3</sup>, J. M. Phillips<sup>4</sup>, A. Y. Hardan<sup>1</sup> and M. Ruzhnikov<sup>1</sup>,** (1)University of Arizona College of Medicine-Tucson, Tucson, AZ, (2)School of Psychological Sciences, University of Melbourne, Stanford, CA, Australia, (3)Department of Child Neurology, Stanford University, Palo Alto, CA, (4)Psychiatry & Behavioral Sciences, Stanford University, Stanford, CA

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**Background:** N-Glycanase 1 (NGLY1) deficiency (NGLY1-CDDG, NGLY1-Related Disorder, OMIM 615273) is a rare autosomal recessive disorder caused by loss of NGLY1 enzymatic activity. It is characterized by global developmental delay and/or intellectual disability with limited to absent verbal speech and a range of additional complex neurological symptoms. Intriguingly, despite significant developmental delays, single case and very small n reports have suggested that social and communication abilities might be less impacted than other domains. No study to date has attempted to provide a comprehensive characterization of the social functioning profile of individuals with NGLY1 deficiency.

**Objectives:** This study aimed to utilize the recently developed Stanford Social Dimensions Scale (SSDS) to provide a comprehensive characterization of the social functioning profile in NGLY1 deficiency, as well as to compare a profile of strengths and weaknesses across key social functioning processes, including different aspects of social motivation and social communication among individuals with NGLY1 deficiency versus individuals with idiopathic autism spectrum disorder (ASD). Finally, we also aimed to characterize individual differences in social functioning within our NGLY1 deficiency cohort.

**Methods:** Parents of 25 individuals with NGLY deficiency ( $Mean_{age}=11.26$  years,  $SD=6.71$ ) and of 164 individuals with idiopathic ASD ( $Mean_{age}=7.19$  years,  $SD=3.96$ ) completed the SSDS. The SSDS is a parent-report measure designed to quantify individual differences across the following five subscales: social motivation (SM), social affiliation (SA), expressive social communication (ESC), social reception (SR) and Unusual Approach (UA).

**Results:** Univariate models with bootstrapping showed that the NGLY1 deficiency group had significantly higher scores (better functioning) on the SSDS SM ( $F=5.58, p=.019, \omega^2=.024$ ) and ESC subscales ( $F=9.03, p=.003, \omega^2=.04$ ) and significantly less deficits on the SSDS UA subscale ( $F=8.09, p=.005, \omega^2=.036$ ). There were no differences for Social Affiliation ( $F=.22, p=.64, \omega^2=.001$ ) nor Social Recognition SSDS subscales ( $F=.09, p=.77, \omega^2=.001$ ). There were pronounced individual differences across different aspects of social functioning within the NGLY1 deficiency group.

**Conclusions:** This is the first study to date to provide a detailed characterization of social functioning profiles among individuals with NGLY1 deficiency. At a group level, NGLY1 deficiency showed better functioning/lower impairments than the ASD group. Importantly, the individual differences approach showed pronounced heterogeneity within NGLY1 deficiency. Findings reported here have a potential clinical utility and emphasize the need for utilizing a detailed assessment of distinct aspects of social functioning in individuals with NGLY1 deficiency in order to enable tailoring of intervention and support approaches.

**506.088** (Virtual Poster) Validation and Factor Structure of the Japanese Version of the Camouflaging Autistic Traits Questionnaire (CAT-Q)  
**M. Hongo<sup>1</sup>, F. Oshima<sup>2</sup>, Y. Nitta<sup>3</sup>, T. Takahashi<sup>4</sup>, H. Kuwabara<sup>5</sup>, T. Ohtani<sup>6</sup>, L. Hull<sup>6</sup>, W. Mandy<sup>6</sup> and E. Shimizu<sup>1</sup>,** (1)Chiba University, Chiba, Japan, (2)Research Center for Child Mental Development Chiba University, Chiba, Japan, (3)Waseda University, Tokorozawa, Japan, (4)Waseda University, Saitama, Japan, (5)University of Tokyo Hospital, Tokyo, Japan, (6)Department of Clinical, Educational and Health Psychology, University College London, London, United Kingdom

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**Background:**

Social camouflage behaviours refers to the behaviours of autistic adults in everyday social situations in which they hide their typical autistic behaviours and pretend to be a 'normal (typically developing) person' (Lai et al., 2017). While social camouflage behaviours are coping strategies to integrate autistic adults into the community, they have negative mental health effects such as anxiety and depression (Cage et al., 2018). Hull et al. (2018) developed the Camouflaging Autistic Traits Questionnaire (CAT-Q) to quantify person-reported social camouflage behaviors. The CAT-Q consists of three subscales: "compensation", "masking", and "assimilation".

**Objectives:**

In Japan, there is no scale to measure social camouflage behaviours of autistic adults. Therefore, the purpose of this study was to validate the Japanese version of the CAT-Q as a quantitative measure of social camouflage behaviours and to explore its factor structure.

**Methods:**

The first survey of the study was administered to 210 autistic adults with a diagnosis of autism spectrum disorder, and 450 non-autistic adults. All of them agreed to participate in the study. The second survey was conducted 2 weeks after the first one. Internal consistency and test-retest reliability of CAT-Q and three subscales were examined. Convergent validity (correlation of CAT-Q or Hull's three factors, with the Broad Autism Phenotype Questionnaire, the Liebowitz Social Anxiety Scale, the Warwick-Edinburgh Mental Well-being Scale (WEMWBS), the Patient Health Questionnaire-9, and the Generalized Anxiety Disorder-7) was assessed. Exploratory factor analysis (EFA) was used to examine the structure of the CAT-Q. All questionnaires were Japanese versions.

## Results:

The alpha coefficient of internal consistency ranged from 0.67 to 0.91. In terms of retest reliability, Pearson's correlations and intraclass correlations (ICC) of the CAT-Q total and the Hull's three factors showed that the autistic sample showed strong positive correlations for all of them. On the other hand, the non-autistic sample showed strong positive correlations for the "assimilation" factor, but moderate positive correlations for the entire scale, the "compensation" factor, and the "masking" factor. The CAT-Q total scores were significant positive correlations with each total scores of the other convergent validity scales, except for the WEMWBS total score of the autistic sample (Table 1). The results of the EFA show that the autistic sample had three factors (Table 2). The first factor included items from the "compensation" factor and items from the "masking" factor of the original CAT-Q. The second factor contained the items of the "assimilation" factor of the original CAT-Q. The third factor consisted of two items, item 9 and item 18. Four factors were extracted for the non-autistic sample, three of which corresponded to the original CAT-Q. The remaining factor consisted of reversed items (Table 2).

## Conclusions:

The reliability and validity of the Japanese version of the CAT-Q were confirmed. The results of the factor analysis for the autistic sample differed from those of Hull's study. It was suggested that there are socio-cultural differences in the situations in which autistic adults are placed. Further validation is needed.

### **506.089** (Virtual Poster) Aggression and Social Deficits Among Children with Autism Spectrum Disorder

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**Background:** Associations between aggression and social functioning have been identified among typically developing individuals; however, the link between aggression and social concerns among individuals with Autism Spectrum Disorder (ASD) is not well understood.

**Objectives:** The aims of this study are to determine 1) whether there is a *concurrent* association between aggression and impairments in social functioning among children with ASD, 2) whether aggression can *predict* social functioning among children with ASD six months later (T2), and 3) whether peer relationships mediate the potential link between aggression and social deficits among children with ASD.

**Methods:** Participants included 399 (ASD = 280) children ages 6 -11 years who were enrolled in the Autism Biomarkers Consortium for Clinical Trials (ABC-CT) study across five sites in the United States. Social ability was measured using the Vineland Adaptive Behavior Scales-Third Edition (Vineland-3); aggression was measured using the aggression sub-scale of the Pervasive Developmental Disorder Behavior Inventory (PDDBI); peer relationships were measured using a question from the social development and play section of the ADI-R. A series of linear models was created with social ability at T2 as the outcome variable, and age, sex, parent-reported level of aggression, and group (ASD or typically developing) as predictor variables. The peer relationship measure was only available for the ASD group and was added as a predictor variable after the best-fit model was found for the ASD group. The optimal model was selected using the Akaike Information Criterion (AIC) and the predictive performance was assessed using 5-fold cross-validation.

**Results:** At baseline (T1) and T2, a negative correlation between aggression and social ability was found for both children with ASD ( $rT1 = -0.42$ ,  $rT2 = -0.42$ ) and typically developing children ( $rT1 = -0.25$ ,  $rT2 = -0.33$ ). The linear model with age, aggression, ASD diagnosis, and peer relationships as predictor variables was the best, as indicated by the lowest AIC score ( $\Delta AIC = 9$ ). Cross-validation confirmed that this model had the lowest prediction error compared to the other models.

**Conclusions:** The negative relationship between aggression and social functioning suggests that children who are more aggressive had lower parent-reported social ability. This may be because aggression limits opportunities for age-appropriate social interaction. The results suggest that increased aggression and fewer peer relationships, along with age, were predictive of social ability 6 months later. Therefore, targeting aggression and peer relationships in interventions for children with ASD may improve social functioning.

### **506.090** (Virtual Poster) Association between Emotion Regulation and Temperament in Children and Youth with ASD

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**Background:** Difficulties with emotion regulation are highly prevalent in autism spectrum disorder (ASD)1-3 and are thought to increase core-domain differences (social differences and repetitive behaviours) as well as behavioural and emotional difficulties (e.g. irritability, aggression, and self-injurious behaviours)1,5. Temperament is a relatively stable characteristic that is similarly associated with emotional functioning, behavioural adjustment, and psychopathology. Little is known about the association between emotion regulation difficulties and temperament in children and youth with ASD. To address this gap, we examined the association between temperament traits and emotion regulation profiles of children and youth with ASD using the parent-report Temperament in Middle Childhood Questionnaire (TMCQ) and Emotion Dysregulation Inventory (EDI), respectively.

**Objectives:** To examine the association between emotion regulation and temperament profiles of children and youth with ASD.

**Methods:** Thirty-eight children with ASD (mean age=11.0, SD=2.15; 30 males) between ages 7-14 have participated in the study. All participants had IQ>85 (FSIQASD=109.3, SD=12.10). Parents completed the TMCQ and EDI parent-report measures. The TMCQ consists of 3 higher-order factors: effortful control, representing self-regulation of emotional reactivity, attention, and behaviour; negative affect, reflecting a capacity for negative emotions; and surgency, characterized by high levels of behavioural activity and positive affect. The EDI comprises two subscales: reactivity, characterized by intense, rapidly escalating, and sustained negative reactions; and dysphoria, characterized by anhedonia, sadness, and nervousness. Linear regression was used to examine the association between the 3 higher-order factors of the TMCQ and the two EDI subscales (6 models), including age and gender as covariates. Bonferroni correction was used to account for multiple comparisons.

**Results:** Linear regression showed a significant positive association between EDI reactivity and TMCQ negative affect (Figure 1;  $R^2=0.30$ ;  $\beta=9.7+2.46$ ; uncorrected  $p=0.004$ ). Associations between EDI subscales and other TMCQ subscales were not statistically significant.

**Conclusions:** Effective emotion regulation strategies, particularly for children exhibiting higher negative affect, could be an important target to help mitigate the impact of reactivity on functional outcomes. Small sample size was a limitation of this study.

**506.091 (Virtual Poster)** Attention Preference in Cooperation and Competition of Preschool Children with Autism: Differences and Implications  
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**Background:** Social deficits have been the focus of autism research, and numerous studies have demonstrated abnormal attention preference linked with social impairment in autistic children. However, existing research mostly compared social vs. nonsocial processing, and it is less clear whether specific social materials can induce attentional preference and social facilitation more effectively.

**Objectives:** The aim of this study was to explore visual attentional preference for competitive, cooperative, and non-social scenarios in young, preschool-age autistic children. The study also aimed to address whether parallel competition can facilitate their behavioral performance.

**Methods:** The present study recruited forty-one 4-6 years old preschool children with autism and typically developing (TD) children matched on chronological age and IQ. Experiment 1 employed a gaze-contingency task using eye-tracking technique to measure visual preference of three types of stimuli: competitive and cooperative play scenarios and a non-social baseline scenario. Experiment 2 included a gross motor task and a card sorting task. In each task, the participant was required to complete independently and with the presence of a competing partner.

**Results:** Both groups preferred the competitive and cooperative scenarios over the non-social scenario. The autism group's percentage of total fixation duration for competitive scenario was significantly less than that of the TD children. Nonetheless, such reduced attention preference for competition did not prevent the autistic children from benefiting from parallel competition in Experiment 2. The presence of a competing partner significantly improved the autistic preschoolers' performance in the motor and cognitive tasks and the amount of facilitation was comparable to that of the TD group.

**Conclusions:** Our data demonstrated that social competition scenario might not be as salient to young children with autism as it is to typical children when measured by visual attentional preference indicators. Nonetheless, parallel competition can provide the same amount of benefit for autistic children across motor and cognitive problem solving tasks. The results suggest misalignment between young autistic children's social attention preference indexed by eye gaze and social motivational effects in participatory situations.

**506.092 (Virtual Poster)** Atypical Social Interaction during Tickle Play in Children with Autism Spectrum Disorder  
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**Background:** Children with Autism Spectrum Disorder (ASD) have difficulty in reciprocal social interaction using multimodal sensory information. Many children with ASD also show an atypical response to sensory stimuli such as hyper- or hyporeactivity. Tickling is an early multimodal social interaction between a child and their caregiver, which utilizes tactile (touch), visual (facial expression/gestures), and auditory (speech) stimuli. An infants' response to tickling is thought to be related to the occurrence of other social behaviors (Ishijima & Negayama, 2017). We hypothesized that children with ASD may show an atypical behavioral response during tickle play with their caregivers in their early developmental stage.

**Objectives:** To investigate behavioral features during tickling interaction in children with ASD, this pilot study examined the relationship between parent-reported autistic traits and behavioral response to tickling.



**Methods:** Fifteen preschool children, aged 2–6 years (4 children with ASD [2 boys and 2 girls] and 11 typically developing children [3 boys and 8 girls]), and their caregivers (14 mothers and one father) participated in this study. We recorded tickling interaction between the child and caregiver individually; all caregivers tickled five body parts of their children twice, including lateral sides of the upper parts of the body, neck, underarm, feet, and one additional part of their choosing (total 10 trials, for 3 min.). Caregivers followed human voice instruction from an i-Pad (e.g., “I’m going to tickle your neck. Are you ready? Tickle, tickle.”). First, the author coded each child’s behavioral response for each of the 10 trials individually. The following five behavioral parameters were scored (1=observed, 0= not observed): (1) approach with positive emotional response (AP), (2) avoidance of positive emotional response (AV), (3) tickling (T), (4) negative emotional response (NeR), and (5) no response (NR) (Table 1). We exploratorily examined correlations between autistic traits, which were investigated by a parent-reported questionnaire (social responsiveness scale-2; SRS-2), and those behavioral parameters.

**Results:** We found significant negative correlation between the SRS-2 total score and the score of AP ( $\rho = -0.60, p = 0.019$ ) (Figure 1). There was no significant correlation between the SRS-2 total score and other behavioral parameters: AV ( $\rho = 0.21, p = 0.463$ ), T ( $\rho = -0.27, p = 0.328$ ), NeR ( $\rho = 0.07, p = 0.817$ ), NR ( $\rho = 0.44, p = 0.105$ ).

**Conclusions:** This pilot study revealed the relationship between autistic traits and approach with positive emotional response, which included physical contact and getting close to the caregiver. Children who showed moderate to severe autistic traits also showed a positive emotional response (i.e., laughter response); however, they showed much less active approach to their caregiver. Our findings imply that children with ASD may show positive emotional responses to tickling typically, but may show less voluntary approach to caregivers to maintain and develop reciprocal social interaction during tickle play.

#### **506.093** (Virtual Poster) Autistic Traits and Social Anxiety Interactively Affect Attention to the Eyes

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**Background:** People with autism spectrum disorder (ASD) are often comorbid with other mental or psychiatric disorders, such as social anxiety disorder (SAD, Maddox & White, 2015). ASD and SAD have overlaps in atypical attention to the eyes. However, their gaze patterns and underlying mechanisms could differ (Kleberg et al., 2017), challenging the diagnosis and intervention for people with comorbidity. It remains unknown how autistic traits and social anxiety separately and interactively influence the attention to the eyes, especially their vigilance or avoidance of the eyes.

**Objectives:** This study investigated how autistic traits and social anxiety influence the attention to the eyes when cueing the first fixation to the eyes or mouth. Cueing the first fixation to the eyes could help us understand that if people maintained their attention to the eyes or avoided eyes after looking at the eyes. Cueing the first fixation to the mouth, on the other hand, could explore the vigilance to the eyes.

**Methods:** Seventy-four typically developed college students participated in our study. We measured their autistic traits and social anxiety using Autism-spectrum Quotient and Social Phobia Inventory. Participants were asked to complete an emotion discrimination task. Each trial began with an animated fixation in the center of the screen. After the participants looked at the central fixation for 1.5 s, a face appeared. The eye or mouth region was positioned at the center of the screen so that the participants’ initial attention was either on the eyes or the mouth of the face. The face was presented for 10 s. After that, participants needed to choose an expression label for the face. We used 5 different expressions of faces: angry, fearful, happy, sad, and neutral.

**Results:** We conducted a linear mixed model to investigate the interactive and separated effects of autistic traits and social anxiety on the log-transformed latency of disengaging from the eyes when the first fixation was cued to the eyes or latency of orientating to the eyes when the first fixation was cued to the mouth. The results revealed a significant interactive effect between autistic traits, social anxiety, and first fixation position on the latency of disengaging from the eyes. The simple slope analysis showed that people with higher social anxiety disengaged from the eyes more slowly when their autistic traits were low, and people with higher autistic traits disengaged from the eyes more quickly when their social anxiety was high (Figure 1). These slopes revealed no differences from zero when first fixations were cued to the mouth. We also found that autistic traits were related to shorter disengaging latency from the eyes, and social anxiety was related to longer disengaging latency from the eyes (Figure 2).

**Conclusions:** We found that people with high social anxiety maintained their attention to the eyes when their fixations were cued to the eyes, while people with high autistic traits quickly shifted their attention away from the eyes. Autistic traits and social anxiety had an interactive effect on the early stage of attention to the eyes.

#### **506.094** (Virtual Poster) Brain Activation Patterns of Detecting Social Transgression in School-Aged Children with High-Functioning Autism

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**Background:**

Numerous neuroimaging studies reported that medial prefrontal cortex (mPFC) and temporo-parietal junction (TPJ) are central to ToM (theory of mind) network in typical adults. In contrast, adults with high-functional autism (HFA) activated only areas associated with general problem-solving abilities (Frith & Frith, 2003). Few studies explored brain activation patterns underlying ToM deficits in younger individuals with HFA. One fMRI

study of young adolescents with HFA reported that reduced activation in mPFC, TPJ, and superiortemporal sulcus (STS) related to ToM skills in this group (Kana et al., 2015).

#### Objectives:

The goal of this study was to evaluate the ToM deficit hypothesis in HFA school-aged children through assessing advanced ToM skills that typically developing children were still continue to master at 9-12 years of age (Osterhaus et al., 2016). Specifically, brain activation patterns involving advanced ToM, e.g., detecting *faux pas*, were implicated in the difficulty of HFA children to recognize social transgression.

#### Methods:

*Participants.* School-aged boys with HFA ( $n = 19$ , mean age = 11.16 years) and typically developing boys ( $n = 18$ , mean age = 10.51 years) matched with chronological age and general intelligence. Inclusion criteria for HFA group were: CAST (Childhood Autism Spectrum Test) score  $\geq 15$ , FSIQ of WISC-IV  $> 90$ , and VCI of WISC-IV  $> 80$ .

#### fMRI Tasks

The faux pas story that behaviors of one character in the story were not socially appropriate and control story were present in the fMRI trials. In each trial, children listened to a story, then children were required to answer faux pas detection, false belief and memory control questions. The fMRI task took approximately 25 minutes to complete. fMRI scans were performed in a 3T Siemens Magnetom Skyra scanner using a 32-channel head coil. fMRI data were analyzed using SPM8 and were entered into a GLM using an event-related analysis procedure.

#### Results:

*Activation patterns.* Compared with TD group, HFA group showed reduced activation in bilateral TPJ, left superior parietal lobule (SPL), bilateral middle frontal gyrus (MFG), and bilateral middle temporal gyrus (MTG). During the simple main effect in Faux pas stories, psychophysiological interaction (PPI) analysis with right anterior cingulate cortex (ACC) as a seed showed enhanced functional connectivity with bilateral MFG in the TD vs. HFA condition (Figure 1).

#### behavioral measures and brain activation

For the social communication impairments, activation difference (TD – HFA) of detecting faux pas were negatively correlated with symptoms of autism (assessed with CAST) in right SPL [ $r = -.377$ ] and right MFG [ $r = -.442$ ].

#### Conclusions:

Compared with TD group, reduced activation patterns of HFA group at TPJ and MFG that involved in basic ToM processing (Ilzarbe et al., 2020) were associated with inaccurate detection of faux pas. The connectivity among ACC and bilateral MFG was the neural network associated with performance difference between HFA and TD group. ACC is sensitive to conflict and error monitoring during social interactions (Apps et al., 2016). Results of this study suggested that error detection and basic ToM skills were essential for HFA children to recognize inappropriate sentences in during social interactions.

**506.095** (Virtual Poster) Cognitive and Emotional Aspects of Social Anxiety in Autism without Intellectual Disability and Specific Learning Disorder

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#### Background:

Social anxiety refers to the fear of social judgments and to act in a way that will be humiliating or embarrassing, resulting in substantial impairment in daily life activities. It is characterized by behavioral, cognitive, and physiological reactions, besides some social consequences, such as the lack of social motivation and isolation. Social anxiety has found to be common in some neurodevelopmental disorders, such as Autism Spectrum Disorder (ASD) without intellectual disability and Specific Learning Disorder (SLD).

#### Objectives:

The aim of the present study was to understand some cognitive and emotional aspects related to social anxiety, in particular public speaking anxiety, in children and adolescents with ASD and SLD.

#### Methods:

The study involved 35 children and adolescents with ASD without ID (15 M), 25 with SLD (10 M) and 70 with typical development (TD; 30 M) aged 8-16 years. Participants were matched for age [ $F(2, 127) = .37, p = .69$ ], gender [ $\chi^2(df=2) = .00, p = 1$ ], and IQ [ $F(2, 127) = 1.94, p = .15$ ]. They were administered an adaptation of the *Trier Social Stress Task* (TSST-C; Buske-Kirschbaum et al., 1997), a test that provides an acute stress response under experimentally controlled conditions, by incorporating social evaluation and unpredictability. Performance was rated with an adaptation of the *Social Performance Rating Scale* (SPRS; Fydrich et al., 1998). Before and after the TSST-C, participants were administered the *Self-Assessment Manikin scale* (SAM; Badley & Lang, 1994) and an ad-hoc questionnaire, through which they rated their emotional aspects (valence, arousal, and dominance), thoughts (perceived competence and comparison with others), and worries (about performance and social judgment) related to the public speech. Univariate and repeated measures ANOVAs were performed.

## Results:

Univariate ANOVAs revealed that participants with ASD [ $M(DS)=24.90(7.89)$ ] performed significantly worse than TD [ $M(DS)=30.24(8.64)$ ] in the TSST-C ( $F(2, 127) = 3.89, p = .02$ ), but no significant differences emerged between the groups of ASD and SLD [ $M(DS)=26.70(7.51)$ ]. Repeated measures ANOVAs indicated some significant interaction effects of group (ASD, SLD, TD) x time (pre-post) for arousal ( $F(2, 127)=3.18, p=.04$ ), perception of competence ( $F(2, 127)=2.75, p=.05$ ), and worries about performance ( $F(2, 127)=3.19, p=.04$ ).

## Conclusions:

Children with SLD felt very confident before the TSST-C whereas, after doing it, they reduced their perception of competence and felt a higher level of arousal, caring more about social judgments than the other groups. Instead, children with ASD do not feel worried and felt more confident than the other groups in the context of a social stressful condition, although they obtain a worse performance. These findings suggest some different emotional and cognitive patterns for ASD and SLD in the context of social anxiety. From a clinical and educational perspective, our results may inspire to adopt individualized and diversified educational practices to empower social communication and public speaking.

**506.096 (Virtual Poster)** Emotion Recognition and Social Adaptive Behavior of Children with Autism Spectrum Disorder  
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**Background:** Understanding the emotions of others plays an important role in effective interaction with others. To be able to do so we must be able to comprehend what others are trying to express through their facial expressions. Typically developing individuals can easily recognise the facial expressions of others and are able to respond appropriately & effectively. However, this ability has been found to be deficient in individuals with Autism Spectrum Disorder (ASD). They fail to recognize the expressions accurately and usually respond inappropriately in social situations.

**Objectives:** The objective of this study was to understand the extent of impairment of facial emotion expression in the children with ASD. The study intended to explore whether the whole spectrum of basic emotions is impaired or if recognition of certain emotions is intact. It was also intended to explore how does this impairment impact their social adaptive behavior.

**Methods:** Forty children with high functioning ASD and 40 typically developing children were selected for this study. Severity of ASD was assessed using Childhood Autism Rating Scale (CARS) and social adaptive behaviour was assessed using Vineland Adaptive Behaviour Scale (Second Edition) (VABS-II). Emotion matching task was utilised for assessing the emotion recognition abilities of the participants. The participants were required to match the expression of the model among the images of the same model exhibiting different emotions.

**Results:** The results of the Chi-square test and repeated measures ANOVA show that children with ASD as compared to TD children find it more difficult to recognise certain emotions such as disgust, fear and surprise. The performance of these children on adaptive behavior scale (VABS-II) was found to be poor in all the subscales with lowest scores in socialization followed by communication, daily living skills, and motor skills domain. Multiple regression was used to assess relationship between deficits in emotion recognition ability and social adaptive behavior. Receptive communication, written communication, domestic daily living skills and community living skills were particularly seen to be affected by poor emotion recognition ability. Poor performance in socialization and communication skills were also affected by severity of the disorder. Lower chronological age also emerged as one of the important factors in predicting deficits in communication and daily living skills of such children.

**Conclusions:** The findings suggest that among the whole spectrum of six basic emotions children with ASD can easily recognize certain emotions such as happiness. However, significant impairment in other emotions such as disgust, fear & surprise negatively impacts the social adaptive behavior of individuals which in turn affects the ability to deal effectively with the social situations.

**506.097 (Virtual Poster)** Emotional Responses to Simulated Social Situations By Autistic and Non-Autistic Youth  
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**Background:** The manner and accuracy of how autistic youth label their emotional responses to social situations is unclear. A recent meta-analysis (Huggins et al., 2021) suggested that emotional self-awareness in autistic youth may be comparable to non-autistic peers and that differences emerge in adolescence. Using an interactive and dynamic social information processing assessment, Virtual Environment for Social Information Processing© (VESIP; 2021, Rush University Medical Center), we assessed emotional responses to social situations across five situational categories: ambiguous provocation, bullying, compromise, peer entry, and friendship initiation with one peer (Russo-Ponsaran et al., 2018; Russo-Ponsaran et al.,

2021). VESIP differs from traditional self-report methods because it is a self-administered, web-based direct assessment of how youth reason through challenging social situations; one of the domains assessed is the respondent's emotion response. Specifically, after watching animated exchanges between a self-avatar and antagonist, respondents were asked by a peer character, "How'd you feel when...?" Multiple-choice response options included angry, sad, ok, happy, scared, and worried. This study reflects a supplemental, retrospective analysis of the emotion response data in a sample of autistic and non-autistic youth from a small-scale study of performance on VESIP (Russo-Ponsaran et al., 2018).

**Objectives:** The objective of this exploratory analysis was to evaluate whether autistic and non-autistic youth endorse similar emotional responses to simulated challenging social situations. We tested two competing hypotheses: (H1) autistic and non-autistic youth exhibit similar emotional response endorsements across challenging social scenarios versus (H2) autistic youth would not endorse any emotional responses to social situations, unlike their non-autistic peers.

**Methods:** Retrospective data (Russo-Ponsaran et al., 2018) from 21 autistic youth (17 boys) and 29 non-autistic youth (18 boys) aged 8-12 years ( $M = 10.91$  years,  $SD = 1.38$ ) were analyzed. All youth were verbal with no confounding diagnoses and of average or higher intellectual ability ( $M_{\text{non-autistic}} = 110.41$ ,  $SD = 10.22$ ;  $M_{\text{autistic}} = 97.57$ ,  $SD = 11.68$ ). Cronbach's alphas were calculated to estimate the internal consistency reliability of emotion response scores. Between-group independent samples t-tests were calculated to compare emotion response scores and distributions. Response patterns were qualitatively evaluated.

**Results:** Internal consistency reliability of the emotion response score for autistic and non-autistic groups was .69 and .625, respectively. The emotion response score exhibited no significant between-group difference ( $t(48) = .113$ ,  $p = .911$ ). Initial evaluation of frequency distributions of each emotion by situation did not differ (all tests, *n.s.*). Further, the distribution of emotional endorsements across all scenes, irrespective of situation, followed a similar pattern across groups (Figure 1).

**Conclusions:** Findings suggest that, using a direct assessment approach, emotional self-awareness in response to simulated social situations among autistic youth largely mirrors that of non-autistic youth. Like the analysis by Huggins et al. (2021), our study suggests that reporting of emotional responses in autistic youth are comparable to non-autistic youth ( $\leq 12$  years old). These data also speak to the potential use of direct, simulation-based formats for measuring internal experiences. Future studies should complement these findings with third-party reports, physiologic data, or measurement of alexithymia and emotion regulation.

#### **506.098 (Virtual Poster)** Empathizing, Systemizing, Empathizing-Systemizing Difference and Their Association with Autistic Traits in Autistic Children with and without Intellectual Disability

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#### **Background:**

Empathizing, systemizing and empathizing-systemizing difference (D score) can be linked to autistic traits in both autistic and general adult populations, however, these profiles and associations remain unclear in autistic children with and without intellectual disability (ID).

#### **Objectives:**

In the present study, we aim to examine the profiles of empathizing, systemizing, empathizing-systemizing difference and their associations with autistic traits in a group of typically-developing children and autistic children in China. Specifically, we explored the differences in these associations in autistic children with and without ID.

#### **Methods:**

We included 127 autistic boys and 99 typically-developing boys (aged 6~12 years). The parent-reported Empathy and Systemizing Quotient (EQ-C / SQ-C) was used to quantify children's profiles of empathizing, systemizing and empathizing-systemizing difference. We measured autistic traits using the Social Responsiveness Scale. We identified autistic children with or without ID (44 with ID and 83 without ID) using the Wechsler Intelligence Scale for Children-Fourth Edition. We examined these profiles and their associations with autistic traits in all children.

#### **Results:**

Autistic children (with and without ID) scored lower on the EQ-C and SQ-C were compared with TD children (all  $p < 0.001$ ). However, the difference in SQ-C between autistic children without ID and TD children attenuated to null when adjusting for intelligence ( $19.14 \pm 7.88$  vs  $24.15 \pm 6.73$ ,  $p = 0.097$ ). Compared with TD children ( $0.02 \pm 0.09$ ), autistic children without ID had a higher D score ( $0.09 \pm 0.09$ ,  $p < 0.001$ ), but not in autistic children with ID ( $0.05 \pm 0.06$ ,  $p = 0.103$ ). In the three groups, EQ-C score was negatively associated with the score of social-communicative functioning difficulties and restricted repetitive behaviors ( $\beta = -1.30 \sim -0.22$ , all  $p > 0.05$ ), but we observed null associations between SQ-C and all autistic traits (all  $p > 0.05$ ). We found positive associations between D score and all autistic traits in all groups, except for the association between D score and social-communicative functioning difficulties in autistic children with ID.

#### **Conclusions:**

The profiles of empathizing, systemizing, empathizing-systemizing difference and their associations with autistic traits were different in autistic children with and without ID. Our findings indicated that behavioral interventions targeting autistic children should consider the balance of empathizing and systemizing.

**506.099 (Virtual Poster)** Exploring the Applicability of the Cognitive Model of Social Anxiety in Autistic Youths

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**Background:**

The Clark & Wells (1995) cognitive model of social anxiety (SA) postulates that heightened self-focused attention (SFA) to one's internal state (interoceptive sensibility) can result in increased negative perception of one's own performance during social situations, thus perpetuating SA. To date, it is unclear to what extent SFA and interoceptive sensibility are related to perceived social performance in autistic youths, in relation to their social anxiety. It is also unclear whether heightened interoceptive sensibility amongst autistic youths is uniform across different body areas for those with high (HSA) versus low SA (LSA).

**Objectives:**

Study One: Explore differences in self versus observer ratings of social performance of autistic youths with HSA vs. LSA;

Study Two: Explore interoceptive sensibility, state and trait SFA as potential mediators between self-perceived social performance rating (independent variable) and SA (dependent variable). To explore patterns of interoceptive sensibility across the body for HSA vs. LSA.

**Methods:**

Autistic youths (age: 13-25 years) were recruited separately for study one and study two, with the data combined for the present analysis. Participants watched a short film before participating in a 10–15-minute small group discussion to share their thoughts. Before the film, all participants completed the Social Anxiety Scale for Adolescents (SAS-A), and those in study two completed the self-consciousness scale (SCS). After the discussion, all participants rated their own performance, and those in study two completed the Social Phobia Inventory (SPIN), Autonomic Perception Questionnaire (APQ; to assess interoceptive sensibility) and Focus of Attention Questionnaire (FAQ; to assess SFA). Two researchers, blind to the participants' self-report ratings, provided observer ratings for all participants' performance.

Study one: 71 participants were divided into HSA (n = 41; age: M(SD) = 18.17(2.46) years; 29 Male) and LSA (n = 30; age: M(SD) = 17.33 (1.42) years; 26 Male) groups. A two-way ANOVA examined the interaction between SA (high/low) and performance rating (self/observer).

Study two: 76 participants (age: M(SD) = 17.91 (1.93) years; 44 Male). Simple mediation analyses were performed using PROCESS Macro V3.

**Results:**

Study One: Participants with HSA received lower observer and self-performance ratings than those with LSA ( $F(1, 69) = 4.70$ , partial  $\eta^2 = .064$ ,  $p = .034$ ).

Study Two: Self-performance rating is indirectly related to social anxiety through interoceptive sensibility, such that participants with lower self-performance ratings had greater interoceptive sensibility, which was subsequently related to HSA. Self-performance rating is not related to social anxiety through state nor trait SFA. Participants with HSA had greater interoceptive sensibility in body temperature, muscle tension and heart rate (Table 1).

**Conclusions:**

Autistic youths may have similar awareness of their social differences and perception of their social interaction to neurotypical observers. Awareness of specific somatic sensations associated with anxiety might contribute to a negative self-image and social anxiety in autistic youths. Caution should be drawn when inferring direction of causation based on the cross-sectional nature of the study. Clinically, it may be beneficial to improve understanding of increased physiological arousal when feeling anxious for autistic youths.

**506.100 (Virtual Poster)** Relationship between Emotions and Repetitive Behaviors in School-Aged Autistic Children

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**Background:**

Some studies suggested that autistic children exhibit higher levels of negative emotions with fewer adaptive emotion regulation strategies throughout their development (Mazefsky et al., 2014; Totsika et al., 2011). It was proposed that autistic children regulate their emotions using extrinsic (e.g., regulated by an outsider) rather than intrinsic strategies (Cibralic et al., 2019; Jahromi et al., 2012). However, recent studies suggested that repetitive behaviors could be associated to self-regulation and well-being in autistics (Mottron, 2017; Smerbeck, 2019). These findings raise the possibility that repetitive behaviors could also play a positive role in emotion regulation ability in autism.

### Objectives:

To document the relationship between emotional expression and repetitive behaviors in school-aged autistic children based on parents' perceptions.

### Methods:

73 parents of autistic children aged between 6.1 and 12.9 years old ( $M = 9.6$ ;  $SD = 2.1$ ; 60 boys and 13 girls) completed the online French version of the *Questionnaire on Repetitive Behaviors and Interests in School-Aged Autistic Children* via LimeSurvey. One subsection of the questionnaire includes a comprehensive list of 47 repetitive behaviors identified by experts in autism (e.g., psychiatrists, psychologists, psychoeducators, speech therapists). First, parents were asked to identify and qualify the predominant repetitive behaviors of their child by answering questions using a Likert scale and open-ended questions. Then, they described the emotional contexts eliciting repetitive behaviors in their child. Descriptive statistics were performed with SPSS software to provide an overview of the predominant repetitive behaviors. Thematic content analysis of open-ended questions was conducted to identify emotional contexts surrounding occurrence of repetitive behaviors.

### Results:

Some parents (42.0%) reported that repetitive behaviors were triggered in the context of their child experiencing a **pleasant emotion** (e.g., happy, excited). From these parents, 21.9% indicated that pleasant emotions were associated with the most frequent repetitive behavior of their child (e.g., hand flapping: 8.2%; hopping: 4.1%). Repetitive behaviors were also associated with **unpleasant emotions** including periods of anxiety/stress (38.3%), anger (36.7%), fear (8.3%) and sadness (6.7%). An emotional context of anxiety/stress was associated to *sentence repetition* by 4.2% of parents who identified this specific repetitive behavior as being the one most frequently displayed by their child. In fact, three parents specifically indicated that repetitive behaviors calmed and reassured their child in periods of anxiety/stress, whereas another explain that it helped their child express joy and excitement.

### Conclusions:

Parents of autistic children associated both pleasant and unpleasant emotions to repetitive behaviors in everyday settings. Whether in pleasant and unpleasant contexts, it appears that autistic children display repetitive behaviors as an intrinsic strategy for emotional regulation and should therefore not be suppressed. These results are a step toward a broader understanding and better awareness of how autistic children regulate their emotions.

### 506.101 (Virtual Poster) Let's Play Together! Cognitive-Motor Abilities Predict Peer Interaction in ASD and TD

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### Background:

Peer interaction is considered a challenge for children with ASD. Recently studies have shown the link between social and motor functioning in TD and ASD. In addition, the important role that social cognition, especially theory of mind (ToM) play in peer interaction is well documented. However, the contribution of cognitive-motor mechanisms to children's peer interaction was not yet explored.

### Objectives:

Study main objective was to examine the contribution of the cognitive (ToM) and motor abilities to the understanding of peer interaction in TD and ASD. We also tested group differences (ASD/TD) in dyadic peer interaction. Findings may lead to the development of new cognitive-motor channels for social interventions to enhance peer interaction in youngsters with ASD.

### Methods:

Study participants included 84 children and adolescents ages 6-16yrs with ASD ( $M = 11.11$ yrs,  $IQ = 103.88$ ) (42 dyads) and 64 with TD ( $M = 10.73$ yrs,  $IQ = 114.53$ ) (32 dyads). Group differences on age and IQ were non-significant. To evaluate peer interaction, we used a construction game, in which children were instructed to build together a marble track in the Marble Works game and then to play with the marbles together. Children's interactions were coded by the Dyadic Relationships Q-set (DRQ) yielding a composite dyadic interaction score. In addition, we evaluated the participants motor and ToM abilities via the Individual Motoric Observation Scale (IMOS) and Theory of Mind Inventory (TOMI) parents' questionnaire generating three ToM levels (early, basic and advanced) and a composite score (Hutchins et al., 2012).

### Results:

Main results yielded significant group differences for DRQ ( $F(1,72)=44.49, p=.000, \eta_p^2=.38$ ) ( $M_{TD}=4.98, SD_{TD}=0.37; M_{ASD}=4.08, SD_{ASD}=0.69$ ). A linear regression analyses indicated the prediction of better peer interaction performance with better motor and ToM abilities at all levels: at step 1 group predicted 38%; at step 2 motor skills contributed additional 15%; at step 3 early, basic, advanced and composite ToM score added between 3-4% to the explanation of the DRQ. Altogether, cognitive (ToM) – motor mechanisms and group contributed between 56-58% to the understanding of peer interaction (DRQ).

#### Conclusions:

Study findings are discussed in light of the connection between social-cognition and motor difficulties in youngsters with ASD and its possible impact on their peer interaction. ToM was found to contribute to peer interaction at all levels, from early through basic to advance. This indicates Tom's significance for peer interaction at early social developmental stages. It seems that effective peer interaction relies both on the movement in space (motor abilities) and on the ability to relate to others in space (ToM). As far as we know, this is the first study to present the contribution of motor and ToM abilities to the understanding of peer interaction in children with TD and ASD. This highlights the importance of integrating motor and social cognitive skills in social intervention for ASD.

#### **506.102 (Virtual Poster) More Than Management: The Stigmatized Identity Framework-General Based on Goffman's Stigma Theory and Applied to Autism**

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**Background:** Stigma marks people based on specific characteristics—personal, social, or inherent—and how a particular society values those characteristics. These marks can negatively affect a person's health, wellbeing, and social functioning. Stigma affects many autists, including autistic teenagers, autistic adults, and even families of autists. This stigma is due to the conflict between societal attitudes and media depictions, as well as the atypical socio-commutative behaviors that manifest in autists. The stigma theorist Erving Goffman provided the first in-depth analysis of the social dynamics, effects, and management of stigma. However, his seminal work on stigma has not yet been systematically examined to create a general framework of stigmatized identity. Such a framework could help researchers identify themes and important quantitative domains to describe and/or assess variation and change in identity within specific groups experiencing stigma.

**Objectives:** The objectives for this two-part study were to 1) create a general framework based on Goffman's descriptions of stigmatized identity; and 2) apply the framework to examine stigmatized identity in autism.

**Methods:** We systematically examined Goffman's treatise for descriptions of self-concept formed in response to stigma. These descriptions were coded and organized into eight major domains to form a general framework of stigmatized identity. Then we applied the SIF-General to identity statements of autists. To gather identity statements from this population, we examined both peer-reviewed and popular literature authored by autists to determine whether expressions of attitudes and perceptions supported, conflicted with, added to, or were noticeably absent from the domains identified by Goffman. These resources were identified through an academic search for literature on "autism" and "stigma" and "identity or self-concept" and "adult" published between 2015 and 2021.

**Results:** We found rich depictions of ways people can internalize or otherwise develop identity related to stigma. From this, we created the eight-domain SIF-General (nonessentiality, inferiority, desire for normalcy, valence or characteristics, changeability, context-dependence, visibility, and desire for community). We found each of the domains from the SIF-General within the literature authored by autists. However, autists described additional nuances beyond Goffman's original descriptions, such as autism as being fully integrated with one's sense of self. Accommodation of autism-specific nuance resulted in the adaptation of the SIF-General to form the eight domain Stigmatized Identity Framework-Autism (relationship to self, disability, desire for normalcy, trait valence, changeability, context-dependent, visibility, and desire for community). Autists varied in their self-concept across the domains. Autists' social and communication differences may mediate the role of stigma in self-concept.

**Conclusions:** In summary, this study increases our understanding of stigmatized identity by providing a general framework that broadens our understanding of Goffman's stigma theory. This eight-domain framework can be adapted and applied to a wide range of stigmas, as we showed by applying the framework to the autism spectrum to show how stigma affects the self-concept of autists. The Stigmatized Identity Framework-Autism can be used in both quantitative and qualitative research to gain a deeper understanding of identity in autism.

#### **506.103 (Virtual Poster) Parental Report of Empathic Disequilibrium Predicts Autistic Traits in Neurotypical Adolescents**

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#### **Background:**

Puberty is developmental period characterized by major changes in social communication and behavior, among others. These skills rely heavily on our ability to empathize with others. Empathy comprises of cognitive (CE) and emotional (EE) components that, together, allow us to understand another's emotions and be affected by them appropriately, while maintaining a self-other distinction (Decety & Jackson, 2004). Autism is a neurodevelopmental disorder characterized by difficulties in social communication, among which is empathy. However, mixed findings regarding the relationship between autism and empathy has led us to suggest a novel way of conceptualizing and measuring empathy. We have recently shown that measuring the imbalance between CE and EE, a measure we termed empathic disequilibrium (ED), is predictive of autistic traits in neurotypical population of adults even when controlling for total empathy scores (Shalev & Uzevovsky, 2020).

## Objectives:

Here, we aimed to examine the developmental roots of ED, using parent-reports of typically developing adolescents' empathy.

**Methods:** 31 parents of adolescents (8.96 – 14.37 years; 15 boys) filled a battery of questionnaires regarding their child's empathy and autism-related traits. Empathy was measured using The Griffith Empathy Measure (GEM; Dadds et al., 2008) that assess both CE and EE. ED was calculated using the GEM as was previously reported by Shalev & Uzefovsky (2020), subtracting standardized CE from standardized EE scores. This measure represents individuals' relative differences between CE and EE with positive score indicating CE-dominance, while a negative score indicates EE-dominance.

Autism traits were measured using two different measures that evaluate autism traits in typical and atypical population – the Autism Quotient (AQ; Baron-Cohen et al., 2001) and the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005). We also measured alexithymia, a subclinical condition characterized by difficulties in identifying and describing one's own emotional state, using the Children's Alexithymia Measure (CAM; Way et al., 2010).

To examine the association between ED and age, as well as traits relating to autism, multiple regression analyses were conducted controlling for general empathy (using the total GEM score).

## Results:

Neither age nor sex predicted ED ( $p = 0.18$ ;  $p = 0.95$ , respectively). Controlling for total empathy, the ED of the child predicted autism traits in AQ ( $\beta = -0.46$ ,  $p = 0.006$ ) and SRS ( $\beta = -0.5$ ,  $p = 0.003$ ). Total GEM score also predicted autism in both AQ ( $\beta = -0.35$ ,  $p = 0.03$ ) and SRS ( $\beta = -0.31$ ,  $p = 0.049$ ). ED, but not total GEM scores further predicted CAM scores ( $\beta = -0.44$ ,  $p = 0.014$  for ED;  $\beta = -0.14$ ,  $p = 0.42$  for total GEM). Results are summarized in Figure 1.

## Conclusions:

This study shows that ED can be a meaningful index of autistic traits already in adolescence. Our study sheds light on the way we understand empathy in the developing child and highlights the feasibility of predicting autism traits throughout development measuring empathy in a novel way.

## 506.104 (Virtual Poster) Predictive Associations between Frontal EEG Alpha Asymmetry and Social Communication Difficulties in Females with ASD

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**Background:** Asymmetry in the relative contributions of left and right frontal EEG has long been associated with social-emotional processes and approach/avoidance motivation across the course of typical development. Accordingly, relatively stronger right asymmetry corresponds to greater social difficulties and reduced approach among individuals with ASD. However, biological sex appears to moderate both the role of asymmetry in typical development, and EEG-behavior associations in youth with ASD. Moreover, we know little about the intersection of sex and asymmetry in relation to social functioning in ASD.

**Objectives:** We aimed to investigate frontal EEG asymmetry as it relates to concurrent and longitudinal social communication difficulties among females and males with and without autism.

**Methods:** Data were drawn from a longitudinal, multisite study of youth with ASD (without intellectual disability) or neurotypical development. ASD diagnoses were confirmed through ADOS-2, ADI-R, and DSM-IV criteria. At Wave 1, participants (N=254; 46% female) were 8-17 years old (mean<sub>wave1</sub>=12.8 years, SD=2.9). A subset of participants (N=55; 55% female) provided longitudinal data four years later (mean<sub>wave2</sub>=16.0 years, SD=1.5), and further data acquisition continues. Frontal asymmetry was computed from high-density EEG alpha band power during resting. Parent-reported social communication difficulties at Waves 1 and 2 were assessed with the Social Responsiveness Scale, 2<sup>nd</sup> edition (SRS-2) total raw score. General linear models were constructed with diagnostic group, frontal asymmetry, and a Group x Asymmetry interaction term as factors, and social communication difficulties at Wave 1 (concurrent model) or Wave 2 (predictive model) as outcomes. Models were run separately for females and males to explore sex-specific associations.

**Results:** For females, the concurrent model accounted for 78.4% of the variance in social communication difficulties,  $F(3,112)=140.34$ ,  $p<.001$ ,  $\eta^2_p=.79$ ; this was driven entirely by diagnostic group,  $F(1,112)=414.09$ ,  $p<.001$ ,  $\eta^2_p=.788$ . Results were similar for males, accounting for 75.4% of the variance in social communication,  $F(3,134)=140.89$ ,  $p<.001$ ,  $\eta^2_p=.76$ , again driven by diagnostic group,  $F(1,134)=419.16$ ,  $p<.001$ ,  $\eta^2_p=.76$ . Thus, concurrent models indicated similar effects across sexes, with greater difficulties associated with ASD diagnosis. However, sex differences emerged with regard to predictive models. Although models continued to account for substantial variance in social communication difficulties for both females,  $F(3,21)=21.70$ ,  $p<.001$ ,  $\eta^2_p=.76$ , and males,  $F(3,26)=21.90$ ,  $p<.001$ ,  $\eta^2_p=.72$ , contributions from individual predictors differed. For females only, the model predicting social communication difficulties at Wave 2 indicated an interaction between frontal asymmetry and diagnostic group,  $F(1,21)=13.18$ ,  $p=.002$ ,  $\eta^2_p=.39$ . Nonparametric follow-up analyses indicated that stronger right asymmetry (relatively less left frontal activity) at



Wave 1 predicted greater social communication difficulties at Wave 2 for females with ASD ( $r=-.86, p=.01$ ), but not for neurotypical females ( $r=.05, p=.86$ ). See Figure 1.

**Conclusions:** Social communication difficulties were associated with ASD diagnosis across sexes and study timepoints, but asymmetry emerged as a predictor of later difficulties only for females with ASD. Thus, frontal asymmetry during middle childhood may be uniquely relevant for females with ASD, influencing social communication trajectories over time. Further exploration of biomarkers and associated mechanisms specific to females will be essential to understanding ASD in girls and women, particularly with regard to longitudinal effects.

**506.105** (Virtual Poster) Puberty and Empathy Development during the COVID-19 Pandemic

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**Background:** Empathy is the ability to recognize the emotions of others, and to share in those emotions while maintaining a self-other distinction (Eisenberg & Eggum, 2009). Empathy is comprised of a cognitive and an emotional component. Studies regarding autistic individuals often show intact emotional empathy (Baron-Cohen & Wheelwright, 2004) and decreased cognitive empathy (Baron-Cohen & Wheelwright, 2004). Studies of empathy development during puberty often show increases in perspective taking with age, and sex differences in empathic concern (Van Der Graaff et al., 2013). Females' emotional empathy mostly remains the same or steadily increases, while males' empathy decreases, which might be explained by hormonal changes that occur during this period (Lam, Solmeyer, & McHale, 2012).

**Objectives:** Explore the connections between puberty and empathy over time during the COVID-19 crisis period.

**Methods:** N=147 10-16-year-old adolescents (mean age 13.3 years, N=53 autistic, N=94 males) participated in the study. Data was collected at two time points- Time 1 was during July-September 2020, two months after the end of the first lockdown due to Covid-19, and right before a second lockdown. Time 2 was in January-February 2021, during the third lockdown. Participants reported their puberty status using the Tanner Puberty Stages (Taylor et al., 2001), a scale of physical development based on external primary and secondary sex characteristics (size of breasts, genitals, testicular volume, and development of pubic hair). Additionally, youths reported on their emotional and cognitive empathy using the Interpersonal Reactivity Index (IRI; Davis, 1983), which consists of the following four subscales: perspective taking; empathic concern; fantasy; and personal distress.

**Results:** Hierarchical regressions were performed to explore the relationship between the predictors and empathy measured at Time 2. Puberty stage at T1 predicted empathy at Time 2, while controlling for empathy at T1. An examination of the IRI subscales revealed that puberty at T1 predicted empathic concern at T2, while controlling for empathy at T1. The perspective taking score at T2 was predicted only by empathy at T1. Diagnosis did not predict any of the outcomes (see summary in Table 1).

**Conclusions:** Findings show empathy is a relatively stable trait, as levels of empathy at Time 2 were predicted by the level of empathy at Time 1. Puberty stages negatively predicted overall empathy and empathic concern levels. This link may be mediated through testosterone, the main hormone secreted during puberty, that is negatively correlated with empathy (Chapman et al., 2006). Interestingly, no group effect emerged, suggesting that autistic and non-autistic adolescents are similarly affected by pubertal changes. Studies concerning empathy development rarely focus on puberty, and the current study contributes to this scarce literature to better understand the complex interactions between physiological and socio-emotional development in autistic and non-autistic youths.

**506.106** (Virtual Poster) Reduced Parasympathetic Regulation, but Not Reactivity, and Socioemotional Symptoms in Male and Female Adolescents with Autism

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**Background:** The parasympathetic branch of the autonomic nervous system (ANS) serves to maintain calm, visceral states at rest and in response to stress, promoting flexible adaptation and behavior. Dysregulation of this coordinated system and its response to stress may increase propensity for physical or psychiatric illness as well as challenges in regulating behavior, cognition, and socialization. Individuals with autism spectrum disorder (ASD) experience difficulties in social communication, increased stress, and elevated risk for internalizing disorders; therefore, understanding the role of parasympathetic regulation and reactivity in relation to socioemotional behaviors is particularly relevant for males and females with ASD.

**Objectives:** The current study examined diagnostic- and sex-differences in respiratory sinus arrhythmia (RSA) during a social interaction and a social evaluation in 202 adolescents, ages 10-13 years, with and without ASD. Further, the study explored the extent to which parasympathetic regulation and responsivity were associated with social and psychological functioning in both groups.

**Methods:** Physiological response was measured in 114 youth (83 male, 31 female) with ASD and 89 (49 male, 40 female) with typical development (TD). Social tasks included the Trier Social Stress Test (TSST) (social evaluative threat) and a modified Trier Social Stress Test-Friendly (TSST-F) (social interaction). RSA was measured continuously using mobile electrocardiography and analyzed in 5-minute segments to capture baseline, preparation, task, and recovery. Parents reported on child's social functioning and affective symptoms. Repeated-measures linear models examined diagnostic- and sex-based effects during both tasks. Area under the curve (AUC) with respect to ground (AUCg) and with respect to increase (AUCi) were calculated as indices of overall parasympathetic regulation (AUCg) or reactivity (AUCi) and were correlated with social and psychiatric symptoms using Pearson or Spearman correlations.

Results: There was a significant effect for diagnosis during both the TSST-F ( $F(1,199)=7.36, p=0.007$ ) and the TSST ( $F(1,192)=6.24, p=0.01$ ), where youth with ASD demonstrated significantly lower RSA. During both the TSST-F and TSST, there were no significant main effects for sex (all  $p>0.05$ ). Univariate analyses further revealed significant diagnostic effects for AUCg (TSST-F:  $F(1,202)=9.36, p=0.003$ ; TSST:  $F(1, 203)=4.82, p=0.03$ ), but not AUCi ( $p>0.05$ ). While RSA regulation (AUCg) was significantly correlated with social symptom severity ( $r=-.23, p<0.001$ ) and affective symptoms ( $r=-.24, p<0.001$ ), there were no statistically significant associations for reactivity (AUCi) and any of the parent-reported variables.

Conclusions: Youth are faced with a variety of social encounters everyday- at home, school, and in the community. While overall response to social stress did not differ between diagnostic groups, individuals with ASD may experience an enduring reduction in parasympathetic regulation. Differences in autonomic functioning have been associated with deleterious outcomes— including, but not limited to, internalizing conditions— with similar associations reported in the current study. Further studies are needed to investigate the nature of autonomic dysfunction in ASD and the relations between social communication difficulties, mood, and physiological dysfunction. Examination of the magnitude and directionality of these relationships may inform enhanced understanding of susceptibility to physical and psychiatric co-morbidities, particularly for individuals with ASD.

**506.107 (Virtual Poster) Sibling Influences on Interpersonal and Coping Skills in Individuals with Autism Spectrum Disorder**

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Background: The sibling relationship is one that shapes individuals' behaviors and social-emotional developments, and its effects extends to other peer relationships, such as friendships (McHale et al., 2012). Ben-Itzhak and colleagues (2016) found an increase in social skills in individuals with ASD with an older TD sibling. More recent research also shows TD siblings of individuals with ASD develop better coping skills (CS) (Johnson et al., 2020). It has not been evaluated if TD individuals who have better interpersonal relationships (IR) and CS skills are correlated with the IR and CS skills of their sibling with ASD.

Objectives: High and low IR and CS skills are correlated in siblings with and without ASD.

Methods: Preliminary data analysis included 20 individuals with ASD and their TD siblings ( $n=40$ ) using retrospective data from The Phenotypic and Genetic Factors in ASD study. Of the individuals with ASD, mental age equivalents ranged from 37 to 212 months (mean = 95.4; SD = 53.3). Participants were included in data analysis if they had a research-confirmed ASD diagnosis by an ADOS or ADI, and a completed Vineland Adaptive Behavior Scales, Second Edition (VABS2; Cicchetti et al., 2019) to provide IR and CS scores as well as a special non-verbal composite (SNC) score greater than 80 on the Differential Ability Scales (DAS; Elliott, Colin, 2007). Two groups were created: Group 1 with 20 individuals total; 10 individuals with ASD (who had IR v-scores ranging from 7 to 14 and CS v-scores ranging from 9 to 16) and their corresponding TD sibling who had a high IR v-score (ranging from 16 to 24) on the subscale of VABS2. Group 2 with 20 individuals total; 10 individuals with ASD (who had IR v-scores ranging from 4 to 11 and CS v-scores ranging from 6 to 13) and their corresponding TD sibling who had a low IR v-score (ranging from 9 to 11) on the subscale of VABS2. IR and CS scores of participants with ASD were compared between the two groups.

Results: T-tests showed a significant difference in IR scores between Group 1 ( $M=10.6$ ;  $SD=2.9$ ) and Group 2 ( $M=8.4$ ;  $SD=2.5$ ),  $t(9)=2.34, p=0.02$ . There is no significant difference of coping skill scores for individuals with ASD in Group 1 ( $M=11.7$ ;  $SD=2.3$ ) and Group 2 ( $M=10.5$ ;  $SD=2.5$ ),  $t(9)=1.35, p=0.11$ .

Conclusions: Preliminary results show individuals with ASD who have a TD sibling with higher IR skills have significantly better IR skills compared with individuals with ASD who have a TD sibling with lower IR skills, as evaluated by the VABS2. This is in line with previous research. There is no significant difference in the coping skills scores between the two groups. A larger sample size will be analyzed in subsequent analysis.

**506.108 (Virtual Poster) Social Disruption and Loneliness in Autistic and Non-Autistic Youth during the COVID-19 Pandemic**

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Background: The novel coronavirus (COVID-19) pandemic is likely to drastically increase the risk of experiencing social isolation and loneliness. Autistic youth already experience elevated social isolation and loneliness (Shattuck et al., 2011), making them highly vulnerable to the pandemic's negative impact. Indeed, research is already beginning to document increases in psychiatric symptom severity in autistic youth during the pandemic (Vasa et al., 2021). Qualitative work indicates that autistic youth report greatly missing social contact during the COVID-19 pandemic (Pellicano et al., 2021), however, no study has quantitatively examined loneliness in autistic youth during this period.

Objectives: To examine the trajectories of social disruption and loneliness in autistic and non-autistic youth during a six-month period of the pandemic in 2020.

Methods: Participants were 76 youth, aged 8 through 17 (Table 1), with an IQ greater than or equal to 70 and prior assessment via the Autism Diagnostic Observation Schedule (ADOS-2). Participants completed a biweekly measure of loneliness (Revised UCLA Loneliness Scale) and their parents completed a biweekly measure of pandemic-related social disruption (Epidemic Pandemic Impacts Inventory) from June 1, 2020 until December 15, 2020. Multilevel models for longitudinal data were employed to account for the nesting of observations within individuals.

Results: There were no baseline differences in social disruption or loneliness (Table 1). There was an interaction between ASD symptom severity (via the ADOS-2) and linear time ( $B=-.445, SE=.191, p=.021$ ), such that non-autistic youth reported greater declines in social activity disruption than

autistic youth. Simple slopes analyses indicated a decline in social activity disruption for both autistic and non-autistic youth (Figure 1a). There was also an interaction between ASD symptom severity and linear time ( $B=-.630$ ,  $SE=.270$ ,  $p=.022$ ), such as that autistic youth reported greater declines in loneliness relative to non-autistic youth. Simple slopes analyses indicated a decline in loneliness for only autistic youth (Figure 1b). Finally, results demonstrated an interaction between ASD symptom severity and social disruption ( $B=.089$ ,  $SE=.030$ ,  $p=.004$ ), such that autistic youth demonstrated a relatively stronger relationship between social disruption and loneliness compared to non-autistic youth. Simple slopes analyses indicated a relationship between social disruption and loneliness for only autistic youth (Figure 1c).

**Conclusions:** Results demonstrated declines in social disruption for both autistic and non-autistic youth, as well as declines in loneliness for autistic youth. One possibility is that autistic youth may have been buffered from experiencing social disruptions and loneliness during the pandemic, due to their pre-pandemic experiences with each. Findings also indicate a relationship between social disruption and loneliness for autistic, but not non-autistic youth. During the pandemic, youth frequently turned to digital social communication, however that may not be conducive to the needs of autistic youth, who often require more concrete social cues (Mendelson et al., 2016). Thus, although autistic youth experienced declines in their social disruption and loneliness, when they did experience social disruption, they were at greater risk for loneliness. These results highlight the importance of examining individual experiences of loneliness among autistic youth.

**506.109 (Virtual Poster)** The Relationship between Autism Symptoms and Reading the Mind in the Eyes

**M. Kurtz<sup>1</sup>**, J. A. Trapani<sup>2</sup> and R. K. Kana<sup>3</sup>, (1)*The University of Alabama, Tuscaloosa, AL*, (2)*University of Alabama at Birmingham, Birmingham, AL*, (3)*Department of Psychology, University of Alabama, Tuscaloosa, AL*

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**Background:** Decades of research suggests that Theory of Mind (ToM), or the ability to infer an individual's mental state, is impaired in individuals with autism spectrum disorder (ASD) (Baron-Cohen et al., 1985). The Reading the Mind in the Eyes Task (RMET) is a relatively frequent utilized measure of ToM. While individuals with ASD are noted to underperform on this task (Baron-Cohen et al., 1997, 2001), critics argue that the RMET may not capture true ToM abilities. Instead, this task may tap into underlying abilities in the domains of social cognition, language functioning, and emotion recognition (Oakley et al., 2016; Baker et al., 2014).

**Objectives:** The current study aims to investigate the relationship across autism symptoms, cognitive abilities, and ToM, as measured by RMET. Further, this study examines possible cognitive skills that may predict performance on measures of empathizing.

**Methods:** Thirty neurodiverse participants (ages 18-28 years) completed tasks and questionnaires to assess self-reported ratings of behavioral and cognitive differences, including the RMET, Autism Spectrum Quotient (AQ), Empathy Quotient (EQ), and Social Responsiveness Scale (SRS-2). The Wechsler Abbreviated Scale of Intelligence (WASI-II) was also administered to estimate general cognitive ability (FSIQ;  $M=107.45$ ,  $SD=12.7$ ), perceptual reasoning skills (PRI;  $M=102.4$ ,  $SD=14.1$ ), and verbal comprehension skills (VCI;  $M=110.52$ ,  $SD=11.3$ ). A series of linear regression analyses were conducted to investigate: (1) the associations between self-reported ratings of autism symptomology (AQ and SRS-2) and accuracy on the RMET; (2) the associations between PRI and VCI scores with accuracy on the RMET; and (3) the associations between PRI and VCI scores with self-reported empathy on the EQ.

**Results:** AQ scores and SRS-2 scores were not significantly related to RMET performance. Interestingly, PRI scores explained a significant amount of variance on RMET performance ( $R^2=.247$ ,  $F(1,27)=8.865$ ,  $p=.006$ ,  $\beta=.497$ ) and on EQ scores ( $R^2=.175$ ,  $F(1,27)=5.725$ ,  $p=.024$ ,  $\beta=.418$ ). VCI scores explained a significant amount of the variance on RMET performance ( $R^2=.135$ ,  $F(1,27)=4.224$ ,  $p=.05$ ,  $\beta=.368$ ), but not EQ scores.

**Conclusions:** Self-reported ratings of autism symptomology among this sample of neurodiverse participants were not found to be associated with RMET performance. This is inconsistent with findings by Baron-Cohen et al. (2001) which revealed RMET accuracy to be inversely correlated with increased severity of autism symptoms reported on the AQ. Instead, our findings suggest that performance on the RMET was better explained by verbal comprehension and perceptual reasoning abilities. Notably, EQ scores were only contingent on perceptual reasoning abilities. It is possible mentalizing and empathizing ability may underlie an interplay of multiple cognitive factors as suggested by Oakley et al. (2016) and Baker et al. (2014).

**506.110 (Virtual Poster)** Thriving in Autistic Children Seeking Socioemotional Supports in a Virtual Group-Based Cognitive Behavioural Therapy Program

**T. Sellitto<sup>1</sup>**, V. Lee<sup>2</sup>, N. Vashi<sup>1</sup>, F. H. Roudbarani<sup>1</sup>, A. Pouyandeh<sup>1</sup> and J. A. Weiss<sup>1</sup>, (1)*Psychology, York University, Toronto, ON, Canada*, (2)*Psychology, Carleton University, Ottawa, ON, Canada*

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**Background:** While there is an abundance of research focusing on remediating deficits experienced by autistic children, few studies have focused on understanding positive outcomes in this population, such as thriving (Burnham Riosa et al., 2017). Thriving has been conceptualized as the growth of attributes known as the "Six Cs" of Positive Youth Development (PYD; Lerner et al., 2005): *Competence* (i.e., self-worth and self-efficacy), *Caring* (i.e., sympathy and empathy), *Confidence* (i.e., a positive view of one's actions), *Connection* (i.e., positive relationships), *Character* (i.e., respect for societal and cultural rules), and *Contribution* (i.e., helping oneself, family, community, and society). The PYD perspective suggests that thriving is more likely to occur when there is an alignment between one's individual strengths (e.g., adaptive behaviours) and ecological assets (e.g., family resources and supports; Lerner et al., 2010; Theokas & Lerner, 2006). Research is needed to understand thriving and determine the factors associated with it in autistic children.

**Objectives:** To explore profiles of thriving and determine the individual strengths and ecological assets associated with thriving in autistic children.

**Methods:** Data were collected from 70 family caregivers of children with a confirmed autism diagnosis between 8 and 13 years of age ( $M = 10.01$ ,  $SD = 1.29$ ; 74% male) prior to participating in an online group-based cognitive behaviour therapy program, the Secret Agent Society (Beaumont, 2015), in Canada. Caregivers completed questionnaires on their child's experience of meaning and purpose (Forrest et al., 2019), emotion regulation and social skills (Butterworth et al., 2014), family income, and family functioning (Sanders & Morawska, 2010). Children's thriving was measured using the Six Cs of PYD (Lerner et al., 2005), where caregivers rated their level of agreement with global statements using a 5-point Likert scale (0 = *Strongly Disagree* to 4 = *Strongly Agree*; *Mean Range*: 0.33 to 3.67;  $M = 2.50$ ,  $SD = .67$ ).

**Results:** The largest percentage of agreement by caregivers was in the Connectedness domain of thriving (84%), followed by Character (71%), Caring (63%), Confidence and Contribution (both 46%), and lastly, Competence (34%). Correlational analyses revealed that overall thriving was positively associated with children's meaning and purpose ( $r = .48$ ,  $p < .001$ ) and emotion regulation and social skills ( $r = .57$ ,  $p < .001$ ). Thriving was also associated with greater family functioning ( $r = -.28$ ,  $p = .03$ ). Thriving was not associated with child age or family income (both  $p > .05$ ). A linear regression revealed that thriving was predicted by meaning and purpose ( $p = .02$ ) and emotion regulation and social skills ( $p = .002$ ).

**Conclusions:** Autistic children demonstrated the highest level of thriving in the Connectedness and Character domains. Overall thriving was associated with children experiencing more meaning and purpose in their lives and with greater emotion regulation and social skills. Future research is needed to explore thriving from the perspective of autistic children to better understand this construct and its correlates within this population.

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**506.111 (Virtual Poster)** Understanding Transgender Identity in a Survey of Autistic Individuals

**H. R. Steinberg<sup>1</sup>**, A. Becker<sup>2</sup> and L. Shea<sup>3</sup>, (1)AJ Drexel Autism Institute, Philadelphia, PA, (2)Policy and Analytics Center, A.J. Drexel Autism Institute, Philadelphia, PA, (3)A.J. Drexel Autism Institute, Philadelphia, PA

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**Background:** Studies utilizing quantitative methods such as analyzing big data and surveys in clinical settings have found a higher co-occurrence of transgender identities and autism spectrum disorder (ASD). However, most of these studies have examined binary medical transitions. Gender scholars consider the gender binary to be socially constructed, meaning that in reality, the categories of "man" and "woman" may be more fluid when enacted. Writing from autistic community activists and first-person narratives suggest that nonbinary identities may be salient in this population. However, little is known about how autistic transgender people identify.

**Objectives:** Using descriptive statistics, this study compared survey responses to questions about gender to understand how autistic transgender individuals may be identifying, especially around nonbinary identities.

**Methods:** One-way frequencies, including counts and proportions, were generated for the full sample of 1,527 autistic adults that responded to the Pennsylvania Autism Needs Assessment – a 2018 statewide survey of autistic individuals. Frequencies were generated for survey items about gender identity, sex assigned at birth, as well as transgender and gender-nonconforming identity. Frequencies were compared both across responses in the survey and with previous literature.

**Results:** 61 of 1,527 (4%) individuals selected that they were transgender and/or gender nonbinary. When asked what gender the respondent identified as, 35 said "other," and 58 did not answer. Of the 27 respondents that filled out the qualitative answer to "other" on this question, 21 (78%) answers reflected identities outside of a binary categorization. These findings suggest a prevalence of nonbinary identities beyond what previous research has suggested. They also indicate that transgender individuals with binary identities may be identifying in binary categories when asked about gender. There may be higher rates of missingness also, due to concerns around stigma and confidentiality from this population.

**Conclusions:** These findings suggest a prevalence of nonbinary identities that may be reflected in community activism, but is not examined in the current academic literature. This indicates a need for further focus on definitions of gender outside of the binary in the autistic population. Additionally, this data can help researchers refine how they ask about gender identities, especially accounting for the higher amount of transgender individuals in the population.

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**506.112 (Virtual Poster)** How Do Individual Differences in Social Motivation and Emotion Regulation Relate to Social-Emotional Difficulties in Youth with Autism Spectrum Disorder (ASD)

**M. Uljarevic<sup>1</sup>**, **J. M. Phillips<sup>2</sup>**, **T. W. Frazier<sup>3</sup>** and **A. Y. Hardan<sup>2</sup>**, (1)School of Psychological Sciences, University of Melbourne, Stanford, CA, Australia, (2)Psychiatry & Behavioral Sciences, Stanford University, Stanford, CA, (3)Psychology, John Carrol University, Cleveland, OH

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**Background:** Reduced social motivation (SM), or the drive to engage, affiliate, and interact with others, during early development has been suggested as a key mechanism behind the subsequent social and communication impairments that characterize autism spectrum disorder (ASD). However, as with other aspects of the clinical and behavioral phenotype, there is pronounced variability in SM among individuals with ASD, with some individuals lacking social interest and awareness of others, and others showing a strong drive to form and sustain social relationships. Importantly, increased levels of loneliness, anxiety and depression among individuals with ASD with more preserved SM have been reported. It has been suggested that despite preserved SM in some individuals with ASD, issues with emotion regulation (ER) and social and communication skills, may lead to repeated negative social experiences, resulting in increased emotional pain, isolation and loneliness, which, in turn, would contribute to the emergence of anxiety and depression. Indeed, ER impairments are common in ASD, and have been shown to be associated with internalizing problems. However, no studies to date have investigated the interplay between SM and ER in predicting higher levels of loneliness and internalizing symptoms.

**Objectives:** This study aimed to investigate the association between individual differences in SM and ER in predicting the severity of loneliness and internalizing problems in children and adolescents with ASD.

**Methods:** Parents of 98 children and adolescents with ASD (Mean age= 13.93 years, SD= 2.54; 28 females) completed the Stanford Social Dimensions Scale (SSDS), the Emotion Regulation Checklist, the Loneliness Scale, and the Strengths and Difficulties Questionnaire (SDQ) as measures of children's SM, ER, loneliness and internalizing problems, respectively. The SSDS includes several domains including the Social Motivation subscale.

**Results:** Children and adolescents with ASD were classified into the following subgroups based on the SM and ER distribution: (i) Poor SM/Poor ER (n= 32); (ii) Poor SM/Good ER (n= 22); (iii) Good SM/Poor ER (n= 15); and (iv) Good SM/Good ER (n= 29). Groups did not differ in terms of sex distribution nor age. There were significant group effects for internalizing problems ( $F= 14.59, p< .001$ ), with post-hoc comparisons showing that Good SM/Poor ER and Poor SM/Poor ER subgroups had significantly higher internalizing problems than Good SM/Good ER and Poor SM/Good ER subgroups. There were significant group differences in loneliness ( $F= 5.10, p= .002$ ) with the Good SM/Poor ER subgroup showing significantly higher loneliness than the other three subgroups.

**Conclusions:** Although subgroups derived here are preliminary and warrant further replication and investigation in longitudinal studies, they provide an important contribution by providing the first characterization to date of the inter-relationship between SM, ER and internalizing problems such as anxiety and depression. Importantly, findings reported here and the derived preliminary subgroups show a potential clinical utility. More specifically, they emphasize the need for detailed assessment of both core ASD impairments such as social motivation using dedicated instruments such as the SSDS and assessment of ER in order to inform the selection of appropriate and personalized intervention and support approaches.

## Technology Demonstration

### POSTER SESSION — TECHNOLOGY DEMONSTRATION

#### 421 - Technology Demonstration

##### **421.202** (Poster) A New Remote Technology Package Demonstration: Bringing the Lab to Families' Homes

**J. Birudavol<sup>1</sup>, M. Howard<sup>2</sup>, A. Morelos<sup>3</sup>, M. Petrucci<sup>3</sup>, K. Ray<sup>4</sup>, W. L. Stone<sup>4</sup>, A. Wainer<sup>5</sup>, B. R. Ingersoll<sup>6</sup>, S. Broder-Fingert<sup>7</sup> and A. S. Carter<sup>8</sup>,**  
(1)University of Massachusetts Boston, Boston, MA, (2)Michigan State University, Lansing, MI, (3)University of Massachusetts, Boston, MA, (4)Psychology, University of Washington, Seattle, WA, (5)Department of Psychiatry, Rush University Medical Center, Chicago, IL, (6)Psychology, Michigan State University, East Lansing, MI, (7)University of Massachusetts Chan Medical School, Worcester, MA, (8)Department of Psychology, University of Massachusetts Boston, Boston, MA

**Background:** Given the dearth of access to psychological assessments and services for historically underserved communities, and the need for operating remotely due to the COVID-19 Pandemic, we have been designing a technology package to enable remote participant assessments for a National Institute of Mental Health (NIMH)-funded multi-site randomized clinical trial for toddlers with social communication challenges or autism spectrum disorder (ASD). An additional impetus to develop such technology arose from COVID-19 health precautions such as mask wearing, which limits the observation of facial expressions during in-person assessments. Our assessment technology package was designed to be highly portable, self-contained, able to store data locally with encryption, and to allow for both recording and coding of videos, all while operating with pandemic safety protocols.

**Objectives:** To develop a secure remote assessment technology package that meets the needs of home-based, caregiver-administered assessments with families.

**Methods:** Off-the-shelf products were integrated with Ubiquiti technology solutions into a self-contained, portable unit. This configuration allows the use of a private network for wireless video recording to an encrypted local internal hard drive, significantly increasing data security when compared to the typical cloud storage most remote video recording applications provide. Wireless, wide-angle, high-definition cameras were mounted to portable batteries to allow for flexible recording positions without introducing unnecessary hazards to the home environment (e.g., wires). Remote access to the secure network via internet was obtained using a 5G mobile hotspot and antenna, with enhancement options adding a MIMO Panel External Antenna or direct ethernet connection to a local broadband router for areas with poor cellular signal. Total material cost per unit is less than \$1,250, plus monthly 5G mobile hotspot data service plan charges. There are no fees for remote access or video storage with this hardware.

**Results:**

Eight pilot assessments showed promise for the assessment technology package. Caregivers were able to successfully setup and operate the equipment with minimal direction required. The assessment footage was securely retrieved and allowed for behavioral coding as well as diagnostic formulations. We achieved remote connection to the network in environments that typically prohibit such access (e.g., basement apartments).

**Conclusions:**

The urgent need for remote assessments during the COVID-19 pandemic led to the development of an assessment technology package that addresses privacy and data security concerns while allowing for virtual, in-home assessments that offer naturalistic, high-quality observations of diverse toddlers and caregivers. Our preliminary findings demonstrate the technology package is capable of capturing interactions between children with social communication concerns or ASD and their caregivers in the home setting. This project highlights the feasibility and potential benefits of conducting child assessments and interventions remotely in the future.

**421.203 (Poster)** A Rapid Co-Design Approach for Digital Health Transformation – Methodology, Community Response and Live Demonstration. **K. Davey**, Decipher Zone, Rosedale South, Australia; Secret Agent Society, Social Skills Training Institute / AutismCRC, Indooroopilly, QLD, Australia

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**Background:** Over 17 years a PhD project has progressed to empower children's social-emotional resilience across multiple countries and gather over 17 publications demonstrating its effectiveness and application to various settings and families. At the pandemic onset, a rapid co-design process commenced to innovate the program into a digital health solution without compromising the existing evidence-base or community utilization and reach. Through careful planning and testing, the program content, process and physical resources became one integrated software package. The software supports group management, interactive clinician-led session activities, automated assessment, and connected adult support networks to facilitate information sharing, skill generalisation, and reward systems. The digital edition launched to the community January 2021.

**Objectives:** The software development objectives were to meet program fidelity measures aligned with the existing published evidence and, to ensure utilization, be practical for service providers and families. The process aimed to meet the short-to-medium term needs of community services facing crisis and the long-term vision for program innovation. The collaborative user-informed process had three intentions: enhance the program through automation efficiencies and reduce practical weaknesses; increase access by enabling face-to-face, telehealth delivery, and integrated self-paced online professional training; and maintain consistency with published content and processes.

**Methods:** The six step co-design process involved fast-paced cyclic feedback with an advisory group of clinicians and educators from across sectors around the globe, program author, software developers, children, and a commitment to the long-standing evidence behind the program. The post-launch evaluation included program uptake data through demographics of both existing and new service providers, quantitative and qualitative feedback from professionals completing training, user data analysis, and qualitative service and family feedback.

**Results:** In the first eight months following the launch, 599 professionals accessed the training courses and 132 provider organisations subscribed including 62.1% transitioned from the physical program and 37.9% new. At least 1500 children either completed the program, currently active, or preparing to start. The program reached four global regions (see Figure 1). 15.9% represented government organisations (i.e., schools and child mental health clinics). 85.6% represented private or non-government sectors of health, disability, and education. The first 143 new professionals trained included Psychologists, Behaviour Analysts, Educators, Occupational Therapists, Speech Pathologists, and Social Workers. They rated the program with mean of 6.46/7 for its appropriateness to their work. 91% rated between *generally* to *very satisfied* with the training course, with a mean 5.92/7 (See Figure 2). For satisfaction ratings less than 4/7, theme analyses revealed three areas of weakness which were addressed where possible.

**Conclusions:** The initial evaluation indicated likely achievement of the project objectives for both program delivery and professional training. The outcomes to-date provide preliminary support both the co-design methodology and resultant suitability of the software-based social-emotional skills program to empower children's resilience into the future. Results include a swift uptake and feedback that aligned with project aims. Internal evaluation methods continue with examination of data mapped to built-in fidelity measures. Outcomes from independent community implementation research using both the physical and digital versions are forthcoming.

**421.204 (Poster)** Balance, Brain, Speech, Kinematic, and Behavioral Effects of a Mechanical Horse-Riding Simulator for Children with Autism **J. Rylander<sup>1</sup>, S. Hockett<sup>2</sup>, B. Garner<sup>2</sup>, R. Switzer<sup>2</sup>, P. Fillmore<sup>2</sup>, J. Ivey<sup>2</sup>, B. Lanning<sup>2</sup>, R. Coleman<sup>2</sup> and V. Kantety<sup>2</sup>**, (1)Mechanical Engineering, Baylor University, Waco, TX, (2)Baylor University, Waco, TX

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**Background:**

Therapeutic horseback riding (THR) is a treatment strategy that appears to benefit children with Autism Spectrum Disorders (ASD) through improvements in self-confidence, sensory integration, social behavior, gross motor skills, and core stability and balance. Though the specific mechanism of THR efficacy is unclear, transference of the complex, three-dimensional equine motion patterns to the rider is believed to stimulate sensory processing and muscular control, engaging interconnection deficiencies. As practical access to THR may be limited by multiple factors (e.g. proximity, weather, fear, etc.), we developed a mechanical horse-riding simulator (MHS) that realistically reproduces the complex motion patterns experienced when riding a horse. The MHS serves as a complementary tool to THR, facilitating indoor, urban access to organic motion patterns for children with ASD.

**Objectives:**

The objective of this study is to investigate and quantify effects of the MHS as an intervention for children with autism. Specifically, we aim to determine the extent to which the MHS affects a broad range of ASD symptoms including core behavior and cognition, balance and motor coordination, speech and language, and brain activity.

## Methods:

This study uses a randomized crossover design in which each participant completes 10 treatment sessions on a moving MHS and 5-10 control sessions on a stationary MHS. A full battery of assessments (balance, gait, EMG, EEG, pelvic movement while riding, behavior & cognition), including within-session assessment before and after riding when possible, are performed before and after treatment and control session blocks. In addition, short assessments of balance, gait, pelvic riding movement, and EEG are measured before and after riding at every treatment session. Currently, one subject has completed the full study protocol and three additional subjects have partially completed the protocol. These early results have been analyzed for this abstract. Data collection is ongoing through Summer 2022, thus we expect multiple additional completed subjects by the time of the INSAR conference.

## Results:

Preliminary results from subjects who completed MHS treatment sessions indicate improvements in their gait, balance, motor function, and brain activity. Balance effects include a significant reduction in sway speed while in a tandem (one foot in front of the other) position. Gait improvements observed were an increase in walking speed and a normalization of step width. We also observed a shift in pelvic riding kinematics, from lagging behind the horse's movement towards synchronizing with its movement. EMG results indicate an improvement in coordination (lower EMG peaks) and a reduction in muscle fatigue (reduced median frequency). EEG results also showed significant improvements in both power and coherence, which was observed both across sessions (pre-treatment vs post-treatment) and within sessions (before and after riding).

## Conclusions:

Early results indicate that simulated horseback riding is capable of producing some of the same benefits in children with ASD that have been observed in traditional therapeutic riding. This study is on-going and results will continue to be analyzed across the broad spectrum of outcome metrics that are being collected.

**421.205** (Poster) Designing Mika 1.0: An Communication Learning Application for Children with Autism Spectrum Disorder in Indonesia **M. Margaretha**<sup>1,2</sup>, **S. R. Yuliani**<sup>2,3</sup>, **N. Khamida**<sup>2,4</sup>, **V. Emir Muhammad**<sup>5</sup> and **I. Puspitasari**<sup>5</sup>, (1)Psychology, Universitas Airlangga, Surabaya, Indonesia, (2)Forum Peduli Autisme Jawa Timur, Surabaya, Indonesia, (3)SLB River Kids Malang, Malang, Indonesia, (4)UPTD ABK Sidoarjo, Sidoarjo, Indonesia, (5)Information Systems, Universitas Airlangga, Surabaya, Indonesia

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Background: Children with autism spectrum disorder (ASD) may have difficulty developing their communication skills, constructing effective sentences in conversation, and understanding what others say to them in their communication contexts. High-technology assisted communication devices have been introduced globally, mainly in English, but less is available in Indonesia.

Objectives: We developed Media of Children Visual Communication apps (Media Komunikasi Visual Anak - MIKA), a mobile-based communication learning application for children with ASD. MIKA is expected to be a method to improve communication skills by promoting visual-based engagement and communication in the learning environments with Bahasa Indonesia.

Methods: MIKA's designing process was bottom-up in three phases: 1) needs and requirements elicitation from users and stakeholders, such as therapists, parents of children with ASD; 2) literature studies; and 3) application design and development.

Results: We initially made the MIKA alpha version (MIKA) using the rapid application design method in the development. However, user testing revealed that MIKA was difficult to use and lacked interface consistency. Based on the users' evaluation, we refined the design process following the Agile Scrum Development Method and Usability evaluation. The usability criteria consisted of Learnability, Efficiency, Memorability, Error, and User Satisfaction. The results showed improvements on MIKA revised version (MIKA 1.0) user's evaluation. The therapists agreed that MIKA 1.0 could be used as a supporting tool for learning therapies. In addition, the results showed improvements from the prior version to the revised version, as indicated by a higher score of all usability qualities in MIKA.

Conclusions: MIKA 1.0 was found to have improved from its initial version and serve a function to support communication learning by using visual-based engagement and communication. The revised version, MIKA 1.0, is expected to support communication learning and therapies for children with ASD in Indonesia.

Keywords: MIKA 1.0, mobile-based learning application, autism spectrum disorder, usability evaluation, agile scrum development method.

## Declaration:

The research and development of MIKA 1.0 are fully supported by the Alumni Grant Scheme (AGS) by the Australia Awards Indonesia and facilitated by Forum Peduli Autisme Jawa Timur and Universitas Airlangga Surabaya.

**421.206** (Poster) Mobile Virtual Reality Skill Building for Autism Spectrum Disorder **S. Turnacioglu**<sup>1</sup>, **V. Ravindran**<sup>2</sup> and **R. Solorzano**<sup>2</sup>, (1)Floreo, Bethesda, MD, (2)Floreo, Inc., Washington DC, DC

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**Background:** Autism spectrum disorder (ASD) is a lifelong condition that affects approximately 1 in 54 children in the United States and is frequently characterized by significant social and adaptive challenges. There remains a clear need for effective, accessible, and low-cost interventions that can address the diverse needs of autistic individuals. Virtual reality (VR) has emerged as a promising method of intervention with over two decades of research on its use for a variety of different skills and areas of challenge in autism.

**Objectives:** Demonstrate how a paired mobile virtual reality system can use real-time coaching to support skill-building with individuals with ASD, using a variety of lessons that focus on foundational social communication skills, school social skills, emotional regulation, and challenging community experiences such as street crossing and interactions with law enforcement.

**Methods:** The mobile virtual reality system used in this presentation has been studied in a pilot project evaluating usability and safety in a population of students with ASD and significant communication needs and in funded research assessing the safety, feasibility, and efficacy of a virtual reality intervention to teach skills needed to successfully navigate encounters with law enforcement officers in adolescents and adults with ASD.

**Results:** In the pilot safety and usability study, no serious adverse events occurred and no participants withdrew from the study due to side effects. In nearly all of the VR sessions, participants tolerated use of the VR headset. Enjoyment and value of the experience were rated highly by teachers working with the participants.

In safety and feasibility phase of the police safety intervention, mild side effects including headache and disorientation were described by five participants and no serious adverse events were noted. Average scores were high on a version of the System Usability Scale modified for use with individuals with ASD. In the efficacy phase of the police safety intervention, results indicated that participants' knowledge regarding how to interact appropriately with police officers and comfort interacting with officers increased significantly as a result of the virtual reality intervention. In addition, key social interaction skills improved. Participants' eye contact during police interactions was rated as significantly better during the post-intervention assessment compared with pre-intervention, and the appropriateness of their behavior was rated as being significantly improved after participating in the virtual reality intervention.

**Conclusions:** Research suggests that a novel mobile virtual reality skill-building system designed to support children and adults with ASD through real-time coaching and feedback is safe and feasible for use by a range of autistic individuals, and may be effective at improving community social problem-solving skills.

**421.207 (Poster)** Peerbots - a Social Robot and Assistive Communication Toolkit  
**M. Rearick**, *Peerbots, Mammoth Lakes, CA*

**Background:** Peerbots was created in 2020 in response to therapists' and educators' needs to access effective technology in distance learning and telehealth settings. After developing the first version of Peerbots software, founders Aubrey Shick and John Choi formed a 501(c)3 to fund further development of this accessible technology. Peerbots is essentially a digital "puppet" that can be used to facilitate interactions and to work on any number of goals related to communication and social exchanges. Professionals can create their own content and share content with others, making Peerbots a flexible, dynamic platform.

**Objectives:** The aim of Peerbots is to provide free, accessible, effective technology to professionals and families supporting people who experience communication and/or social challenges, including Autism.

**Methods:** At the time of this submission (October 2021) Peerbots is executing the third and final phase of a grant funded by the Autism Science Foundation (ASF). Phase III focuses on updates and improvements based on feedback from Peerbots users. To inform these updates the Peerbots team is currently collecting quantitative data in the form of clicks (how often a user uses a specific button/function in the software) and qualitative data from focus groups co-hosted by ASF. Findings from this data collection and analysis will be available in late 2021.

**Results:** N/A

**Conclusions:** N/A

## Translational

### PANEL — TRANSLATIONAL

#### 204 - Oxytocin and Vasopressin – Where Do We Go from Here?

**Panel Chair: Srinivas Rao**, *atai Life Sciences, New York, NY*

**204.001 (Panel)** Imaging and Behavioral Trials with Oxytocin  
**K. Pelphrey**, *University of Virginia, Charlottesville, VA*



Background: As humans, we are constantly engaging in social cognition, using cues from facial expressions, gaze shifts, and body movements to infer the intentions of others and plan our own actions accordingly.

In this talk, I will describe my team's research using brain imaging techniques to chart the development of brain systems for social cognition in typically developing infants, children, and adolescents. Our work has served to characterize the functional properties and development, from infancy to adulthood of a set network of interacting, distributed neuroanatomical structures dedicated to processing social meaning.

Objectives: With this understanding of the typical development of the neural basis of social cognition as a backdrop, I will describe our efforts to chart the atypical development of these brain mechanisms in infants at increased risk for developing autism spectrum disorder (ASD) and autistic children, as well as their unaffected siblings.

Methods: I will then describe a developmental experimental therapeutics approach to using social neuroscience findings in the development and evaluation of more precise, individually-targeted behavioral and pharmacological treatments for autism spectrum disorders.

Results: To illustrate this approach, I will discuss our discovery that intranasal administration of oxytocin enhances activity in the brain for socially meaningful stimuli and attenuates its response to nonsocially meaningful stimuli in autistic children as measured via functional magnetic resonance imaging (fMRI).

I will then present evidence suggesting that the functional neural attunement we demonstrated might facilitate social learning, thus potentially bringing about long-term change in neural systems and subsequent behavioral improvements.

Conclusions: Our results illustrate the power of a translational developmental neuroscience approach to facilitate the development of pharmacological interventions for ASD.

#### **204.002 (Panel) Soars-B Trial: Overview & Results**

**L. Sikich**, *Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

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Background:

Studies of intranasal oxytocin treatment extending over several weeks in humans with Autism Spectrum Disorders (ASD) have found inconsistent benefits, despite strong data from animal models and single dose studies of intranasal oxytocin in autistic individuals. Heterogeneity in design, dosing, outcome measures and sample characteristics are thought to contribute to conflicting results.

Objectives:

The federally funded, multi-site, placebo-controlled, randomized trial of intranasal oxytocin in ASD to improve reciprocal social behaviors (SOARS-B) sought to address these inconsistencies in large (n~300) 24-week trial in individuals 3 – 17 years with ASD, regardless of level of cognitive functioning. Since SOARS-B failed to distinguish any difference in response between those treated with intranasal oxytocin and placebo, this presentation will discuss the options and suggested initial steps for future use of oxytocin in the treatment of ASD.

Methods:

The sample characteristics and results of the SOARS-B trial will be presented. Potential factors that may have contributed to the study's negative results will be discussed. Issues that will likely need to be resolved prior to further oxytocin trials will be explored.

Results:

The SOARS-B trial randomized 290 participants (146 treated with oxytocin, 144 treated with placebo), 277 had a baseline and at least one subsequent assessments of the primary outcome and 250 (125 in each group) completed the trial. Oxytocin was safe and well tolerated. However, there was no difference in Least-square-mean changes from baseline on either the primary or any of the secondary outcomes and the baseline plasma oxytocin level didn't influence response. The study used a novel formulation of intranasal oxytocin rather than Syntocinon, which was unavailable in needed quantities when the study was started. Dosing ranged from 8 IU/day to 80 IU/day with a target dose of 48 IU/day.

Conclusions:

Considerable information is lacking that is necessary to resolve inconsistencies between clinical trials of prolonged oxytocin treatment targeting social behaviors in ASD, including information regarding brain oxytocin receptor occupancy at various doses, extent and timeline of down regulation of oxytocin receptors with continued exposure to exogenous oxytocin, comparability in different formulations of intranasal oxytocin, interactions between behavioral interventions and administration of exogenous oxytocin and specific phenotypic or genetically defined groups of autistic individuals, whom may be particularly responsive. These issues are magnified by the use of rodent rather than primate animal models in many preliminary studies.

**Background:**

Balovaptan is a vasopressin 1a (V1a) receptor antagonist and was investigated to improve social communication difficulties autistic individuals. V1aduct was a phase 3, randomized, placebo-controlled, double-blind trial, conducted at 46 sites across six countries. This study aimed to assess the efficacy, safety, and pharmacokinetics of balovaptan versus placebo in autistic adults. The primary endpoint was change from baseline in Vineland-II 2DC score (the mean composite score across the Vineland-II socialization and communication domains) at week 24.

**Objectives:**

In addition to summarizing study results, I will highlight challenges relating to selection of outcome measures, impact of baseline characteristics, and role of expectation bias in influencing trial results. Insights gained can be used to inform and improve the design of future trials with the collective aim of developing efficacious therapies for autistic individuals.

**Methods:**

Eligible participants were aged 18 years or older with an intelligence quotient (IQ) of 70 or higher and met the criteria for moderate-to-severe autism spectrum disorder (DSM-5 and Autism Diagnostic Observation Schedule). Participants were randomly allocated (1:1) to receive balovaptan (10 mg) or placebo daily for 24 weeks. Randomization was stratified by an individual's baseline Vineland-II two-domain composite (2DC) score (<60 or ≥60), sex, region, and age (<25 years or ≥25 years). Participants, study site personnel, and the sponsor were masked to treatment assignment. The primary analysis was done with ANCOVA in the intention-to-treat population.

**Results:**

540 people were screened for eligibility, of whom 322 were allocated to receive balovaptan (164 [51%]) or placebo (158 [49%]). The V1aduct study was terminated for futility after around 50% of participants completed the week 24 visit; participants were discontinued. Sample consisted of 64 (20%) women and 257 (80%) men, with 260 (81%) participants from North America and 61 (19%) from Europe. At baseline, mean age was 27·6 years (SD 9·7), and mean IQ score was 104·8 (18·1). Mean baseline Vineland-II 2DC scores were 67·2 (SD 15·3) in the balovaptan group and 66·2 (17·7) in the placebo group. The interim futility analysis showed no improvement for balovaptan versus placebo in terms of Vineland-II 2DC score at week 24 compared with baseline, with a least-squares mean of 2·91 (SE 1·52) in the balovaptan group (n=79), and 4·75 (1·60) in the placebo group (n=71; estimated treatment difference -1·84 [95% CI -5·15 to 1·48]). In the final analysis, mean change from baseline in Vineland-II 2DC score at week 24 was 4·56 (SD 10·85) in the balovaptan group (n=111) and 6·83 (12·18) in the placebo group (n=99). Balovaptan was well tolerated. Similar proportions of participants had at least one adverse event in the balovaptan group (98 [60%] of 163) and placebo group (104 [66%] of 158). Serious adverse events were reported for two (1%) participants in the balovaptan group, and five (3%) participants in the placebo group.

**Conclusions:**

Balovaptan did not improve social communication in autistic adults. When summarizing all the randomized trials of balovaptan, placebo response was predicted by greater baseline symptom severity, online recruitment of participants, and less experienced or non-academic trial sites.



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