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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Rittle-Johnson, Bethany

What Counts as STEM, and Does it Matter?

Rebecca M. Adler, Mingkai Xu, & Bethany Rittle-Johnson

Introduction: To accurately measure students' science, technology, engineering, and mathematics (STEM) career interest, researchers must get inside the "black box" to understand students' conceptualizations of STEM careers. The aim of Study 1 was to explore whether students' conceptualizations of STEM included medical careers. The aim of Study 2 was to explore whether predictors of STEM career interest (e.g., motivation) varied by STEM definition (inclusion/exclusion of medical careers).

Methods: In Study 1, the sample was U.S. college students (N = 125) who were mostly White (80%). In Study 2, the sample was U.S. 10th grade high-school students (N = 455) who were mostly Black (79%). In Study 1, students completed an online questionnaire. In Study 2, students completed various measures of math achievement, motivation (science and math expectancies of success, interest, and utility value), and career interest with an experimenter.

Results: In Study 1, medical careers were less often classified as STEM careers than traditional STEM careers, but more often classified as STEM than non-STEM careers. In Study 2, science utility value was the only motivational predictor of students' STEM+Medicine career interest, and no motivation constructs predicted traditional STEM career interest. Boys expressed greater interest in traditional STEM careers, while girls expressed greater interest in STEM+Medicine careers.

Discussion: Students' conceptualizations of STEM are not binary. Researchers must be aware of this as they interpret data and tailor interventions, as gender differences and motivational predictors of STEM career interest vary by whether medical careers are included.

Keywords (if any): STEM career interest; math motivation; gender

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The State of Teachers of Students with Visual Impairments in Tennessee

Shannon M. Agnes, Rachel A. Schles

Introduction: The United States has always suffered from a lack of teachers of students with visual impairments (TVIs), a problem which still persists to this day (Mason, Davidson, & McNerney, 2000; Savaino et al., in press; Schles, 2021). Additionally, there has been increased focus recently on teacher burnout, especially for those in itinerant (serving children with visual impairments in many different schools) and in special education positions. This study determined the demographics of TVIs in Tennessee, their caseload size, the number of schools they served, their burnout levels, and their future plans.

Methods: Responding to a survey distributed to TVIs throughout Tennessee, 66 TVIs described their workload demographics, caseloads, experiences, and future plans. The Copenhagen Burnout Inventory (CBI; Kristensen et al., 2005) was used to determine their levels of work-related burnout. Descriptive statistics were run to get the range, minimum, maximum, mean, and standard deviation of each variable; we are currently examining ties of such variables to TVI work burnout.

Results: The TVIs in this sample were predominately White (82.1%) with an average of 13.6 years of experience. The majority of TVIs served 10 or less schools (68.9%), but nearly half of all TVIs had caseloads larger than the recommended 1 TVI to 8 children ratio suggested by the United States Department of Education (Mason et al., 2000). Surveyed TVIs were moderately burned out, with 56.7% of this sample's TVIs planning to or considering leaving the field within the next five years.

Discussion: TVI's constitute an important, specialized group of teachers who face enormous challenges. To ensure that Tennessee's students with visual impairments continue to be appropriately supported, schools must decrease large caseloads, a major concern for TVIs that causes the job to seem unmanageable and brings forth great amounts of stress (Meador et al., 2015; Correa-Torres & Howell, 2004). Such stress and burnout in teachers is associated with increased attrition rates, worsening teacher physical and psychological health, and negative impacts on student learning (Schaufeli & Greenglass, 2001; Brunsting et al., 2014; Robinson et al., 2019; Wong et al., 2017). More work needs to be done to keep TVIs in the field and continue sufficiently serving students with visual impairments in Tennessee.

Keywords (if any): Visual Impairments; TVI; Teachers

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Social Visual Engagement to Infant-Directed Song and Speech Across Development in Autism and Typical Development

Camila Alviar, Noah Fram, Manash Sahoo, Shivaang Chawla, Chris Nicholson, Mackenzie Hines-Wilson, Warren Jones, Laura Edwards, Miriam Lense

Introduction: Infant-directed (ID) song and speech both promote children's attention with ID song being particularly effective at sustaining infants' attention in typically developing (TD) infants and those with ASD (Macari et al., 2020; Trehub et al., 2016). However, specific patterns of social visual engagement across development and in relation to song characteristics are unknown. We examined TD and ASD children's social visual engagement to adults engaging them with ID song and speech across the infant and toddler period.

Methods: 82 TD and 48 ASD males viewed audiovisual clips of naturalistic ID speech without gestures, ID song without gestures, and ID song with gestures, while eye-tracking data was collected longitudinally at 6 time points: 6-months (nTD=57, nASD=34), 9-months (nTD=50, nASD=27), 12-months (nTD=60, nASD=30), 15-months (nTD=53, nASD=33), 18-months (nTD=49, nASD=32) and 24-months (nTD=64, nASD=36). We ran 2 mixed-effects models with random intercepts per subject predicting either total fixations or fixations to the mouth with a linear and a quadratic component of age, clip category, diagnosis, and all interactions.

Results: TD infants fixated significantly more than ASD infants overall ($B=0.06$, $p<.001$). However, both TD and ASD infants exhibited higher overall fixation rates for song over speech ($B=0.03$, $p<.001$), and for song with gesture over song without gesture ($B=0.03$, $p<.001$). Fixations increased with age overall during the first year across diagnostic groups, and continued to increase for speech during the second year for TD but not ASD infants ($B=5.12$, $p<.05$). Both TD and ASD infants' overall attention to the mouth increased with age ($B=3.53$, $p<.001$), and this increase was more pronounced for speech in TD infants ($B=7.75$, $p<.05$). Attention to the mouth was also significantly higher overall during song without gestures than during song with gestures ($B=-0.15$, $p<.001$) or during speech ($B=-0.11$, $p<.001$) across diagnostic groups. Lastly, children with ASD looked more at mouth during song with gestures than their TD peers ($B=0.04$, $p<.05$).

Discussion: Children engage differently with ID song and ID speech across development. ID song potentiates overall visual engagement over a longer developmental time window in ASD. Song also promotes mouth-looking for both TD and ASD, of interest given mouth-looking's association with expressive language skills (Habayeb et al., 2021). Future analyses will examine children's individual differences (e.g., language skills, musical preferences), and stimuli level characteristics (e.g., gestures, tempo) to inform mechanisms by which song impacts attentional allocation and potential clinical implications in early intervention for ASD.

Keywords (if any): eye-tracking; Autism Spectrum Disorder; infant-directed communication

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Predicting longitudinal psychiatric effects of the COVID-19 pandemic in a transdiagnostic sample of youth using task-based fMRI

Camille Archer, Annie Jeong, Simone P. Haller, Allison Jaffe, Anita Harrewijn, Reut Naim, Julia O. Linke, Joel Stoddard, & Melissa A. Brotman

Introduction: It is important to understand the neural effects of stress in youth, as the developing brain may be hypersensitive to stress, with lasting negative mental health consequences. In this study, we leverage existing pre-pandemic clinical and imaging data to model change in anxiety and mood in response to the COVID-19 pandemic in a transdiagnostic pediatric sample. Our aim was two-fold. First, to examine associations between stress and change in anxiety and mood symptoms pre- and mid-pandemic. Second, to investigate whether attention towards threat and associated whole brain activation patterns assessed pre-pandemic predict change in mood and anxiety and/or COVID-19-related worries during the pandemic.

Methods: A transdiagnostic sample of 81 youth enriched for psychopathology completed longitudinal clinical follow-ups during the pandemic including measures of anxiety, irritability, depression, and ADHD, as well as an assessment of COVID stress and COVID-related worries. Forty-six youth also completed a threat processing fMRI task pre-COVID. Clinical outcomes were assessed using child- and parent-report forms of well validated questionnaires. Pandemic-related stress was measured using the Coronavirus Impact Scale; the CRISIS COVID worries subscale was used to assess COVID-related worries. Within two years pre-pandemic, neurobiological correlates of threat-related attentional processes were assessed using a dot-probe task. Changes in clinical scores pre-mid pandemic were examined, as well as COVID stress and COVID worries as potential mediators of change in symptoms. Whole-brain models examined relationships between pre-pandemic activation to neutral and angry faces and mid-pandemic anxiety as well as pandemic-related worries. Parent- and child-report were examined in separate models. Results were thresholded at voxelwise $p=.005$, whole-brain cluster corrected to $p<0.05$ ($k=51$).

Results: Child-reported anxiety, depression, and parent-reported anxiety significantly increased during the pandemic (all $ps<.05$), while symptoms of irritability and ADHD remained stable. Change in parent-reported anxiety was partially mediated by COVID stress and worries (all $ps<.05$), while change in child reported anxiety and depression was partially mediated by COVID worries only (all $ps<.05$). Elevated activation to neutral faces in several clusters including the bilateral striatum, left insula, anterior cingulate cortex, right inferior and left middle frontal gyrus before the pandemic predicted increases in parent-reported anxiety during the pandemic (all $F(1.95,81.86)>14.44$, $p<.001$), but not change in child-rated anxiety or pandemic worries.

Discussion: The present work expands existing knowledge on the mediating role of psychological stress on symptoms of anxiety and depression in adolescence. It also provides preliminary evidence that enhanced brain activity in response to neutral (potentially also more ambiguous faces) renders youth more susceptible to the effects of psychological stress in terms of anxiety.

Keywords (if any): Internalizing; fMRI; COVID-19

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Measuring Early Interests in Science

Jihye Bae, Amy Booth

Introduction: Evidence suggests that interests in science emerge early and are associated with future engagement and achievement in STEM (Leibham et al., 2013). However, we know little about whether interests can be measured reliably prior to school entry when the roots of these interests might take hold. This study begins to address this problem by developing and evaluating two such measures: the Science Preference Test (SPT) and the Science Interest Interview (SII).

Methods: Twenty-two preschoolers between the ages of 3 and 5 were recruited at a local science museum, where SPT and SII were administered in a single-session. Two types of SPT were used and alternated between participants. The SPT forced-choice task consists of 12 trials, on each of which children select preferred illustrations between science, literacy, and math activities. The other SPT is a sorting task, where children sort the same illustrations into either the happy face basket for activities they like or the unhappy face basket for activities they do not like. SIII, derived from the Puppet Interview Scales of Competence in and Enjoyment of Science (Mantzicopoulos et al., 2008), consists of nine pairs of bipolar statements about enjoyment and confidence in science, in which experimenter shows a happy face to represent the positive end of the continuum and a sad face to represent the negative end. Children select the face they more agree with and then are prompted to select the degree to which they feel strongly about that statement.

Results: To assess the reliability of our measures, we asked whether they were 1) internally consistent and 2) related to each other. The SPT sorting task and SII both had acceptable Cronbach alphas at $\alpha = .80$ and $\alpha = .78$, respectively, suggesting good internal consistencies. The SPT forced-choice task, however, was short of the acceptable level at $\alpha = .56$. Perhaps not surprisingly given this low internal reliability, the SPT paired task and SII failed to significantly correlate with each other, $r(8) = -.39$, $p = .26$. On the other hand, SPT sorting task and SII had a moderately positive correlation, but was also insignificant, $r(10) = .35$), $p = .27$.

Discussion: Preliminary analyses suggest our measures are currently insufficient to reliably inform investigations into the origins and variability of early scientific interests. One speculation for these outcomes is that the SPT sorting task and SII are prone to positivity biases, while the SPT forced-choice task is not. Further work needs to be done to prevent positivity biases. The SPT forced-choice shall be revised to improve its internal consistency.

Keywords (if any): scientific interest; early childhood; assessment

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Antioxidant Response to Large Artery Stiffness in the Mouse Brain

Caroline E. Baggeroer, Angela Jefferson, Ph.D., Fiona Harrison, Ph.D.

Introduction: The brain, which uses 20% of the body's oxygen, is particularly vulnerable to changes in pulsatile velocity of blood flow. 1,3,4,5 Large arteries, like the carotid, require a greater balance of elastin to expand in response to high pressure waves of blood during heart contraction (systole). Without this expansion, smaller arterioles are exposed to high velocity pulse waves and periods of low blood flow during heart relaxation (diastole). Over time, elastin breaks down and is replaced by collagen, making large arteries less compliant. Arterial stiffening, elastin breakdown and replacement with collagen, and the resulting high pulse wave velocity (PWV) within arteries, typically occurs with age.8,9 It can, however, manifest more rapidly and even occur in children with greater cardiovascular risk factors like congenital heart disease, type 1 diabetes, obesity, metabolic syndrome, hypercholesterolemia, and physical inactivity.2 In animal models, increased carotid stiffness results in deficits in spatial learning as well as a reduction in cerebral blood flow and an increase in gliosis mediated by oxidative stress in the hippocampus.4,6,7 The goal of this study is to investigate the molecular pathways that underlie cerebral damage and behavioral changes in a mouse model of carotid stiffening. Specifically, how antioxidants produced through the nuclear factor erythroid 2-related factor 2 (Nrf2) pathway respond to oxidative stress changes following changes in blood flow.

Methods: 12-week-old, wild type mice underwent a carotid calcification surgery where the carotid artery was exposed to calcium chloride (or saline as a control) for 20 minutes. PWV was measured prior to the surgery and three times (bi-weekly) following surgery to confirm an increase. One week following surgery mice underwent behavioral testing including tests of learning and memory (contextual fear conditioning, Barnes maze, nest building) and spontaneous activity and anxiety related behaviors as controls (elevated zero maze test, locomotor activity). Three weeks following surgery mice were euthanized and the carotid artery and brain removed for molecular analysis. Collagen, calcium, and elastin levels in the carotid artery were determined using immunohistochemistry approaches. Genes related to the antioxidant response were analyzed using RT2 Profiler PCR Array in hippocampus and cortex.

Discussion: Arterial stiffness is widely accepted as a risk factor for cardiovascular disease in adults with demonstrated associations with cognitive decline .1,3,4,5 While less studied, children are also at risk for arterial stiffening caused by other cardiovascular risk factors which could be damaging to their developing brains.2 Elucidating a clear molecular link between increased arterial stiffening (and subsequent PWV of blood) and cognition will be essential in developing early intervention methods for children with greater cardiovascular risk factors.

Keywords (if any): arterial stiffening; oxidative stress; behavior

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Improving Follow Up for Children with Autism in a Resident Training Clinic

Laleh Bahrami, Cara Theoret, Holly Miller, Abhinaya Ganesh, Tori Foster, Jeffrey Hine

Introduction: Primary care providers (PCPs) are often expected to help families navigate next steps after an autism spectrum disorder (ASD) diagnosis. However, PCPs do not receive sufficient training in providing follow up care, parents report inadequate guidance related to next steps, and care coordination for ASD is often inconsistent and disjointed within primary care settings. To address this need, we designed an ASD pathway that included streamlined assessment from an embedded provider and routine PCP follow up following ASD diagnosis within a busy resident training clinic.

Methods: Our study population consisted of children aged 0-48 months receiving care in a large primary care clinic wherein all residents receive their continuity clinic training. Children at high risk of autism were referred to an embedded diagnostician. If diagnosed with ASD, these children were then automatically scheduled for follow up with their PCP. All providers were trained in the use of a novel clinic note template that integrated best practices, including genetic testing and co-occurring concerns. We tracked autism-specific follow up appointments within 60 days of diagnosis. Baseline data were extracted from the EHR for the 12 months prior to intervention. Intervention data were collected using statistical process control charts while the team tested changes using Plan-Do-Study-Act (PDSA) Cycles monthly. RedCap surveys were sent to providers to assess satisfaction and template usability.

Results: Wait time between referral and diagnosis was 43 days. Of the 71 patients receiving a diagnosis pre-intervention, a mean of 9.8% had ASD-specific follow-up. Following project launch in June 2021, 72 follow up appointments have been attended, which is 87.8% of patients with a new ASD diagnosis. Special cause variation was identified with data points above the upper control limits in 6 of the 8 months following project launch though we do not yet have evidence of a centerline shift. 78.5% of follow up visits have utilized the embedded template. RedCap surveys indicate high degree of satisfaction with the new system and high ratings of usability including that it allows providers to "better follow best-practice guidelines for general ASD care".

Discussion: Our results demonstrate a significant increase in follow up visits for children with recently diagnosed ASD, as well as high provider satisfaction with our embedded template. We hope to disseminate use of the template to assist providers in navigating the complexities of ASD, increasing consistent evidence-based management for children with ASD.

Keywords (if any): autism spectrum disorder; resident education; EHR based intervention

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Examining the agreement between caregivers and dependents on measures of chronic pain behavior and symptomatology in autism

D. Jonah Barrett, Zachary J. Williams, Tiffany Woynaroski

Introduction: Given an increased prevalence of comorbid medical conditions in autism, the question of how to measure an autistic dependent's symptoms is ever-present (Diaz-Roman et al., 2018; Hossain et al., 2020). While the agreement between caregivers and dependent reports in autism has been reported on across multiple domains, the informants' concordance on measures of chronic pain has seldom been studied. The current study provides a statistical analysis of the agreement between a well-characterized cohort of dependents with autism and their caregivers on measures of chronic pain symptomatology and pain behavior.

Methods: We computed interrater reliability statistics, including Cohen's kappa coefficients, polychoric correlations, and probability of agreement for each of the 619 caregiver-dependent dyads' responses on items of our study's two questionnaires.

Results: Fair to moderate agreement was observed for most of the items on the two questionnaires and mostly non-statistically significant discrepancies were found on items pertaining to various aspects of the dependent's chronic pain; however, larger statistically significant differences existed on items pertaining to the dependent's expression of pain behavior.

Discussion: Current limitations of the study and future research methods for understanding these discrepancies are outlined.

Keywords (if any): autism; interrater; reliability

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Comparing psychosis risk during COVID in Hispanic/Latino Americans, Non-Hispanic/Latino Americans, and Hispanic/Latinos living in Latin and Central American countries

Tatiana Baxter, Sunil Shenoy, Taylor Griffith, Hyeon-Seung Lee, Angelica Rivas-Baxter, Sohee Park

Introduction: Ethnic minority status is associated with societal disadvantages and is noted as a significant risk factor for the development of psychosis (Lincoln et al., 2022). Concurrently, the COVID pandemic has been associated with increased risk for psychosis across cultures but especially among ethnic minority groups, such as Hispanic/Latino Americans (HLA; Griffith et al., 2021). To further understand how minority status might be linked to psychosis risk, we compared the psychosis risk rate among a prominent ethnic minority group (HLA) with rates among two majority groups: non-Hispanic/Latino Americans (n-HLA) and Hispanic/Latinos living in Latin and Central American countries (HL). We predicted that HLA would have the greatest number of high-risk respondents compared to n-HLA and HL. Several cross-cultural studies of mental wellbeing during COVID have also identified universal markers associated with high psychosis risk: younger age, social isolation, and trauma (Lee et al., 2020; Dean et al., 2020; Tso and Park, 2020). Based off these findings, we predicted that these markers would be consistent among high-risk participants across HLA, n-HLA, and HL.

Methods: We assessed psychosis risk across HLA, n-HLA, and HL, and assessed characteristics of high- vs. low-risk individuals across cultures. 45 HL participants, 34 n-HLA respondents, and 30 HLA respondents completed an anonymous, online survey in English or Spanish. Respondents self-reported demographic information (including racial and/or ethnic background), physical health, and past trauma. The Depression, Anxiety, and Stress Scale (DASS); the UCLA Loneliness Scale, and the Prodromal Questionnaire-16 (PQ-16) assessed mental health. Social isolation was assessed by the Social Network Index (SNI).

Results: 30% of HLA participants met criteria as high-risk for psychosis on the PQ16. In HLA, high-risk individuals were younger, had less education, more depression, more days disabled, more days physically ill, and were lonelier than low-risk individuals. The HLA group had fewer male respondents than n-HLA and HL, but the groups matched on all other demographic variables. 8.8% of n-HLA respondents were noted as high-risk for psychosis. High-risk participants had worse general health, fewer social networks, more trauma, fewer days happy or hopeful, and were lonelier than low-risk respondents. 26.7% of HL participants were classified as high-risk for psychosis. High-risk participants were younger, had more trauma, fewer social networks, and fewer high-contact social roles than low-risk people. In sum, HLA had the greatest number of high-risk respondents, closely followed by HL. HL also had the most distress related to psychotic-like experiences. Multiple linear regression analysis showed group membership predicted the number of psychotic-like experiences and related distress, as well as trauma and number of high-contact social roles - two factors related to elevated psychosis risk.

Discussion: Our results support our primary hypothesis and echo previous findings there are disparities across groups in proportion of high-risk individuals based on ethnic minority status, with HLA having the most high-risk respondents. Results also support our secondary hypothesis that younger age, trauma, and social isolation are markers for high psychosis risk across groups. Of note, each group also demonstrated specific additional markers for high-risk status, which suggests additional risk factors may be culturally distinct. A thorough understanding of these distinctions and group-specific markers is crucial for culturally informed research, especially in Hispanic/Latino populations, which are historically underrepresented in psychological research.

Keywords (if any): Psychosis risk; Minority mental health; Hispanic/Latino

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Theme: Cellular & Molecular Neuroscience
P.I/Advisor: Harrison, Fiona

Ascorbate insufficiency alters neuronal transmission in a model of beta-amyloid aggregation

Rebecca A Buchanan, Yuhan Wang, Fiona E Harrison

Introduction: Beta-amyloid aggregation is a neuropathological marker shared between Alzheimer's disease and Down Syndrome. Many Alzheimer's disease patients and individuals with Down Syndrome also present with epilepsy and other neuronal transmission abnormalities which are detectable using electroencephalogram (EEG). In Alzheimer's disease, existence of EEG abnormalities is associated with poorer cognition and faster decline poorer cognition although this is less studied in younger individuals. Ascorbate, or vitamin C, is an important antioxidant obtained through diet. Ascorbate has a specific role in neuromodulation as it is released concomitantly with glutamate reuptake following excitatory neurotransmission. We hypothesize that ascorbate insufficiency alters neuronal transmission in the presence of beta-amyloid in young and aged mice which may contribute to cognitive change.

Methods: Using a mouse model of beta-amyloid aggregation (APPswe/PSEN1dE9) crossed with a mouse model that requires dietary ascorbate for survival (gulo-/-), EEG was recorded at baseline and during 4 weeks of ascorbate depletion. We determined changes in global neuronal firing patterns in young (5 months) and aged (20 months) gulo-/-APPswe/PSEN1dE9 and control (gulo-/-) mice. Data were scored for changes in spike wave discharges, sleep-wake rhythms, and brainwave power bands over 24hr periods each week. Amyloid levels were quantified by ELISA. Protein expression levels of glutamate clearance transporters, GLT-1 and GLAST, were quantified by western blot in a separate cohort of mice.

Results: We observed an early increase in neuronal spike discharges with age and also following ascorbate depletion. A reduction in EEG amplitude was also observed with decreasing ascorbate. Our findings are consistent with epileptiform activity and an increase in wakeful periods compared to slow-wave and paradoxical sleep which are observed in a subpopulation of Alzheimer's Disease patients. Amyloid levels were consistent with a genotype- and age-dependent increase. Expression of GLT1 and GLAST was decreased in gulo-/-APPswe/PSEN1dE9 mice with no further changes due to ascorbate level at 12 months.

Discussion: Our data suggest that maintaining optimal brain ascorbate levels may support normal epileptiform activity. This may be particularly important in cases in which increases in neuronal spike discharges are already observed. Observed changes could not be attributed solely to altered expression of key glutamate clearance proteins. Future studies are required to determine alternative mechanisms of effect and determine how such changes may relate to changes in multiple behavioral domains.

Keywords (if any): EEG; amyloid; vitamin c

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Theme: Systems Neuroscience
P.I/Advisor: Cutting, Laurie

Executive function-related neural activity and connectivity during word reading predict later reading ability

Andrea N. Burgess, Laurie E. Cutting

Introduction: Both behavioral and neurobiological studies have linked executive function (EF) skills to reading comprehension (RC) ability. More specifically, decoding and oral language abilities may mediate the behavioral relationship between EF and RC. However, less is known about how EF ability in childhood relates to neural activity during decoding or how that relationship may predict later RC ability. The current study investigates the neural correlates of word reading in a cohort of first-grade children, and how this functional architecture relates to concurrent EF and longitudinal reading ability.

Methods: We collected functional magnetic resonance imaging (fMRI) data from 52 typically developing first-graders (age M = 7.5 years). During the fMRI session, children completed a reading task where they viewed short, scrambled phrases (e.g., "field the other") to elicit neural activity related to word reading. Additionally, we assessed children's EF (i.e., working memory) during their first-grade visit and tracked their reading ability into third grade. Using task-based general linear modeling and functional connectivity analysis, we examined how neural activity and connectivity relationships were related to concurrent EF skills and longitudinal reading ability.

Results: A covariate analysis within the frontal cortex revealed that children with relatively less activity in the left IFG and right dlPFC during word reading had higher behavioral EF. These EF-related regions were functionally connected to the left ventral occipitotemporal region (vOT; i.e., the putative visual word form area), bilateral intraparietal sulci, and left visual areas. Interestingly, connectivity between the left IFG and the L vOT region explained 15% of the variance in children's third-grade reading ability.

Discussion: Overall, we observed that less activity in EF-related frontal brain regions is associated with higher behavioral EF ability and that connectivity between EF and visual word reading areas is predictive of later reading ability. These relationships may indicate that early in reading development, the strategic allocation of EF neural resources is critical for processing written words and, in turn, later reading ability. Future studies will investigate EF-related neural activity during coherent passage reading and analyze neural-behavioral relationships in later elementary school.

Keywords (if any): Reading; Executive function; fMRI

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Corbett, Blythe

ASD Diagnosis and Sex Effects on Memory for Faces and Eye Contact in Social Situations

Rachel Calvosa, Blythe A. Corbett, Rachael A. Muscatello

Introduction: Individuals with Autism Spectrum Disorder (ASD) commonly have impairment in memory for faces (Weigelt, 2013). Autistic individuals also struggle in making eye contact in both social and non-social situations (Hessels, 2018), and increased difficulty with eye contact in a social situation. In contrast, typically developing individuals tend to focus on eyes and eye contact (Uono, 2015) when examining faces to remember them and to examine emotion. Indicators of anxiety in a conversation include lack of eye contact (Ratto, 2011), especially for those with ASD. A lack of eye contact may also influence memory in autistic children (Falck-Ytter, 2014). However, females with ASD can and do sometimes "camouflage" symptoms of ASD, especially in social interactions (Corbett, 2021). As memory for faces is associated with social anxiety (Kikutani, 2017) and ASD (Snow, 2011), exploring the extent to which this pattern is observed in a friendly social interaction is warranted.

Methods: The proposed study examined the NEPSY memory for faces (MF; scaled scores) in Year 1of a four-year longitudinal study and eye contact (well-modulated percentage) derived from the Trier Social Stress Test - Friendly (TSST-F). Typically developing (TD) males, TD females, ASD males, and ASD females were examined to measure group differences in eye contact and MF using one-way ANOVAs. It was hypothesized that sex and diagnosis would interact in MF. Yet, there would be no interaction between sex and diagnosis in eye contact since it is predicted that Females would have greater eye contact than males. Overall, this would predict lower MF and higher eye contact as a compensatory measure in autistic females.

Results: There was a significant difference in MF between diagnostic groups ($p>0.001$), but no significant difference between sexes ($p=.875$). There was no interaction between diagnosis and sex in MF score ($p=.789$). However, females overall demonstrate significantly more eye contact ($p<0.001$) than males during the TSST-F. There was no significant interaction between diagnosis and sex in eye contact ($p=.278$).

Discussion: TD and ASD females demonstrate better eye contact than TD and ASD males, which would corroborate better social skills in females overall. However, there was no sex and diagnosis interaction in face memory. Although there was no significant interaction found between sex and diagnosis in either measure, the sample size of females with ASD was small (N=12). With a larger sample, interaction with MF and eye contact may emerge where ASD females demonstrate eye contact similar to TD females but reduced memory for faces (similar to ASD males). These results emphasize the need for further research about females with ASD with larger samples to examine plausible sex-based phenotypic differences.

Keywords (if any): Autism Spectrum Disorder; Sex differences; Social skills

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Exploring the Learning Trajectory of Children's Ordinality Knowledge

Roger Chen, Dr. Bethany Rittle-Johnson, Jake Kaufman, Sara Gregg, Kenzy Elmessiry

Introduction: Children's early number skills are shown to be strong predictors of later mathematical ability and life success (Watts et al. 2014; Rivera-Batiz 1992; Reyna et al. 2009). One skill of specific interest is understanding the order that numbers go in, or ordinality. While previous research has distinguished between a "shallow" understanding of ordinality (understanding that sequences with consecutive numbers are in order, e.g., 2 3 4) versus a "deeper" understanding (which extends to non-adjacent numbers, e.g., 2 4 6), one goal of this study is to further our understanding into the development of children's deeper numeral ordinality knowledge. A second goal is to examine the development of children's ordinality knowledge for spoken number words (ex. "three"), as this has not yet been considered by previous research. Finally, this study will explore various predictors of children's numeral ordinality knowledge.

Methods: Children (N=85) completed seven tasks assessing their number word magnitude and ordinality knowledge, as well as their numeral magnitude and ordinality knowledge.

Results: We expect to find that adjacent sequences will be easiest for children to understand, followed by "non-adjacent 2" sequences (ex. '1 3 5'), followed by "non-adjacent 3" sequences ('1 4 7'), and lastly, "uneven" sequences ('1 4 6'). We also expect that children will possess better number word ordinality knowledge than numeral ordinality knowledge, and that their number word ordinality knowledge will be predictive of their numeral ordinality knowledge.

Discussion: This study aims to shed light on the trajectory of children's ordinality knowledge and could help tailor methods to improve this knowledge during formal math instruction.

Keywords (if any): Ordinality

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Early Neurodevelopment and Cytoarchitecture is Altered in Tuberous Sclerosis

Mary-Bronwen L. Chalkley, Lindsey Guerin, Asa A. Brockman, Mustafa Sahin, Emily Hodges, Rebecca A. Ihrie & Kevin C. Ess

Introduction: Tuberous Sclerosis Complex (TSC) is a debilitating developmental disorder characterized by a variety of clinical manifestations. While benign tumors in the heart, lungs, kidney, and brain are all hallmarks of the disease, often the most severe symptoms of TSC are neurological, including seizures, autism, psychiatric disorders, and intellectual disabilities. TSC is caused by a heterozygous loss of function mutation in the TSC1 or TSC2 genes, which encode the hamartin/tuberin proteins respectively. Hamartin/tuberin function as a heterodimer that negatively regulates mechanistic Target of Rapamycin Complex 1 (mTORC1). While TSC neurological phenotypes are well-documented, it is not yet known how early in neural development TSC1/2-mutant cells diverge from the typical developmental trajectory, and whether such phenotypes are seen in the heterozygous-mutant populations comprising the majority of cells in patients. To examine early neurodevelopmental phenotypes, we utilized TSC patient-derived induced pluripotent stem cells (iPSCs) with a heterozygous microdeletion mutation in TSC2. Within the field, it is debated whether second hits are required. To model this state, CRISPR was used to create a similar deletion mutation in the other TSC2 allele, producing a homozygous mutant line. The heterozygous mutant was also corrected to wild type, creating a set of isogenic lines. This isogenic series was compared to another allelic series with TSC2 deleted. Using immunofluorescent microscopy, immunoblotting, and flow cytometry, we observed aberrant early neurodevelopment in both sets of TSC2 mutant iPSCs. Homozygous mutant neural progenitors exhibit altered behavior as in vitro differentiation proceeds, including changes in multicellular structures within the first 10 days with misexpression of key transcription factors associated with lineage commitment. Collectively, these data suggest that mutation or loss of TSC2 has early effects on proper neural development. Understanding precisely when development is disrupted in TSC1/2- mutant brain will be essential to tailoring treatment and determining whether prenatal treatment should be pursued.

Keywords (if any): Neurodevelopment; Tuberous Sclerosis; Cell fate

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Common and Distinct Mechanisms of Reading Skill and Anxiety Symptoms

Alisha B. Compton, Jiulin Dai, Claire M. Tate, Neelima Wagley, James R. Booth

Introduction: Reading disability and anxiety disorders are prevalent and often co-occur, yet we do not understand what are the common or distinct mechanisms. Previous research suggests that reading disability is related to lexical efficiency (Perfetti, 2007), anxiety disorders are related to valence reactivity (Bar-Haim, 2007), and both are related to working memory (Daneman & Carpenter, 1980; Moran, 2016). We wished to determine whether the relationships for lexical efficiency and valence reactivity were selective, and for working memory were general. To investigate this, we took an individual difference approach in typical children to examine the relation of reading skill and anxiety symptoms to lexical efficiency, valence reactivity and working memory.

Methods: 33 participants, 7-12 years old (M=10.2, SD=1.4), completed standardized measures of reading skill (WJ-ID) and anxiety symptoms (SCARED), as well as an experimental rhyming task. The rhyming task manipulated lexical efficiency (high- versus low-frequency words), valence reactivity (threat versus neutral images), and working memory (1- versus 2-back load). Data collection is ongoing.

Results: In correlations for each contrast of interest, we controlled for all other experimental conditions (i.e., lexical efficiency: 1-back neutral trials; valence reactivity: 1-back high-frequency trials; working memory: high-frequency neural trials). All analyses were controlled for age. To examine selectivity for reading skill, we calculated univariate correlation of reading skill to lexical efficiency ($r(30)=-0.21$, $p=0.24$), and then when this correlation was partialed for anxiety symptoms ($r(29)=-0.22$, $p=0.23$). To examine selectivity for anxiety symptoms, we calculated univariate correlation of anxiety symptoms to valence reactivity ($r(30)=--0.18$, $p=0.34$), and then when this correlation was partialed for reading skill ($r(29)=-0.23$, $p=0.22$). To examine whether working memory was a general mechanism, we calculated univariate correlation of reading skill to working memory ($r(30)=-0.03$, $p=0.88$), and then when this correlation was partialed for anxiety symptoms ($r(29)=-0.04$, $p=0.84$). We then calculated univariate correlation of anxiety symptoms to working memory ($r(30)=-0.05$, $p=0.78$), and then when this correlation was partialed for reading skill ($r(29)=-0.06$, $p=0.76$).

Discussion: We see trends for reading skill to be selectively associated with lexical efficiency and for anxiety symptoms to be selectively associated with valence reactivity, although the direction of the effect for anxiety was opposite from that generally reported in the literature (Bar-Haim, 2007). There was no evidence for working memory being a general mechanism to both reading skill and anxiety symptoms. However, other studies have found stronger effects for reaction time in n-back tasks (Ladouceur et al., 2005; Schweizer et al., 2019).

Keywords (if any): Reading; Anxiety; Working Memory

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In vivo cholinergic system integrity and cognition using [18F]-FEOBV PET in healthy postmenopausal women: a pilot study

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Introduction: Women are at a higher risk of developing Alzheimer's disease (AD), and a possible reason for this may be the effects of estrogen depletion and cholinergic system activity following menopause. The investigational radiotracer [18F]-fluoroethoxybenzovesamicol (FEOBV) can assess in vivo cholinergic integrity, as the tracer binds to the vesicular cholinergic transporter at the synapse. FEOBV has previously shown cholinergic system decline in AD patients. The present study is an investigation of cholinergic system integrity in a sample of cognitively normal postmenopausal women, aged 50-70 years that were part of a larger study examining cholinergic compensation following menopause. We predicted that higher FEOBV standardized uptake value ratios (SUVR) would be associated with larger basal forebrain cholinergic volumes, lower levels of amyloid SUVR, and better cognitive performance as measured by the RBANS.

Methods: Ten postmenopausal women (mean age: 57.3 ± 5.1 years) completed an FEOBV PET scan (6.5 mCi dose), MRI and cognitive assessments. The FEOBV PET images were co-registered to the participant's structural MRI data. FEOBV SUVR was normalized in reference to the supraventricular white matter to avoid partial volume effects from ventricular tissue. Preliminary analyses focused on associations between FEOBVSUVR and the key outcome variables.

Results: Preliminary analyses showed a positive relationship between FEOBV SUVR and the gray-matter volume of the cholinergic basal forebrain of both hemispheres (L: $r = 0.51$, R: $r = 0.65$). Two participants were amyloid positive, and their FEOBV SUVR values were lower compared to the amyloid negative participants. A positive relationship was also seen between FEOBV SUVR and the RBANS total score, with higher SUVR associated with better cognitive performance ($r = 0.43$).

Discussion: In a small sample of cognitively normal postmenopausal women, greater FEOBV uptake was positively associated with both basal forebrain volume and cognitive performance. The results of this pilot sample show the importance of cholinergic system integrity in cognitive performance following menopause, supporting the idea that cholinergic integrity may be linearly related to performance and amyloid aggregation. Deterioration of cholinergic integrity post-menopause may increase the risk of future cognitive decline and development of AD.

Keywords (if any): cholinergic system; menopause; positron emission tomography (PET)

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P.I/Advisor: Melanie Schuele

Complex Syntax Methods of Assessment: Relative Clauses

Ana Delgado, Melanie Schuele

Introduction: Complex syntax refers to utterances with one or more dependent clauses (e.g., I want a dinosaur toy because it looks fun). There is a hypothesized link between children's production of complex syntax and academic performance. However, some children have difficulty with producing complex syntax. Thus, it is important to have efficient and effective methods of complex syntax assessment. Effective and efficient methods of CS assessment will assist clinicians and researchers in identifying deficits in an important area of development. In this study, we focus on assessments of one type of complex syntax, relative clauses (clauses that modify a noun, e.g., the dog that runs in the house).

Methods: We compare two types of commonly used assessments in the research literature: sentence imitation tasks (where the child repeats a relative clause) and elicitation tasks (where the child spontaneously produces a relative clause in a structured task). We assess typically developing preschoolers (3-, 4-, and 5-year-olds) using one elicitation task and two sentence imitation tasks.

Results: There was a significant between-group difference for the 3- and 5-year-old groups on all tasks. The between-group comparisons for the 3- and 4-year-old groups and the 4- and 5-year-old groups did not reach statistical significance; however, most comparisons approached significance with medium to high effect sizes. For within-group comparisons there were no statistically significant differences between the straight imitation and toy elicitation tasks.

Discussion: At the outset of our study, we hypothesized that the nature of the toy elicitation relative task provided the most valid representation of children's relative clause production skills. However, the task requires two adults to administer and takes about 20 minutes to administer. We measured performance on the elicitation task in comparison to two imitation tasks, which require only one adult to administer and can be administered in less than 10 minutes. Given our findings, the straight imitation task, which appeared to yield similar results to the elicitation task, may provide an equally valid measure of relative clause production skills. Additionally, the straight imitation task may be able to capture growth over the years, given the age effects observed on this task.

Keywords (if any): complex syntax; relative clauses; language assessments

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Best Practices in Science Education for Students with Severe Disabilities

Keren E. Deneny, Alexandra Da Fonte

Introduction: The publication on A Nation at Risk in 1983, describes science education performance in the United States as mediocre, with a call for national reform suggesting that students in America were underperforming on a national and international level, and were unprepared to successfully enter a growing scientific and technological society. Additionally, No Child Left Behind furthered science education by emphasizing that all students regardless of disability be educated in science concepts. Although there has been a push for science education, there is limited research on best practices for educating students with severe disabilities on science concepts. As a result, the aim of this presentation is to outline key elements suggested in the literature and highlight best practices for the instruction of science as well as future research directions.

Methods: A literature search from 2000 to 2022 was conducted using common science and disability terms to identify literature on science education for students with disabilities. The inclusion criteria was that articles focused on students with severe disabilities, included content from one of the National Science Education Standards content areas, and detailed teaching practices used.

Results: A total of 27 studies were identified which included three literature reviews (Courtade et al., 2007; Knight et. al., 2020; Spooner et. al., 2011) that outlined the literature for the past 30 years. Using these three articles, and cited references, best practices in science education were summarized. Overall, results suggest limited research on science education for students with disabilities. Yet, important recommendations should acknowledge that students with severe disabilities are capable of learning science content, that task analyses, chained activities, and time delay to teach discrete skills are effective during science instruction. However, there is limited scope of science content taught to students with disabilities, and a significant portion of the literature in this area focused on personal safety skills. Many of the other areas of science, which promote wonder and curiosity about the natural world, have limited evidence on how to teach students with severe disabilities.

Discussion: There is a noteworthy gap in science education literature related to how to effectively instruct students with severe disabilities. These gaps are surrounding scope and sequence of science content, essential skills to be taught, educational best practices, and generalization for teaching a variety of students and content. Future research is needed that focuses on differentiating science content and skills based on student's skills. Although literature is needed in this area, evidence suggest that task analyses, chained activities, and time delay to teach discrete skills, are effective strategies to teach science concepts.

Keywords (if any): Severe Disabilities; Science Education; Best Practices

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Kaiser, Ann

Caregiver-focused Groups for Stress Reduction in Caregivers of Children with Disabilities: A Meta-analysis

Kelsey M. Dillehay, Ann P. Kaiser

Introduction: Caregivers of children with disabilities frequently report increased stress compared to caregivers of typically developing children. Studies of caregiver-focused group interventions (CFGI) addressing caregivers' psychosocial well-being indicate that these interventions may reduce stress. This meta-analysis evaluated the effect of CFGI on standardized measures of stress in caregivers of children with disabilities and addressed the following questions: (a) Does participation in CFGI reduce stress in caregivers of children with disabilities? (b) Does the type of CFGI moderate stress outcomes? (c) Do outcomes differ for caregivers of children with ASD versus caregivers of children with other developmental disabilities? (d) What is the overall quality of the evidence assessing the impact of caregiver-focused groups on stress reduction in caregivers of children with disabilities?

Methods: This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA; Moher et al., 2009; Page et al., 2020). Studies were included if: (a) a CFGI was implemented with caregivers of children ages 0-18 years with disabilities, mental health, and/or behavioral conditions; (b) an experimental or quasi-experimental group design was used; (c) a standardized self-report measure of caregiver stress was administered at pre and post-test; and (d) the CFGI took place in an in-person format. A random effects meta-analysis was conducted to determine the overall effectiveness of CFGI on caregiver stress. Using the R package, clubSandwich (Pustejovsky, 2019), robust variance estimation (RVE; Hedges et al., 2010; Tanner-Smith et al., 2016) was used to account for multiple measures of stress within studies.

Results: The systematic search identified 22 experimental group design studies of CFGI enrolling 1,491 caregivers of children with disabilities. Fourteen studies with a total of 19 unique effect sizes provided sufficient data to be included in the meta-analysis. There was an overall non-significant reduction in caregiver stress (g = -0.17, SE=0.177, 95% CI [-0.56, 0.21]). Moderator analyses indicated a significant small to moderate effect (g = -0.38, SE = 0.08, 95% CI [-0.65, -0.10]) for mindfulness groups compared to all other caregiver-focused group approaches. There were no significant differences in stress outcomes for caregivers of children with ASD (g = 0.08, SE = 0.30, CI [-0.69, 0.86]) and caregivers of children with other disabilities (g = -0.32, SE = 0.22, CI [-0.84, 0.21]). Studies exhibited a moderate to high risk of bias, however, study quality did not moderate stress outcomes.

Discussion: Across all studies, CFGI did not significantly reduce caregiver stress. Only mindfulness-based CFGI interventions significantly reduced self-reported stress in caregivers of children with disabilities, a finding consistent with previous reviews.

Keywords (if any): caregivers; group intervention; stress reduction

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Malow, Beth

All StakeholderS Engaged in Research Together: The ASSERT ECHO Program

Emma DiMartini, Kasey Fitzpatrick, Sally Furukawa, Dave Caudel, Tiffany Hines, David Isaacs, Nan Kennedy, Elise McMillan, Althea Shelton, Susan Brasher, Beth A. Malow

Introduction: People with intellectual and developmental disabilities (IDD) have varying degrees of difficulties in learning, problem solving, and social and life skills. As youth with IDD grow older and transition to adulthood, they have increased and unique healthcare needs. There is a great need for researchers to work alongside people with IDD, caregivers, and healthcare clinicians towards enhanced healthcare delivery and decision making to achieve desired patient-centered health outcomes. This project builds research capacity among people with IDD and stakeholders using a Project Extension for Community Healthcare Outcomes (Project ECHO) model. This Patient-Centered Outcomes Research/Comparative Effectiveness Research (PCOR/CER) learning community unites researchers, self-advocates, family advocates, clinicians, and other stakeholders in virtual sessions, thereby allowing these groups real-world practice in sharing their points of view, learning from each other, and building trust while learning PCOR/CER.

Objectives 1) Create a Regional Advisory Board that includes people with IDD and other stakeholders. 2) Harness the Project ECHO model to engage in co-learning on PCOR/CER among people with IDD and other stakeholders, along with researchers, to improve health outcomes in people with IDD. 3) Identify future engagement activities that meet the needs of people with IDD and stakeholders, building toward co-creating research proposals focused on PCOR/CER.

Methods: The ECHO Model: Project ECHO uses secure video conferencing to connect learners in local communities ("spokes") to a team of experts ("hub"), focused on the principle of "all teach, and all learn." Project ECHOs have traditionally focused on engaging and educating healthcare clinicians. We extended this ECHO model to include transition-age youth and young adults with IDD, caregivers, researchers, and healthcare clinicians, thereby allowing these groups real-world practice in sharing their perspectives, learning from each other, and building trust while learning PCOR/CER.

Activities: We are holding two rounds of ECHO training sessions on PCOR/CER related to transition to adulthood and adulthood, consisting of bi-monthly sessions, lasting 60-90 minutes each, and occurring over six months, to create an "all teach, all learn" community. To measure engagement, surveys are collected at the beginning of the project, after each ECHO session, and at the conclusion of the 6 months. Additionally, stakeholders from Georgia, Tennessee, and Missouri have been convening quarterly in a Regional Advisory Board to provide guidance to the project. The Project Lead, Dr. Beth Malow, represents Vanderbilt University Medical Center in Nashville, Tennessee. The Project Co-Lead, Dr. Susan Brasher, represents Emory University School of Nursing in Atlanta, Georgia. Collaborators include people with IDD and other stakeholders in multiple states.

Results: In the first round of ASSERT ECHO sessions, a total of 18 people with IDD and stakeholders have participated in ECHO sessions to share their ideas and build capacity in research, including self-advocates, family advocates, clinicians, and researchers. Geographical locations of participants include Tennessee, Missouri, Georgia, Ohio, Maryland, Pennsylvania, New York, California, and an overseas participant based in Vietnam.

To measure engagement and capacity building, survey and qualitative data were collected. Post-session quantitative surveys indicate that high percentages (80-100%) of stakeholders felt heard, valued, trusted, and that community is being built throughout the ECHO sessions. These surveys also included feedback on engagement. Comments on Engagement:

• "The group came to the discussion being our authentic selves. Everyone shared openly and honestly and as always, it was great to hear different perspectives."
• "Every session, participants seem more comfortable with sharing information and asking questions of each other."
• "The greatest benefit of this program is hearing multiple perspectives! It is exciting to see the "ah-ha" look come over many of our participant's faces when they hear a perspective they have never considered before. That demonstrates the level of respect that only a diverse community possesses."
• "It is so helpful to hear different perspectives and suggestions on how to improve community relationships."

Of note, the session 9 ECHO session topic was announced to include discussions about Applied Behavioral Analysis (ABA) therapy. One self-advocate shared with the team that she felt uncomfortable with the topic. The participant was given the options to skip the session, record a video of her concerns, leave a statement for someone else to read, or trust that she is not alone in her beliefs and that the group is respectful of her opinions regardless. At the end of the conversation, she was ensured that her voice would be valuable and important to the session. Because of an unrelated scheduling conflict, she was unable to attend but opted to record a video message that was shared with the group.

Discussion: This expanded ECHO model has successfully fostered multidirectional learning between individuals with IDD, stakeholders, and researchers. As we continue to engage stakeholders in identifying priority areas to improve health outcomes of transition age youth and adults with IDD, we hope this work will build capacity to position us to develop future CER/PCOR projects. This model will be repeated in another round of 6 month sessions beginning in January 2023. Please email assert@vumc.org for more information about how to become a part of this project.

Keywords (if any): PCORI; building trust; ECHO

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Theme: Cellular & Molecular Neuroscience
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Potentiation of the M1 muscarinic acetylcholine receptor modulates neurophysiological features in a mouse model of Rett syndrome

Hong-Wei Dong, Kelly Weiss, Kathryn Baugh,Jeffrey L. Neul, Colleen M. Niswender

Introduction: Rett syndrome (RTT) is a neurodevelopmental disorder (NDD) that is caused by loss-of-function mutations in the X chromosome-linked Methyl-CpG Binding Protein 2 (MECP2) gene. In addition to well-characterized clinical problems such as the loss of acquired spoken language, repetitive hand movements, gait problems, seizures, and breathing irregularities, alterations in neurophysiological features, including basal EEG power and event-related potentials, have also been identified in people with RTT and animal models of RTT. These neurophysiological abnormalities represent potential pharmacodynamic or treatment-responsive translatable biomarkers that could improve and accelerate preclinical and clinical therapy development in RTT. Recent results have shown that the muscarinic acetylcholine subtype 1 receptor (M1) is reduced in brain autopsy samples from people with RTT, and treatment of RTT mice with a compound that acts as a positive allosteric modulator (PAM) of M1 activity improves phenotypes, suggesting a novel therapeutic approach for the disease. In the current study, we investigated whether M1 PAM treatment could alter neurophysiological assessments in RTT animals to evaluate their potential to serve as biomarkers. The M1 PAM VU0486846 (VU846) was administered acutely via an intraperitoneal route at doses of 3, 10 and 30 mg/kg in heterozygous female RTT mice and auditory event related potentials (AEPs) were recorded via electroencephalography. Our results demonstrate that acute dosing of VU846 at 3 mg/kg in wildtype female mice did not have any effect on AEP waveform or peak amplitudes. However, acute injection of this same dose of VU846 improved the AEP waveform and increased AEP N1 and P2 peak amplitudes in heterozygous female RTT animals when compared to vehicle treatment. Interestingly, higher doses of VU846 (10 and 30 mg/kg) did not improve AEPs in mutant mice, and actually reduced P2 amplitude at 30 mg/kg, suggestive of an inverted U-shaped response. These findings suggest that potentiation of M1 can functionally improve neural circuit synchrony to auditory stimuli in RTT animals, but that the effect is limited to low doses. We anticipate that this acute response could represent a pharmacodynamic biomarker useful for dose finding and guiding future pre-clinical or clinical trials. Supported by Vanderbilt Kennedy Center Director's Priority Award (CMN & HWD) and P50HD10353 (JNL).

Keywords (if any): Rett Syndrome; Neurophysiology; acetylcholine receptor

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Understanding Cellular Mechanisms in Learning and Memory: Activity-dependent regulation of c-Fos eRNA transcription

Alexandra E. Duncan, Celeste B. Greer, Qian Yang, Roger J. Colbran

Introduction: Activity-dependent gene expression drives long-term changes in neuronal properties, as neuronal activation alters mRNA transcription and protein translation. Our project is focused on activity-dependent transcription of c-Fos, an immediate early gene important in neuronal mechanisms of learning and memory. By modeling c-Fos transcriptional activation we aim to better understand cellular mechanisms of learning and memory. Recent studies showed that activity-dependent expression of c-Fos is regulated by enhancer regions which are transcribed into enhancer RNA (eRNA). eRNAs are also regulated in an activity-dependent manner. Our project tests the hypothesis that activation of the CREB transcription factor via calcium signaling cascades modifies c-Fos eRNA transcription.

Methods: Experiments were performed in primary neuronal cultures from mouse cortex and rat cortex/hippocampus. A pharmacological inhibitor of CREB (CREBi 666-15) was used at 1 µM dose. Expression of c-Fos mRNA and eRNA was compared in control (DMSO-treated) and CREBi-treated cultures under basal, non-activated (-KCl) conditions and following depolarization to activate L-type calcium channels and activity-dependent transcription (+KCl). We used qPCR to quantify expression of c-Fos mRNA and eRNAs. We also performed immunohistochemistry to assess c-Fos protein expression.

Results: KCl increased c-Fos transcription in DMSO-treated mouse primary cortical neurons. In CREBi-treated cells, activity-dependent transcription of c-Fos mRNA, e2 and e5 expression was significantly reduced to baseline. These data indicate that CREB is necessary for activity-dependent transcription of Fos enhancer regions in mouse primary cortical neurons. Interestingly, a previous study showed that CREBi had no effect on eRNA transcription in cultured rat hippocampal neurons. We found inconsistent induction of mRNA expression with KCl rat hippocampal neurons. To test whether this inconsistency was due to presence of non-excitatory neurons, we used immunohistochemistry techniques to evaluate c-Fos protein expression and cellular composition in our rat hippocampal neuron cultures. Results demonstrated that tintensity of c-Fos protein staining in CAMKII+ excitatory neurons was increased by KCl, and expression was blocked by CREBi. But culture analysis showed that in our primary rat neuronal cultures at least 50% of cells were non-excitatory neurons. Thus, our mRNA and eRNA expression was diminished by cells not activated by KCl. To optimize cell culture conditions, we added AraC to reduce non-excitatory neuron contamination. New experiments with these conditions are ongoing.

Discussion: CREB's role in c-Fos eRNA transcription is more complex than previously suspected. Our data demonstrate that in mouse primary cortical neurons, eRNA transcription is CREB-mediated. Given the difference between our findings and previous results in rat primary hippocampal cells, we suspect species or cell-type specific regulation. Ongoing experiments with new optimized cultures will allow us to better understand the role of CREB in eRNA.

Keywords (if any): Transcription regulation; Learning and Memory; enhancer-RNA

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Audiovisual Speech Processing Efficiency and Links with Language in Autistic and Non-Autistic Children

Kacie Dunham, Jacob I. Feldman, David Simon, Sarah Edmunds, Alexander Tu, Wayne Kuang, Julie Conrad, Pooja Santapuram, Mark T. Wallace, Tiffany G. Woynaroski

Introduction: Explaining individual differences in language understanding and use in autistic children is a critical research topic because language has been repeatedly linked with long-term outcomes in this population. Theory and prior research suggest that audiovisual speech processing efficiency may explain variability in language understanding and use across children on the autism spectrum. Audiovisual speech processing efficiency can be operationalized as amplitude differences in the event-related potential (ERP) response to audiovisual speech versus auditory-only speech. Prior work indicates that in neurotypical adults, the ERP amplitude is suppressed, particularly at the P2 component, in response to audiovisual speech compared to auditory-only speech, likely reflecting a facilitation effect when presented with both auditory and visual speech cues. This phenomenon, known as P2 amplitude suppression, has been observed in non-autistic children, but has yet to be measured in autistic children. Furthermore, it is unknown whether this neural index explains individual differences in language in autistic children.

Methods: This project evaluated the theoretical association between P2 amplitude suppression and language in a sample of autistic and non-autistic children (n=25 per group) between 5.5 and 12.4 years old matched on chronological age and biological sex. Electroencephalography (EEG) was collected while children watched videos of audiovisual (auditory speech + synchronous mouth movements) and auditory-only (auditory speech + still image of the face) speech. The raw EEG signal was sampled at 1000 Hz and referenced to vertex (Cz). The amplitude of the P2 component (defined a priori as occurring between 160 ms and 240 ms) measured at Cz was extracted from the average ERP of each participant. Participants also completed standardized receptive and expressive vocabulary assessments. P2 amplitudes in response to auditory-only and audiovisual conditions were compared between groups, and a series of regression analyses was conducted to evaluate associations between amplitude suppression and receptive and expressive vocabulary standard scores.

Results: Both groups demonstrated P2 amplitude suppression, on average, in response to audiovisual speech compared to auditory-only speech, and between-group differences in mean amplitude suppression were not significant. However, the degree of amplitude suppression observed varied considerably across participants and was positively associated with receptive vocabulary scores, but not expressive vocabulary scores, across groups.

Discussion: These results suggest that this neural proxy of audiovisual speech processing efficiency may explain variance in language in autism and may serve as a candidate target for language intervention for autistic children.

Keywords (if any): autism; audiovisual speech; ERP

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Association between Brain Volume and Polygenic Risk for Externalizing Problems During Development

E. Leighton Durham, Gabrielle E. Reimann, Hee Jung Jeong, Peter B. Barr, Sarah J. Brislin, Danielle M. Dick, Tyler M. Moore, Brandon L. Pierce, Lin Tong, Randolph M. Dupont, Benjamin B. Lahey, and Antonia N. Kaczkurkin

Introduction: Externalizing problems refer to a broad dimension of impairing problems that can manifest across the lifespan and are related to oppositional behavior, conduct problems, inattention, hyperactivity, impulsivity, substance use, and antisocial behavior (1). Externalizing problems are associated with widespread negative consequences (2,3) and contribute to substantial burden of disease at a global level (4). They are also are highly prevalent during childhood and adolescence (4,5) and there are considerable rates of co-occurrence within different forms of externalizing problems (6-9). Additionally, externalizing problems are substantially heritable and have been found to have shared underlying mechanisms at genetic (1,8,10,11) and neurobiological (12-14) levels. However, there is a paucity of research investigating the interplay of the genetic risk and the neurobiological mechanisms of externalizing problems, particularly from a more broadly defined perspective (i.e., including multiple overlapping phenotypes) and in developmental samples.

Methods: In the current study, a novel and robust polygenic risk score for externalizing problems (extPRS) developed for adolescents and adults (15) was used to examine associations between externalizing genetic risk and regional gray matter volume (GMV) in a large sample (N = 4,063) of 9 to 10-year-old children from the Adolescent Brain Cognitive DevelopmentSM Study (ABCD Study®). The extPRS, consisting of 579 loci identified as being associated with a genetic liability for externalizing outcomes, was created using data from genome-wide association analyses and a pooled sample of approximately 1.5 million adolescents and adults (15). Brain volumes were acquired using 3T neuroimaging. Regression analyses were conducted to test the associations between 87 regional GMVs and the extPRS. All analyses controlled for age, sex, and MRI manufacturer. Sensitivity analyses including global measures of brain volume as additional covariates were also performed.

Results: Following correction for multiple comparisons, results revealed that higher externalizing polygenic risk scores were associated with smaller gray matter volumes in most cortical regions and in the cerebellar cortex. When total cortical and subcortical gray matter volume and total intracranial volume were controlled for in separate analyses, nearly all region-specific associations became non-significant.

Discussion: These findings suggest that a polygenic risk score based on externalizing behavior in adolescence and adulthood may be significantly associated with smaller global gray matter volume at 9 to 10 years of age before serious substance use and antisocial behaviors emerge. Additionally, the present study suggests that smaller brain volume may be a genetically influenced neurobiological vulnerability to externalizing traits, behaviors, and problems.

Keywords (if any): Externalizing; Neurostructure; Development

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Factors of Job Satisfaction for Autistic Adults

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Introduction: Improving employment outcomes are an important aspect of independent living and quality of life for young adults on the autism spectrum (Harmuth et al., 2018; Taylor et al., 2015). Attention has shifted beyond measuring whether these adults have a job to considering factors of workplace satisfaction (Hedley et al. 2017; Pfeiffer et al. 2018; Martin et al, 2022). Though under-researched, work environments may be important determinants of job satisfaction for these individuals (Hedley et al. 2017; Vogus & Taylor, 2018). The purpose of this study is to describe aspects of job satisfaction and examine which factors of the workplace climate are associated with job satisfaction for autistic adults.

Methods: Data were taken from the baseline of a longitudinal study examining employment and education stability. Data were collected via online survey from 55 autistic adults who were in paid employment. The mean age of participants was 27.06 years. Participants identified primarily as male (n=30, 55%). Participants were asked questions from the Job Descriptive Index (JDI), which measured job satisfaction in relation to supervision, coworkers, pay, promotional opportunities, and the work itself (Smith et al., 1969). Adults also filled out three measures about workplace environment: diversity climate, leader-member exchange, and psychological safety (Deci et al., 2001; Ilardi, Leone, Kasser, & Ryan, 1993; Kasser, Davey, & Ryan, 1992, Mor Barak, Cherin, & Berkman, 1998; Vogus, Cooil, Sitterding, & Everett, 2014). Job satisfaction was examined using descriptive statistics. The relation between aspects of workplace environment and job satisfaction were tested using Pearson's r correlations.

Results: Of the subscales in the JDI, participants were least satisfied with promotional opportunities (Mdn=2). Participants were most satisfied with the supervision they were receiving (Mdn=5) and their coworkers (Mdn=5). Correlations between workplace environment and job satisfaction were generally high ($r = .397 - .726$, $p < .01$) except for satisfaction with pay, which was not significantly correlated with any measures of workplace environment. Measures of workplace environment were most highly correlated with satisfaction with supervision ($r = .619 - .705$, $p < .01$).

Discussion: Although many aspects of job satisfaction seem to be related to workplace environment, satisfaction with supervision seems to be most strongly associated with all aspects of the workplace environment. Notably, satisfaction with pay was not associated with any aspects of workplace environment. A deeper understanding of which work environment aspects are most impactful on job satisfaction can demonstrate to employers how to best provide an accommodating environment to autistic adults. Further research in this area could aid in more specific interventions focused on the workplace environment that would best aid in satisfactory employment for autistic adults.

Keywords (if any): Autism; Employment; Job Descriptive Index

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Niemann Pick Type C links between synaptic dysfunction and neurodegeneration

Anna Eberwein, Kendal Broadie

Introduction: The lipid storage disease (LSD) Niemann Pick Type C (NPC) results in progressive childhood neurodegeneration owing to loss of the NPC1 (95%) or NPC2 (5%) genes. NPC accumulated lipids include cholesterol, sphingosine and glycosphingolipid (GSL), which are all targeted with therapeutic approaches. We propose two linked hypotheses; 1) GSL mistrafficking of mannosyl glucosylceramide (MacCer) causes synaptic defects, and 2) synaptic dysfunction underlies subsequent NPC neurodegeneration. We are testing these hypotheses using an established Drosophila NPC disease model, with experiments focused at the well-characterized glutamatergic neuromuscular junction (NMJ) model synapse. We have found that null npc1a mutants have increased synaptic transmission, which is phenocopied by brn mutants that cause MacCer accumulation. Importantly, double null mutants show no additional increase in synaptic transmission, indicating that npc1a and brn operate in the same functional pathway. To test whether synaptic dysfunction underlies NPC neurodegeneration, terminal deoxynucleotidyl transferase biotin-dUTP nick end labeling (TUNEL) is used to measure cell death. We have found that npc1a null brains have highly elevated TUNEL, and are currently testing this outcome in brn mutants and npc1a; brn double mutants. We also plan to assay neurodegeneration within the motor circuit, linking characterized synaptic deficits to the onset of neurodegeneration. This work supported by a VUSRP fellowship to A.E.

Keywords (if any): The lipid storage disease

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Inclusion Opportunities for Youth with Disabilities in the Catholic Church

Emily F. Elchos, Elizabeth E. Biggs

Introduction: Within church communities, there is a population of individuals with disabilities that often goes unnoticed and unsupported. Specifically, within the Catholic church, youth with intellectual and developmental disabilities (IDD) are often not welcomed into church activities and participation in the sacraments (Smalley, 2018). Without their full participation in the Catholic church, youth with IDD struggle to feel as if they truly belong in their faith community (Carter, 2020).

Methods: In order to write a literature review on the topic of youth with IDD in faith communities, I complied research related to the following: the meaning of inclusion, the extent of inclusion of youth with IDD both inside and outside of the Catholic church, inclusion practices in faith communities, Catholic teachings, and personal witnesses. I separated my research into four main topics: What Is Inclusion, Activities of the Church, Specific to the Catholic Church, and Inclusion of Youth with IDD in the Sacraments.

Results: What I found from reviewing the literature was that there is a need for inclusion practices or programs to be implemented in Catholic churches in the United States and in other countries as well. In an effort to find a way to bridge the gap between youth with IDD and faith communities, I become aware of some helpful inclusion models, practices, and strategies that could benefit a wide range of churches. I also discovered some Catholic teachings that could help frame one's mind in the correct manner before taking on the task of implementing inclusive practices in different areas of the Catholic church.

Discussion: The main purpose of the complied literature aimed to provide careful considerations of ways in which the Catholic church as a whole can become more inclusive to youth with IDD. Carter et al. (2016) discovered 10 important dimensions that contribute to one feeling like they belong in a community: present, noticed, welcomed, accepted, supported, cared for, known, befriended, needed, and loved. While these dimensions can be applied to any setting, they can especially be taken advantage of when attempting to adopt inclusive practices into a place where inclusion is rarely seen: the church.

Keywords (if any): Inclusion; Faith; Youth

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Biswas, Gautam

Creating a Physics and Computational Thinking Curriculum using a 3D Virtual Learning Environment

Carlos Espinoza, Caitlin Snyder, Bernard Yett, Gordon Stein, Gautam Biswas

Introduction: For the last decade, there has been increasing support for the integration of computational thinking (CT) into students' education to better prepare them for our increasingly computerized world. CT is a problem-solving method, used across a variety of fields, that deconstructs problems and frames solutions into a set of logical steps that humans or computers can follow. Additionally, previous studies suggest that conventional physics pedagogical techniques are ineffective at teaching students classical physics (CP).

Methods: The increase in use of technology and the ineffectiveness of conventional physics teaching prompted us to explore the affordance of a 3D virtual learning environment (3D-VLE) as a medium to teach high school students a CP curriculum and develop their CT skills. For this exploratory study, high school students will take part in a 4-week after school club where they complete physics problems on paper and later move to programming in the 3D-VLE. Prior to the start of the club and following the end of the club, the students will complete a comprehension test and a self-efficacy survey to assess their performance and perceived mastery of the CP concepts and CT skills.

Results: This work will provide initial results on the efficacy of our 3D-VLE based curriculum by presenting the development of the students' comprehension of the concepts while examining the roles of confidence and background knowledge.

Keywords (if any): 3D Virtual Learning Environment; Computational Thinking; Physics

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Theme: Systems Neuroscience
P.I/Advisor: Woynaroski, Tiffany

Resting State EEG Predicts Later Language in Infants Siblings of Children with and without Autism

Jacob I. Feldman, Kacie Dunham, Jennifer E. Markfeld, Bahar Keceli-Kaysili, Tiffany G. Woynaroski

Introduction: Recent work has investigated early neurological biomarkers in infants with and at increased likelihood for autism. One such factor is frontal alpha asymmetry, a metric of neural oscillatory power obtained during resting-state electroencephalography (EEG) that indexes an infants' neural lateralization when their brains are resting. At 6 months, typically developing infants demonstrate right relative frontal asymmetry, which gradually shifts to a left relative frontal asymmetry by 18 months. It has been found that infants with autistic siblings (Sibs-autism) experience significantly more variability in their frontal asymmetry, with many infants exhibiting left frontal asymmetry between 6 and 12 months and right frontal asymmetry at 18 months. Further, frontal alpha asymmetry has been found to explain variance in concurrent autism symptoms, such as patterns sensory responsiveness. Therefore, an endophenotype like alpha bandwidth asymmetry could be used as a stable biomarker for autism and potentially lead to earlier diagnoses for autism in infants. Thus, the purpose of this work was to evaluate whether resting state EEG variables, such as frontal alpha asymmetry, (a) differs in Sibs-autism versus infant siblings of non-autistic children (Sibs-NA) and (b) is associated with (i) concurrent language and (ii) later language.

Methods: Fifty infants have participated in the Sensory Project in Infant Siblings (Project SPIS; PI: Tiffany Woynaroski). At 12-18 months, infants completed resting state EEG; these samples have been cleaned and data extraction is in progress. At that time, infants' expressive and receptive communication was evaluated using the Mullen Scales of Early Learning (MSEL; Mullen, 1995), the Vineland Adaptive Behavior Scales (VABS; Sparrow et al., 2005), and the MacArthur-Bates Communicative Development Inventory: Words and Gestures (MCDI; Fenson et al., 2007). Nine months later (i.e., at 21- 27 months), communication was assessed using the MSEL, VABS, and the MCDI: Words and Sentences.

Results: Analyses are ongoing but will be completed before VKC Science Day. T-tests assessing group differences in EEG metrics between sibling groups (i.e., Sibs-Autism vs. Sibs-NA) and correlations between EEG metrics and communication metrics will be presented.

Discussion: If our hypothesis are borne out, our study will have important implications for using EEG to predict later communication and possibly even autism diagnosis in infants. Full implications will be discussed at VKC Science Day.

Keywords (if any): Autism; EEG; Language

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P.I/Advisor: Duff, Melissa and Romero, Daniel

Recordability of Vestibular Cerebellar Evoked Potentials (VsCEPs)

Jessica J. Feller, Daniel J. Romero, Richard A. Roberts, Gary P. Jacobson

Introduction: Vestibular cerebellar evoked potentials (VsCEPs) are short-latency, vestibular-dependent responses recorded from surface electrodes positioned over cerebellar regions of the scalp. VsCEPs have only recently been documented, and the recordability and origin of activity (myogenic vs. neurogenic) has been debated. The aims of this study were to: 1) determine optimal recording sites for the VsCEP, 2) compare reference electrode locations (earlobe vs tip of nose), and 3) determine whether the latencies and amplitudes of the VsCEP are consistent with previous reports.

Methods: VsCEPs were recorded from six young, healthy participants in response to air-conducted (AC) 500 Hz tone bursts presented at 125 dB pSPL. Scalp electrodes were positioned at the midline (Iz and CBz) and bilaterally 3 and 6 cm lateral to the midline. A ground electrode was placed on the forehead, and the reference electrode was placed either at the tip of the nose or at the earlobe contralateral to stimulation. Responses were considered present if both a positive and negative peak could be visually identified above the noise floor. For all present responses, p1 and n1 latencies and p1n1 amplitudes were determined.

Results: There was significant individual variability in VsCEP responses, with a response rate of 66% (4/6 subjects). VsCEP responses were consistently characterized by a positive deflection (around 11 ms) followed by a negative deflection (around 17 ms). Responses with the largest amplitudes occurred at electrode locations over midline and contralateral to the stimulated ear, particularly for electrodes located 3 and 6 cm lateral to CBz. However, 33% (2/6) of subjects had present responses across ipsilateral and contralateral channels. Response rate was similar for right and left ear stimulation, suggesting the VsCEP is a bilateral response. There were no significant effects of reference location.

Discussion: VsCEP response rate (66%), latency, and amplitude were consistent with previous reports (Govender et al., 2020). However, to our knowledge, our study is the first to report data supporting the VsCEP as a bilateral response (no significant ear differences). While responses with largest amplitudes have been previously reported for electrode locations contralateral to ear stimulation, our study suggested both midline and contralateral locations are feasible recording sites for VsCEPs. Clinical tests of central vestibular function are currently limited, thus understanding the origin and best recording method of VsCEPs takes us one step further to determining the role and clinical utility of this response in the standard vestibular test battery.

Keywords (if any): Electrophysiology; Cerebellum; Vestibular

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Govender, S., Todd, N. P., & Colebatch, J. G. (2020). Mapping the vestibular cerebellar evoked potential (VsCEP) following air-and bone-conducted vestibular stimulation. Experimental Brain Research, 238(3), 601-620.

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Peters, Sarika

Validity of a Clinician-Reported Outcome Measure in Rett Syndrome

Jada Finley, Sarika Peters, Cary Fu, Jeffery Neul

Introduction: Rett Syndrome (RTT) is a rare, X-linked neurodevelopmental disorder that affects 1 in 10,000 females. RTT is associated with loss of function of the MeCP2 gene and characterized by regression, loss of purposeful hand skills and replaced with stereotyped hand movements/hand-washing motions, limited speech, dyspraxia, impaired sleep, breathing disturbances, abnormal muscle tone, among others. Fortunately, clinical trials are underway to treat associated symptoms. Unfortunately, there remains a significant need for well validated Clinical Outcome Assessments (COA). The most commonly used COA is the Motor Behavior Assessment (MBA) scale. However, the MBA has not been compared to existing measures of psychological assessment in RTT (e.g. Vineland Adaptive Behavior Scales - VABS). The VABS is a widely used standardized parent interview that evaluates adaptive behavioral skills in four domains (Communication, Daily Living Skills, Social Skills, Motor Skills). The range of scores on standardized psychological measures is more limited because many people with RTT often have such marked impairments that they score at the "floor" of these instruments. So, the overall goal of this study is to determine the utility of the Vineland for use in Rett Syndrome as a clinical outcome measure.

Methods: 15 participants (ages 3-34 years) were enrolled meeting consensus criteria for RTT (typical or atypical) Participants received the MBA from a child neurologist whose evaluation was videotaped. They were also evaluated with the Vineland Adaptive Behavior Skills assessment (Clinician-guided interview) and Aberrant Behavior Checklist (Care-giver reported questionnaire).

Results: The results show that there is variation in skill set of girls who have Rett Syndrome with Receptive Lang showing the most variability. We also see strong Pearson Correlations between the R-MBA functional skills subscale and the Vineland Receptive (r = -0.69) and Expressive (r= -0.60) language scores. There is also a strong correlation (r = -0.67) between the R-MBA social skills and the Vineland Interpersonal subdomain.

Discussion: These results show us there is construct validity between the RMBA and the Vineland-lll in that the R-MBA measures what it was designed to measure. We found that low Vineland scores significantly correlated with greater severity on R-MBA. The results also show both convergent and divergent validity between the R-MBA and the Vineland-lll. Convergent validity is evident via strong correlation between VABS Interpersonal and R-MBA Social Skills. Divergent validity is seen between VABS Receptive Lang and R-MBA Functional skills. As evident through the raw scores, we see that there is less restriction in range than would be conveyed through standard scores. This is important when trying to see the benefits in a clinical trial. Overall, we learn that certain sections of the Vineland-3 depict future clinical utility in predicting clinical severity

Keywords (if any): Rett Syndrome; Clinical Outcome Measure; Vineland Adaptive Behavior Scales

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Loring, W & Malow, B

Clinical model of community-based sleep education intervention for children with IDD

Kasey Fitzpatrick, Whitney Loring, Beth Malow

Introduction: Sleep difficulties are common for children with intellectual and developmental disabilities (IDD). We previously found that implementing the principles of community-based sleep education intervention with children with IDD through a consultative caregiver training model improved key components of sleep and was a feasible model for both providers and caregivers (MacDonald, 2021).

Methods: Record reviews were conducted from a behavioral sleep clinic for children with IDD to evaluate for the reported effectiveness of the recommendations provided on improving sleep and to gather information regarding reported caregiver implementation of recommendations. A clinical psychologist trained in community-based sleep education and IDD met with 43 children, ages 1 to 18 years old with clinical diagnosis of an IDD, and at least one caregiver, to give individualized recommendations for their caregiver-reported sleep issues. These patients were referred to the psychologist by a developmental medical provider or a sleep medical provider after medical evaluation of these concerns. Concerns consisted of sleep onset latency, nighttime wakings, and/or co-sleeping. Patients and caregivers typically met 1 to 3 months after the initial visit to report their success at implementing recommendations and to share if there were any improvements at first follow-up or questions/concerns regarding the recommendations or sleep behavior. In some cases, additional follow-up visits were typically scheduled 1 to 6 months after and these were also reviewed. The notes from these visits were evaluated using qualitative measures and tools modified from Pediatric Sleep and Autism Clinical Global Impressions Scale (Pediatric CGI; Malow, 2016) to determine effectiveness and feasibility.

Results: Qualitative and quantitative measures adapted from Pediatric CGI were used by the record reviewer to evaluate notes. It was observed that 81% of caregivers reported complying with recommendations by the first follow-up and of those who complied, 72%reported improvements in their child's sleep and/or daytime behavior. Of those who did not comply by first follow-up, only 37.5% saw improvement. Of those who had second follow-up, 89% of caregivers reported improvement in their child's sleep and/or daytime behavior.

Discussion: Time-limited models of community-based sleep educational interventions within a clinical setting are reported by caregivers and clinicians to be an effective method at delivering sleep education to families and improving sleep for children with IDD. Compliance with recommendations was associated with a higher proportion of improvement in sleep and/or daytime behavior.

Keywords (if any): Community-based education; Sleep; Children with IDD

References:

MacDonald LL, Gray L, Loring W, Wyatt A, Bonnet K, Schlund D, Gaston ML, Malow BA. A community-based sleep educational intervention for children with autism spectrum disorder. Res Autism Spectr Disord. 2021 Mar;81:101719. doi: 10.1016/j.rasd.2020.101719. Epub 2021 Jan 11. PMID: 34394709; PMCID: PMC8356904.

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P.I/Advisor: Kaiser, Ann

Shared book reading with embedded language intervention vs. standard repeated reading: Outcomes for children with and without language delays

Natalie Formento, Kathryn M. Bailey, Yang Hu, Eon-Joo Jang, Ashlyn Lanier, Sophia Delmare, Ann Kaiser

Introduction: Supporting children's language development during early childhood is crucial, as language development critically influences several other developmental domains (Kaiser & Roberts, 2011). Children with autism spectrum disorder or language delays often require additional support of their social communication development (American Psychological Association, 2013). Enhanced Milieu Teaching (EMT) is an intervention that promotes language acquisition in children, including those with disabilities (Hampton & Kaiser, 2016) and blends well with book reading interventions. The Bundle of Learning is a book reading intervention designed to promote emergent literacy skills, language use, and play in children. It is possible that a blend of the Bundle of Learning and EMT may promote higher levels of language use and play in children than standard book reading; however, a direct comparison is still needed.

Methods: This study included a comparison of the Bundle of Learning + EMT to standard repeated book reading using an alternating treatments design (ATD). This multicomponent intervention included naturalistic strategies proven to promote language development and play. Eight children aged 26-38 months were enrolled. We conducted four small groups, with each group including a child with a language delay/ASD and a child with typical language abilities. The primary dependent variable was the number of different words (NDW) said by each child. Additionally, we evaluated differences in the frequency of children's play actions. We also evaluated whether the syntactic and semantic features of children's responses to a structured language sample changed from pre- to post-intervention, although this design included no experimental control for these variables. The extent to which children generalized play actions to other materials was also evaluated.

Results: Results for some groups are forthcoming, however preliminary results suggest that the Bundle of Learning + EMT intervention may be more effective than repeated reading alone for promoting children's NDW. Functional relations were identified between the implementation of Bundle of Learning + EMT and children's NDW for all children in two small groups. Functional relations were identified between the Bundle of Learning + EMT and play acts for one typically-developing child. No changes were observed on structured language samples or generalized measures of play.

Discussion: These results suggest that the Bundle of Learning + EMT may be more effective for promoting increased NDW compared to repeated reading alone when implemented in small groups of children with and without language delays/ASD. Further research is needed to evaluate teachers' implementation of this intervention within early childhood classroom settings. Additionally, future researchers should consider analyzing interactions between children participating in the Bundle of Learning + EMT intervention.

Keywords (if any): Reading; Language; Children

References:

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P.I/Advisor: Lense, Miriam

Children with and without autism use different predictive strategies when engaging with temporally unpredictable child-directed singing

Noah R. Fram, Camila Alviar, Youjia Wang, Shivaang Chawla, Laura Edwards, Warren Jones, Miriam Lense

Introduction: Autism spectrum disorder (ASD) has been associated with predictive coding (Sinha et al., 2014). Music's predictability may be a useful therapeutic scaffold for social interactions with children with autism (Lense & Camerata, 2020). We previously demonstrated that during infant-directed singing, typically developing (TD) toddlers use predictable rhythms to modulate eye gaze, increasing attention to a singer's eyes on metrically strong beats. Here we investigated how autistic and TD toddlers engage with musical stimuli of varying rhythmic (un)predictability.

Methods: Eye movements of toddlers 18-36 months old (n = 25 ASD; 34 TD) were tracked while watching videos of child-directed singing. Songs were presented in original, temporally predictable versions and experimentally-manipulated versions in which rhythms were jittered to disrupt predictability. We used peristimulus time histograms (PSTHs) to assess toddlers' rhythmically entrained eye gaze and inter-subject correlation (ISC) to assess the consistency of gaze location within autistic and TD populations.

Results: When viewing predictable singing, both autistic and TD toddlers showed increased eye-looking time-locked to the singing's rhythm. During jittered singing, time-locked eye gaze was reduced in both groups and was only significantly above chance levels in TD toddlers. To further investigate underlying processes, additional analyses examined time-locked eye-looking during rhythmically unpredictable stimuli based on two models of beat timing: a running average of inter-onset intervals, and a linear regression of onset times. These models represent increased sensitivity to variation in sensory inputs and increased reliance on a stable prior expectation, respectively. TD toddlers showed increased, diffuse eye-looking at times predicted by both models, while autistic toddlers showed increased, strongly phase-locked eye-looking around the linear regression only. While TD toddlers showed more consistent gaze location in unjittered songs, autistic toddlers became more consistent in jittered songs.

Discussion: Results suggest that while both TD and ASD toddlers attempt to predict temporal patterns of events, they may employ different cognitive processes. Toddlers with ASD may exhibit reduced flexibility or accommodation when processing temporally unpredictable input. In addition, they appear to seek structure in unpredictable stimuli in relatively consistent ways, particularly when compared to their TD peers. Rhythmic predictability may be an important avenue for supporting social behavior in toddlers with ASD, suggesting ways in which music and rhythm may be employed during natural social interactions to scaffold social behavior.

Keywords (if any): autism; rhythm; computational modeling

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Sinha, P, et al. (2014). Autism as a disorder of prediction. Proceedings of the National Academy of Sciences 111(42), 15220-15225. doi: 10.1073/pnas.1416797111. Lense MD, Camarata S. (2020). PRESS-Play: Musical engagement as a motivating platform for social interaction and social play in young children with ASD. Music and Science. doi: 10.1177/2059204320933080.

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P.I/Advisor: Kaczkurkin, Antonia

can i sleep? excessive negative thoughts explain the relationship between insomnia and anxiety in college undergraduates.

Ralph E. Francois, Randolph M. Dupont, Isabella F. Jackson, Zoe Chang, Antonia N. Kaczkurkin

Introduction: About 60% of college undergraduate students suffer from poor sleep quality (Jasson-Frojmark et al, 2008). Additionally, the American College Health Association found that over 60% of college undergraduates reported having overwhelming anxiety in 2018. Past research has shown that there is a high correlation between generalized anxiety disorder (GAD) and insomnia. There is likely a bidirectional relationship between the two disorders. With such findings, it is becoming increasingly clear that college students lack sleep and mental well-being. One probable cause for this cycle is rumination, a pervasive and repetitive thought process focused on past failure or the cause of current distress. However, little is known about the link between rumination, GAD, and insomnia symptoms. Thus, the objectives of this study were to examine the relationship between GAD and insomnia with rumination as a mediating factor.

Methods: Data were pre-collected by surveying 904 individuals from a predominantly undergraduate population using an online questionnaire. In this questionnaire, they were three psychological methods used in this study. The GAD-7 inventory was used to measure how the severity of the generalized anxiety. The Insomnia Severity Index assessed the severity of night and daytime components of insomnia. Lastly, the Persuasive Thinking Questionnaire assessed rumination by measuring repetitive negative thoughts. Data was analyzed in R Studio. Correlations were performed between the GAD and insomnia and rumination measures. Next, using multiple regression, we tested whether rumination mediated the relationship between insomnia and GAD. This procedure involves computing unstandardized indirect effects for each of 10,000 bootstrapped samples and calculating the 95% confidence interval (Shrout & Bolger, 2002).

Results: Analyses showed a positive relationship between GAD symptoms and insomnia symptoms (p-values < .001). There was also a positive relationship between GAD symptoms and rumination (p-values < .001). Additionally, rumination was found to significantly mediate the relationship between insomnia and GAD (95% CI [.11, .22]). In other words, lack of sleep causes rumination which leads to more GAD symptoms. There also seems to be evidence that those who have GAD symptoms experience rumination which may lead to trouble sleeping at night.

Discussion: These findings suggest that rumination can cause a perpetuating cycle of extreme anxiety and sleep loss in college undergraduates. This can provide insight into why college students are continuously anxious and sleep-deprived throughout their secondary schooling into post-baccalaureate life. Additional research in this area might also uncover other mediators that drive this bidirectional relationship and negative behaviors that these symptoms may elicit such as depression or perfection.

Keywords (if any): generalized anxiety disorder; insomnia; rumination

References:
Jasson-Frojmark et al 2008, American College Health Association, 2018, , Shrout & Bolger, 2002

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Malow, Beth

Stakeholder Input on Opportunities and Challenges Related to Inclusion in Research

Sally Furukawa, Kasey Fitzpatrick, Amanda Wyatt, Elizabeth Turner, Courtney Taylor, Elise McMillan, Jeff Neul, Beth Malow

Introduction: 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.

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.

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 note-takers 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

Discussion: 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.

As a result of this event, we have revised our strategy to include regularly engaging stakeholders in the creation of tools, strategies, and objectives as well as advocating for and supporting inclusion of IDD populations into ongoing research studies.

Since the event, we have created toolkits for clinicians and caregivers to address the needs for needle sticks, in light of the COVID vaccine. We were able to create the Autism Research Registry to continue to inform individuals about research opportunities.

Keywords (if any): Engagement; Toolkit development; Stakeholders

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Theme: Cellular & Molecular Neuroscience
P.I/Advisor: Carter, Bruce

Increased expression of Charcot-Marie-Tooth associated protein PMP22 in Schwann cells causes mitochondrial dysfunction and integrated stress response

Pramod S. Gowda and Bruce D. Carter

Introduction: Charcot-Marie-Tooth disease (CMT) is the most common inherited peripheral neuropathy, affecting 1 in 2500 people in the United States. The subtype CMT1A, accounting for roughly 50% of all CMT cases, is caused by duplication of the gene for Peripheral Myelin Protein 22 (PMP22), which is expressed mainly by myelinating Schwann cells (SCs) in the peripheral nervous system. Normally, only ~20% of nascent PMP22 is correctly folded and trafficked to the SC membrane, while the remainder is degraded by the proteasome. Excess PMP22, such as occurs in CMT1A, results in the accumulation of misfolded protein and is thought to be responsible for the CMT1A pathology. However, how over production of PMP22 leads to the dysmyelinating pathology is not known.

Methods: Here, we demonstrate that excess PMP22 in SCs results in inhibition of the standard 26S, but not the immune- proteasome, based on substrate-specific activity assays. Moreover, Seahorse metabolic flux analysis revealed mitochondrial dysfunction in PMP22 over expressing cells. The disruption of protein degradation and mitochondrial function correlated with activation of the integrated stress response (ISR), in which eIF2α phosphorylation was increased to attenuate global translation to reduce the misfolded protein overload in the cells.

Results: Together, our results demonstrate that excessive PMP22 in SCs causes proteasome inhibition and mitochondrial dysfunction, which increases eIF2α phosphorylation causing global translational repression. Such broad suppression of protein translation in SCs will affect the synthesis of key myelin-related proteins and likely contributes to the pathological dysmyelination in the disease.

Discussion: Facilitating proper PMP22 folding and/or degradation or modulating eIF2α phosphorylation might increase myelin-related protein translation and improve myelination in the context of CMT1A.

Keywords (if any): CMT1A; PMP22; Integrated stress response

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Hodapp, Robert

Preparing Special Educators and School Principals in Special Education Law: An Undervalued Area of Professional Training?

Alysia F. Green, Ellen G. Casale, Samantha E. Goldman, Meghan M. Burke, Robert M. Hodapp

Introduction: Throughout our nation's schools, special educators and school principals are responsible for developing and implementing IDEA-compliant day-to-day special education services and supports. Given the need for both special educators and school principals to be trained in special education law, we examined professional standards and textbooks to assess the amount and salience (within both professions) accorded to pre-professional training in special education law.

Methods: For special education teachers, we examined two sets of preparation standards from the main professional organization, the CEC, as well as five main textbooks. For school principals, we examined the NELP Program Recognition Building Level Standards (NPBEA, 2018), as well as six main principal preparation texts. But as many principal-preparation programs listed (required or optional) courses in educational law, we also examined the content of four educational law textbooks for pre-service school principals. Using a list of 31 significant legal concepts within IDEA (2004), we examined the presence or absence of discussions of each term. To be considered present, the term must have referred to special education and only had to be mentioned on a single page or once within a professional standard. If a term was included in a textbook, the coder then listed all page numbers in which the term was present.

Results: Standards and common textbooks for special educators (vs. for school principals) provided more information regarding special education law. The CEC Initial Preparation Standards addressed 32% of IDEA legal concepts and the Advanced Preparation Standards 30%. In contrast, within the NELP standards, only 6.25% of legal concepts were mentioned. Similarly, across texts, special education textbooks referenced 71% to 77% of the special education law concepts; school principal texts 3% to 16% of all concepts. In contrast, significantly more information regarding special education law was provided in school principals' law textbooks.

Discussion: Compared to school principals, special educators are generally exposed to greater amounts of special education law. Still, in both professions, a disconnect persists between concepts presented by leading texts and the listing of those concepts in professional standards. For both groups, certain concepts are covered and other (also important) concepts are ignored. Finally, the special education legal training for school principals relies on extra courses (which are only provided in some-not all-principal preparation programs). Ultimately, every school principal and special educator needs to be well-versed in special education law; in both professions, training programs and professional standards need to address this critical need.

Keywords (if any): School Principals; Special Education Training; Special Education Legal Knowledge

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Key, Alexandra

Biological Sex and Socioeconomic Status Influences on Behavioral and Neural Markers of Speech Processing in Preschool Children in Brazil

Kylie Hilsen, Sarah Powell, Linda J. Hood, Alexandra P. Key

Introduction: Early language development in childhood may be affected by biological and environmental factors. This study aimed to characterize the contributions of biological sex and family socioeconomic status (SES) to the neural processing of speech as well as to communicative and cognitive abilities of normal-hearing children aged 4-7 years (N=39).

Methods: Cortical auditory event-related potentials (CAEPs) were recorded while passively listening to naturally spoken consonant-vowel syllables. Standardized behavioral assessments evaluated verbal and nonverbal skills.

Results: Data analysis revealed no consistent effects of biological sex on behavioral or neural measures. Lower SES was associated with reduced receptive language skills as well as shorter P1(100-250ms) latencies ($p = .027$) and larger N2(250-400ms) amplitudes ($p = .033$) in response to speech onset. A review of brain-behavior correlations indicated that longer P1 latencies were observed in children with better performance on behavioral measures of language and communication abilities. Larger N2 amplitude differences for the /ga/ vs. /ba/ contrast were also related to higher behavioral scores.

Discussion: These findings suggest that environmental factors such as SES may have a greater influence than biological sex on behavioral and neural measures of language development during early childhood. Lower SES was associated with less adaptive (faster P1) and more effortful (larger N2) processing of speech sounds. Future studies with larger samples will need to replicate these findings and examine possible long-term effects of altered neural responses on later language development.

Keywords (if any): Biological Sex and SES comparison

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P.I/Advisor: Cutting, Laurie

Using A Semi-Automated Approach to Quantify Unidentified Bright Objects in Neurofibromatosis Type 1 and Linkages to Social & Behavioral Outcomes

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Introduction: Neurofibromatosis type 1 (NF1) is an autosomal dominant neurocutaneous syndrome frequently associated with widespread symptoms including social/behavioral outcomes such as anxiety, depression, ADHD, and ASD (Vogel et al., 2017). In addition to exhibiting NIH-defined criteria required for an NF1 diagnosis, approximately 70% of children with NF1 also present with Unidentified Bright Objects (UBOs) (Sabol et al., 2011). UBOs are hyperintense bright spots seen on T2-weighted magnetic resonance images but most prominent on Fluid-Attenuated Inversion Recovery (FLAIR) magnetic resonance images. Thought to be intramyelinic edema, the manifestations of these UBOs are uncertain. Studies investigating the potential relationship between UBOs and cognitive/academic outcomes have provided mixed results, but to the authors' knowledge, no research has been conducted that investigates potential relations between UBOs and social/behavioral outcomes.

Methods: We explored potential relationships between total and regional UBO volume, defined as the sum of all voxels representing all of the UBOs for each participant or each brain region of each participant respectively, and social/behavioral outcomes in two samples of 30 children and adolescents with NF1 (M=12.80 years; SD=3.32 years; 13 female). A novel tool, the Lesion Segmentation Tool (LST), was applied to images for automatic detection and segmentation of UBOs. We then used MRIcroGL to measure UBO volumes. Social and behavioral outcomes were measured using parent rating scales. Regression analyses were conducted in R.

Results: The LST was able to detect UBOs in images of children and adolescents with NF1. Furthermore, we found that while controlling for age, biological sex, study, and scanner, total UBO volume was significantly related to symptoms of anxiety and depression, but not symptoms of ADHD or ASD. We then parsed UBO volume by brain region to see which regional volumes drove these whole brain relationships; UBO volume was concentrated in the subcortical regions and cerebellum. We found that the significant relationship between total UBO volume and symptoms of anxiety and depression was driven by regional UBO volume in the subcortical structures, cerebellum, frontal lobe, and temporal lobe. Additionally, while the overall relationship between total UBO volume and attention skills was not significant, relationships between the regional volumes of UBOs in the cerebellum, frontal lobe, and temporal lobe and attention skills were significant. No underlying relationships between total or regional UBO volumes and ASD symptoms were significant.

Discussion: The LST appears to be a viable tool for automatically detecting and segmenting UBOs. These findings contribute to the emerging NF1 literature, helping parse the specific deficits that children and adolescents with NF1 have, to then help improve the identification and characterization of NF1 in children and adolescents.

Keywords (if any): Neurofibromatosis Type 1; Unidentified Bright Objects; Behavior

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Theme: Clinical, Behavioral, Educational, & Intervention Research
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Examining the Certainty in Provider Diagnostic Impressions and Level of Confidence while utilizing an Autism e-Screener for Early Identification of Autism Spectrum Disorder in Children Aged 18-36 Months

Makayla G. Honaker, Amy Swanson, Nilanjan Sarkar, Amy S. Weitlauf, Zachary E. Warren, Joshua Wade

Introduction: Early identification of autism spectrum disorder (ASD) in children < 36 months old has been an ongoing challenge. Because early identification of ASD speeds access to support, it is crucial to give community providers efficient and easily accessible diagnostic tools. To meet this need, we developed a novel application ("Paisley") that supports community providers in identifying signs of ASD in toddlers. As such, the objective of this study was to assess whether Paisley helps community providers accurately identify signs of ASD relative to expert psychologists and to assess levels of confidence and comfortability to inform future system modifications.

Methods: Paisley is a tablet-based app that uses video, audio, and text instructions to guide providers through nine play-based activities. Providers (n = 65) completed the Paisley tutorial immediately before meeting a child and completing activities based upon the app guidance, using available materials. Immediately following Paisley administration, providers completed a structured risk assessment embedded in the app. This risk assessment asked them to rate the presence of certain ASD symptoms and their overall diagnostic impressions (ASD Yes/No/Unclear). They also provided post-ratings about how certain they were in their diagnostic impression (1-5, 5 being most certain) and how confident they felt administering the app (1-5, with 5 being most confident). Each provider could administer Paisley to up to 5 children, with 171 children being included in analyses, all of whom received comprehensive psychological evaluations with blinded examiners after Paisley activities concluded.

Results: We compared diagnostic impressions from Paisley to the full blinded evaluation. Overall, 84.21% of Paisley-based provider impressions matched the diagnosis issued by blinded psychological examiners. Regarding cases where there was disagreement, most instances related to false negatives. Specifically, 6 Paisley session providers reported a child as having ASD when the psychologist did not; 21 Paisley providers gave a non-ASD impression, when the final diagnosis given was ASD. When rating how certain they were in their Paisley-facilitated diagnostic impressions, providers rated themselves very certain (5) in 50 sessions (29.24% of total sessions). Providers felt more confident in their administration of tasks, with maximum ratings of 5 (most confident) in 72 sessions (42.11%).

Discussion: Providers that used Paisley were able to walk through instructions and a brief administration of activities, then provide a rating of ASD risk that agreed with most gold standard psychological assessment results. Using Paisley helped many providers feel confident in administering tasks, but ratings of diagnostic certainty were lower. This reflects the importance of using Paisley as part of a structured provider training program rather than in isolation to address any gaps in knowledge or confidence regarding ASD and its care. Findings support the use of app-guided technologies to enhance community provider ability to identify children with ASD that would benefit from further assessment and evaluation.

Keywords (if any): ASD; Paisley; Toddler

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Individualized non-invasive brain stimulation enhances information recall in adult readers

Min Kyung Hong, Katherine S. Aboud

Introduction: Non-invasive brain stimulation (NIBS) approaches show promising gains in the treatment of dyslexia and the enhancement of single word reading. However, the impact of non-invasive brain stimulation on more complex processes like reading comprehension (RC) is still unclear. RC requires rapid and complex communication across brain areas, and these brain patterns vary across individuals. However, current NIBS approaches across cognitive domains almost exclusively use a "one-size-fits-all" approach, in which each subject is stimulated in the same brain region.

Methods: In the current study, we present a proof-of-concept for the use of high-resolution brain imaging to generate individualized targets for NIBS-based RC enhancement. We examined three individuals who were previously non-responsive to a one-size-fits-all NIBS approach. We used a fused MRI/EEG analysis to identify high-resolution brain profiles of RC for each individual while they read informational texts. We then used these brain patterns of RC to generate two individualized brain targets for a NIBS intervention. In this intervention, subjects received two back-to-back sessions of low-intensity (2 mA) NIBS, specifically, transcranial alternating current stimulation in the theta range. During stimulation, subjects read the same five passages on medical treatments for both sessions. RC growth was operationalized as the increase in fact retention from the first to second session.

Results: We found that in 2 out of 3 subjects, individualized non-invasive brain stimulation significantly enhanced recall of medical facts compared to both one-size-fits-all stimulation and sham. Subjects had a learning growth of 8% more facts from session 1 to session 2 compared to the sham. One subject was not responsive to individualized or one-size-fits-all stimulation.

Discussion: This pilot study lays out a framework in which to implement individualized NIBS in the enhancement of RC, and provides early evidence that individualized non-invasive brain stimulation may succeed beyond one-size-fits-all NIBs approaches.

Keywords (if any): non-invasive brain stimulation; reading comprehension; fused analysis

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Jedi-1/PEAR1-mediated efferocytosis by microglia regulates neurogenesis in the postnatal ventricular-subventricular zone.

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Introduction: In the postnatal brain, neural stem cells in neurogenic niches, such as the ventricular-subventricular zone (V-SVZ), generate more neural precursor cells (NPCs) than will mature. Excess cells will undergo apoptosis and be cleared through a process termed efferocytosis, which is carried out by microglia in the CNS. Disruption of efferocytosis has been associated with an increase in pro-inflammatory microglia and suppression of neurogenesis. A candidate efferocytic receptor, Jedi-1/PEAR1, was discovered in the peripheral nervous system, where satellite glia in the dorsal root ganglion express Jedi-1 to clear apoptotic sensory neurons during development. We hypothesized that Jedi-1 expression in microglia serves a similar function in the V-SVZ and that by facilitating efferocytosis, Jedi-1 regulates microglial phenotype and cytokine production to maintain neurogenesis.

Results: We found Jedi-1 expressed in microglial cells in the V-SVZ at postnatal day 7 (P7), during peak V-SVZ proliferation and apoptosis. To test whether loss of Jedi-1 hinders microglial phagocytosis, we employed an in vitro engulfment assay using microglia from wildtype (WT) and Jedi-1 null (JKO) mice and found a significant reduction in engulfment ability of JKO microglia. This finding was recapitulated in vivo by analyzing apoptotic cell engulfment by microglia in V-SVZ through 3D image reconstruction, where there was an accumulation of apoptotic cells as shown by TUNEL assay. The deficiency in efferocytosis by JKO microglia was accompanied by a dramatic shift in their phenotype. Specifically, microglia in the V-SVZ of JKO mice had characteristics associated with inflammation: increased proliferation, ameboid morphology, and elevated levels of the proinflammatory cytokine interleukin-1β. Finally, JKO mice also showed a reduction in the number of proliferating NPCs and committed NPCs. Critically, both the microglia phenotype and suppression of neurogenesis were recapitulated using an inducible model of microglia-specific Jedi-1 deletion, cx3cr1-CreERT2;jedi-1fl/fl mice. Together, our results strongly support the hypothesis that Jedi-1 plays a critical role in regulating homeostasis of the postnatal V-SVZ neurogenic niche through its ability to mediate efferocytosis and mitigate microglia-derived inflammatory processes.

Keywords (if any): Microglia; Neurogenesis; Development

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Teacher Executive Function Language Segmentation and Classification

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Introduction: Executive function (EF) is a set of goal-oriented processes which help regulate and execute cognitive, behavioral and emotional tasks. EF skills have been shown to impact reading comprehension; however, the mechanism by which EF growth occurs is still relatively unknown, and direct EF training has not resulted in far transfer to academic skills. The current study focused on developing ways to capture EF language that is used by teachers through Natural Language Processing (NLP) methods. The ultimate goal of the larger project is to determine whether a teacher's use of EF language is a predictor of student growth in EF and reading comprehension skills. In the current study we focus on (a) best NLP methods to capture teachers' use of EF language and (b) the extent to which teachers use EF language during reading instruction.

Methods: For this pilot study, 60 hours of small group reading instruction were recorded and a sample of 30 minutes was used to determine the optimal method for segmenting and classifying EF language for future use in a classification transformer model. Pyannote, a speech diarization model used in Python, was used to create segments from audio files. The same portions of audio were transcribed using OtterAI and segmented manually based on utterance guidelines. Each audio segment or utterance was classified as EF language or not, and EF language was then subclassified as one of seven types of EF: inhibit, shift, react and regulate, monitor, initiate, plan and organize, and sustain attention.

Results: Methodologically, initial findings suggest that automated segmenting and fixed duration segmenting using Pyannote do not significantly differ from one another; however, they both underestimate the number of EF occurrences when compared to human language segmenting based on speech utterances. In terms of the extent to which teachers use EF language, findings revealed that regardless of segmenting method, teachers do use EF language during small group reading instruction. Initial findings based on the coded sample show EF language occurring 2.37- 4.07 times per minute (2.37 automated; 3.12 fixed; 4.07 human), with instances coded as monitoring language and planning and organizing language occurring most often.

Discussion: Executive function language and different subtypes of EF language are present in teachers' daily instructional language, thus providing a means for investigating whether EF teacher language is a predictor of growth in EF and reading comprehension. Methodologically, findings indicated that Pyannote language segmenting in its current form underestimates the number of EF language occurrences during reading instruction as compared to human segmenting. Future research aims to determine the optimal NLP model to use for segmenting and classification.

Keywords (if any): executive function; Natural Language Processing; language

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School Behavior Supports: Special Educators with Students who Exhibit Challenging Behaviors

Kendall M. Huizinga, Aunna Colter, Edward LeMaster, & Robert M. Hodapp

Introduction: In their everyday professional lives, teachers must provide high quality academic instruction to all students, including those who exhibit challenging behavior(s). These expectations bring to light the need for school behavioral supports. These supports come from professional developments, paraprofessionals, behavior therapists/BCBAs, administration, and education specialists. This study identified 1) the frequency and effectiveness of school behavior supports, 2) factors that correlate with the frequency and effectiveness of school behavior supports, and 3) relationships between what supports teachers say they are using and what supports teachers say they are wanting more of.

Methods: Using a national survey, we gathered responses from 621 special educators, each of whom had at least one student with a Behavior Intervention Plan on their caseload. Respondents were asked questions relating to the following domains: Participant Demographics, Professional Satisfaction, School and Classroom Demographics, Behavior Supports, Professional Burnout, and Reflections (i.e., open-ended responses). School behavioral supports were surveyed in three sections: 1) Frequency related to the use of school behavioral supports, 2) Effectiveness of school behavioral supports when provided, and 3) open-ended responses.

Results: Almost ¼ of respondents noted that they never received any school behavior support. Even among participants who did receive school support, over three-quarters indicated never receiving school support daily. The frequency of school-related supports related to public schools, classroom level, preparedness from training programs, # of students with a BIP on caseload, and level of intensity of challenging behavior. Higher effectiveness of school-related supports related to working at a public school, feeling prepared to deal with behavior problems from teacher training programs, having greater numbers of students overall and having a greater number of students with BIP on one's caseload. Teachers who nominated professional development as a helpful behavior support influenced how effective the teacher felt the professional development supports were. Similarly, when teachers wrote about using paraprofessional support more frequently, they received paraprofessional support more frequently.

Discussion: Although a critical component of behavioral support in the classroom, school provided behavior support has to date been the subject of only sporadic research attention. There is a significant need for an increase in the frequency and effectiveness of school support for special educators who teach students who exhibit challenging behavior. School behavior supports are critical to support teachers to provide high quality academic instruction to all students, including those who exhibit challenging behavior(s).

Keywords (if any): Supports; Behavior; Teachers

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Fear of the unknown in perfectionists can lead to social anxiety

Isabella F. jackons, Randolph M. Dupont, Zoe Chang, Ralph E. Francois, Antonia N. Kaczkurkin

Introduction: Social anxiety disorder is estimated to affect 7.1% of the U.S. population. Perfectionism is known to be a significant factor related to social anxiety, where more perfectionism is likely to lead to an increase in social anxiety symptoms. Prior research has also revealed another factor, intolerance of uncertainty, to be a significant predictor of some anxiety-related disorders such as obsessive-compulsive disorder. Intolerance of uncertainty presents itself as prospective worries about the unknowable future which may inhibit individuals from acting on their wants and needs in unfamiliar situations due to fear. However, less is known about the effects of intolerance of uncertainty on social anxiety as no studies have examined how intolerance of uncertainty contributes to the relationship between perfectionism and social anxiety. Thus, this study aims to examine 1) the relationship between perfectionism and social anxiety, and 2) whether intolerance of uncertainty may be a mediating factor. We hypothesize that perfectionism and social anxiety would be significantly correlated, and that intolerance of uncertainty will act as a significant mediating factor

Methods: Data were pre-collected through surveying 904 individuals from a predominantly undergraduate population using an online questionnaire. This survey was open to Tennessee residents of all ages but was mostly advertised to undergraduate students at a private institution. Three Likert scale measures within the survey were used for this study, which assessed 1) social anxiety symptoms 2) perfectionistic tendencies, and 3) reactions to implications of being uncertain. Continuous total scores on each measure were analyzed using multiple regression and bootstrapped mediation analyses in R.

Results: Consistent with prior work, analyses showed that higher levels of perfectionism were associated with greater social anxiety symptoms ($p < 0.001$). Additionally, the effect of perfectionism on social anxiety was mediated by intolerance of uncertainty (95% CI= 0.12, 0.18). These results reveal that greater feelings of perfectionism lead to greater feelings of intolerance of uncertainty which leads to more symptoms of social anxiety.

Discussion: This suggests that more perfectionistic individuals tend to have more intolerance of uncertainty, and thus are more susceptible to the development of social anxiety. For treatment purposes, this work suggests that targeting maladaptive perfectionism may potentially be useful for diminishing an individual's intolerance of uncertainty and social anxiety symptoms.

Keywords (if any): Perfectionism; intolerance of uncertainty; social anxiety

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A FMRP-dependent pathway for the glial phagocytosis of brain neurons

Rincon Jagarlamudi and Kendal Broadie

Introduction: Brain circuit remodeling is a crucial developmental process that is disrupted in a number of different neurological disease states, including Fragile X syndrome (FXS); the leading heritable cause of intellectual disability (ID) and autism spectrum disorder (ASD). Recent work suggests that the developmental clearance of neurons during circuit remodeling requires neuron-to-glia signaling that drives glial phagocytosis. In this mechanism, glia need to 1) be recruited to the target neuron, 2) engulf the neuron, and then 3) phagocytose the neuron. For this protracted clearance process, the glia actin cytoskeleton is critically important, and likely needs to be precisely regulated at multiple steps. We are studying these events in the Drosophila brain PDF clock circuit, which contains the developmentally transient PDF-Tri neurons. We have previously shown that the Fragile X Mental Retardation Protein (FMRP) is required in neurons to activate and recruit glia for the phagocytosis and developmental clearance of these PDF-Tri neurons.

Methods: A transgenic RNA interference (RNAi) screen, was performed to identify glial-derived targets implicated in PDF-Tri neuron removal. Confocal microscopy was used to assay glial expression/localization phenotypes and the developmental clearance of PDF-Tri neurons.

Results: We have now found that glial Basket (mammalian Jun N-terminal kinase; JNK) signaling and the downstream AP-1 transcriptional pathway are required for the clearance of PDF-Tri neurons. We discovered this JNK/AP-1 signaling pathway drives the glial expression of Cheerio (mammalian filamin A; FLNA), an F-actin cross-linking protein, which is likewise required for the clearance of PDF-Tri neurons. Null cheerio mutants and glia-target cheerio RNAi similarly prevent removal of the normally developmentally transient PDF-Tri neurons. We also discovered FMRP genetically interacts with Cheerio to enable this clearance mechanism, with transheterozygous animals showing a complete blockade of PDF-Tri neuron removal. We found FMRP mutants exhibit reduced Basket/JNK translocation into glia nuclei, indicating a disruption in JNK signaling to AP-1 transcriptional control. We found that neuronal FMRP drives Basket/JNK signaling principally in ensheathing glia, which use the Cheerio/FLNA actin crosslinker to remove the PDF-Tri neurons.

Discussion: Taken together, we conclude that neuronal FMRP drives glial Basket/JNK signaling to induce AP-1 transcription of Cheerio/FLNA to modulate the glial F-actin cytoskeleton to enable glial phagocytosis of the developmentally transient PDF-Tri neurons. Our ongoing work is attempting to image the F-actin cytoskeleton in glia in order to gain a detailed mechanistic understanding of actin requirements in glial recruitment, engulfment and phagocytosis. Future work will also focus on the FMRP-dependent neuron-to-glia signaling mechanism (ligand and receptor) that initiates the Basket-AP1-Cheerio pathway in glia. This clearance pathway has important implications for the study if Fragile X syndrome, as it provides a new cellular mechanism for the disease state and new molecular targets for the development of new therapeutic treatments.

Keywords (if any): brain circuit remodeling; glial phagocytosis; actin cytoskeleton

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Functional Network Topology and Environmental Stressor

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Introduction: Functional networks are collections of brain regions that interact to respond to incoming cognitive demands (1). Throughout development, functional networks become more refined; connectivity within modules increases while connectivity between modules decreases, allowing more efficient information processing by each network (2). Functional networks may be shaped most impactfully during childhood, a sensitive period marked by high brain plasticity and environmental stressors. To explore the effects of environmental stress on the developing brain, the current study investigated the association between environmental stressors and functional networks, using a large sample of children aged 9-10 years from the Adolescent Brain Cognitive Development (ABCD) Study.

Methods: Bifactor modeling was used to delineate both a general factor of environmental stress that explains covariance among all stressors, as well as specific subfactors (i.e., familial risk, interpersonal support, neighborhood deprivation, and urbanicity) that explain covariance unique to those sub-types of stressors. We used graph theory to quantify the efficiency of functional networks at the global level (i.e., between networks) and at the local level (i.e., within networks) (3). The association between network properties and general and specific factors of environmental stress was examined at rest and during tasks of reward processing, inhibition, and affective working memory, controlling for symptoms of psychopathology.

Results: The general stressor factor was associated with lower modularity, indicating a tendency toward global configuration at the expense of local configuration, at rest and during the affective working memory task. Local metrics indicated that the general stressor factor was associated with a longer path that the signals have to travel in the subcortical-cerebellar and visual networks at rest. Consistent with the brain results, the general stressor factor was associated with poorer behavioral performance across tasks. The specific factor of urbanicity was associated with lower modularity as well as a longer path to travel and reduced local efficiency within the motor network at rest. In contrast, urbanicity was also associated with greater local efficiency within the motor network during the affective working memory task. Behaviorally, greater scores on urbanicity were related to better performance across tasks.

Discussion: Less modularity and efficiency associated with the general factor indicate that a wide range of stressors in the child's environment could potentially lead to less refinement of brain network topology. Variable patterns associated with urbanicity extend our prior work (4) showing that various aspects of urban living may provide harmful as well as protective factors for brain development. Overall, the current study highlights the importance of considering diverse aspects of environmental stress to understand its effect on brain development.

Keywords (if any): Environmental Stress; Brain Development; Functional Networks

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Bully Victimization in Autistic Adolescents and Adults: A Systematic Review

Claire Cotton, Chen Jin, Claire Hildebrand, Delaney Caldwell, T. A. Meridian McDonald

Introduction: Bullying, an adverse childhood experience (ACE), is a significant public health problem that is exacerbated in autism1,2,3. Autistic children experience more physical, verbal, and relational/indirect (e.g., ostracism, rumors) bully victimization (BV) than their peers who do not have an autism diagnosis1. Further, 40% of them report experiencing bullying daily2. Although adolescents are often included in BV studies of children, older adolescents and adults navigate different settings with less supervision/greater autonomy than autistic children. A synthesis of the experiences, treatment, and outcomes related to BV is needed to better understand and inform research on BV occurring with autistic older adolescents and adults.

Methods: We conducted a scoping review of research literature (cohort, case-control, cross-sectional, and single-case studies) on BV in autistic adolescents and adults (average age 14 and older) diagnosed, or self-diagnosed, with autism. We included all forms of BV, such as direct and indirect forms of physical, verbal, relational, cyber, and sexual victimization. We searched PubMed, PsycINFO, ERIC, Web of Science, and PROQUEST for studies published January 1, 1980 and later. We uploaded search results to Abstrackr and double-screened abstracts based on inclusion/exclusion criteria. We then read included abstracts in their entirety to confirm inclusion before data extraction. We extracted data for the following categories: b) study type; a) types of BV; c) participant demographic variables; d) study purpose and e) study results.

Results: Of the 4297 abstracts, 298 (7%) were included for the full review. The analysis is ongoing. Of the 216 articles fully reviewed to date, 84 articles met criteria for extraction. Of these, 24% included older adolescents, 21% included adults aged 18 and older, 32% contained mixed adolescents and adults, and the remainder were unspecified. Not all studies reported sex/gender. The concepts of sex (19 studies; M:F 2379:2181) and gender (48 studies; M:F 6039:5091; Trans/Non-binary/Other: 90) were not clearly defined within these studies. We identified emotional, familial, property destruction/theft, financial, and criminal justice as additional bully types. Some studies identified chronic and/or severe episodes as important dimensions of BV. Twenty-six studies examined the perceptions and experiences of autists and other stakeholders. Ten studies examined the relationships between BV and outcomes of psychological and physical health and quality of life. Fourteen studies included predictor variables(autistic traits and demographic variables). One qualitative study outlined a group-therapy intervention for BV.

Discussion: BV continues into older adolescence and adulthood for autists. Further research is needed to mitigate exposure to BV and develop interventions and therapies to support those surviving BV.

Keywords (if any): Bully victimization; Autism; Adolescent and adults

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Presenter name: Sophia Kaiser (sophia.m.kaiser@vanderbilt.edu)
Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Woynaroski, Tiffany

Comprehensive Evaluation of Spontaneous Language Samples in 5 Year-Old Siblings of and Autistic and Non-Autistic Children

Sophia Kaiser, Jacob Feldman, Bahar Keceli-Kaysili, Jennifer Markfield, Tiffany Woynaroski

Introduction: Siblings of autistic children have an increased likelihood for a future diagnosis of autism and language disorder. Project SPIS (PI: Tiffany Woynaroski) seeks to identify factors early in life that predict later language in both autistic and non-autistic children. At five years old, there is wide heterogeneity in language (i.e., infants range from non-verbal to linguistically precocious). Further, standardized assessments of language only tell us very generalized information about participants and are unable to inform our knowledge about language growth over time. This project seeks to address these gaps by evaluating how to best measure spontaneous language in autistic and non-autistic children around their fifth birthday. This project aims to evaluate two spontaneous language sampling procedures to evaluate which one (a) yields the most valid usable data and (b) has the best concurrent validity with standardized expressive language measures, as well as (c) whether one sample is sufficient to derive stable estimates of spontaneous language.

Methods: Between infants' fifth and sixth birthdays, they are returning to the Woynaroski Lab for two visits. During these visits, we are administering two standardized assessments of expressive language (i.e., the Preschool Language Scales [PLS-5], the Test of Expressive Language [TEXL]) and two spontaneous language sample procedures (i.e., the Communication and Symbolic Behavior Scales Developmental Profile [CSBS], Language Sample procedures [LS]). The language samples are transcribed, coded, and analyzed for variables such as Mean Length of Utterance (MLU), which give us more personalized, nuanced insight on a child's language development. By Science Day, we will have a sample of 10-12 infants to answer our research questions.

Results: We hypothesize that: (a) All participants, regardless of autism diagnosis, will be able to complete this battery with no missing data; (b) Metrics from the LS will be more highly correlated with TEXL and PLS than those from the CSBS; and (c) Spontaneous language can be measured stabally within 1-2 samples.

Discussion: If our hypotheses are borne out, our study will have important implications for how to measure spontaneous language in 5 year-old infant siblings of autistic and non-autistic children, both in our laboratory and in other laboratories participating in the Baby Siblings Research Consortium Network (BSRC). Ultimately, after we determine how to derive valid and stable metrics of spontaneous language in these children, we want to look at growth in spontaneous language and what factors predict (a) language growth over time and (b) language outcomes at 5 years old. These efforts will likely focus on sensory functioning, which is the goal of the larger project.

Keywords (if any): Language development; Autism; Validity

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Theme: Systems Neuroscience
P.I/Advisor: Gordon, Reyna

Rhythm abilities in individuals with post-stroke aphasia: Motivation and preliminary data

Anna Kasdan, Kat Bryan, Marianne Casilio, Nori Jacoby, Stephen Wilson, Reyna Gordon

Introduction: Aphasia is an acquired communication disorder resulting from damage to language regions of the brain, with stroke as the leading cause. Aphasia is notoriously difficult to treat and patients exhibit significant individual variability in recovery trajectories and in what therapeutic elements work best in aiding such recovery. Speech-language pathologists frequently use rhythmic elements (e.g., tapping to a beat) in the clinic in order to facilitate speech output. However, there is a lack of a deep and systematic assessment of rhythm in this population. Our aim in the current work is to characterize rhythm abilities and their neural correlates in post-stroke aphasia.

Methods: Twenty-two individuals with chronic, post-stroke aphasia and 15 age-matched neurotypical controls have thus far completed the research study. All participants completed a comprehensive battery of rhythm tasks which included both rhythm production (tapping to metronome sequences and the beat of musical excerpts) and rhythm perception (Beat Alignment Test [BAT], Iversen & Patel, 2008) tasks. Individuals with aphasia additionally completed language and motor assessments. Last, all participants were surveyed about their musical experience.

Results: While analyses are ongoing, preliminary data suggests that, behaviorally, rhythm perception abilities are different between the two groups - participants with aphasia had overall lower d-prime scores (a signal detection theory measure) on the BAT compared to neurotypical participants ($t(35) = -3.34$, $p=0.002$, 95% CI:[-2.44, -0.60]). Age, sex, and level of education were not significant predictors of BAT d-prime scores.

Discussion: Further analyses including brain, musical experience, and language related variables will allow us to further understand what might be driving group differences in rhythm perception and production abilities. Our future work will use lesion-symptom mapping approaches (voxel-based, multivariate) to determine which brain regions are associated with rhythm processing in aphasia. We predict that individuals who have damage to brain regions important for rhythm, including the basal ganglia and the precentral region, may exhibit rhythm impairments, along with individuals who have large lesions. By characterizing individual differences in rhythm abilities and their underlying neural substrates in individuals with aphasia, it may be possible in the future to tailor the use of such strategies to specific individuals, in line with precision medicine approaches.

Keywords (if any): aphasia; rhythm

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Theme: Cellular & Molecular Neuroscience
P.I/Advisor: Winder, Danny

Validating a novel astrocyte specific GCaMP8s virus using brain BLAQ staining

Lisa Kim, Nick Petersen, Danny Winder

Introduction: Lisa Kim, Nick Petersen, and Danny Winder An addiction to alcohol affects multiple neurotransmitter systems including the dopamine neural (DA) pathway, causing poorer sleep quality characterized by increased wakefulness throughout one's sleep. This explains why recovering alcoholics struggle to sustain an abstinence of alcohol. However, the molecular pathway caused by alcohol that increases wakefulness is widely unknown. Recently, research revealed the activation of alpha-1 adrenergic receptors (∝1ARs) concentrated on astrocytes lead to the activation of wake-promoting DA neurons in the ventral periaqueductal gray (vPAG). Moreover, it was discovered that these DA neurons are stimulated by alcohol. Previous research also used a GCaMP8s virus to determine that alcohol and the activation of ∝1ARs increases astrocyte calcium activity.

Methods: hus this study sought to validate that the expression of the virus is specific to astrocytes to ensure the calcium activity was a response observed within astrocytes. Ten mice brain slices with the virus were stained with an astrocyte and neuron specific antibody using the BLAQ protocol. A confocal microscope was used to collect images, then the number of neurons and astrocytes that had the virus were counted.

Results: Average percentage of astrocytes with the virus (84.1± 3.6%) was significantly greater than that of neurons with the virus (2.3±0.3%) ($p<.0001$, two tailed t-test).

Discussion: We determined the GCaMP8s virus was highly specific to astrocytes, allowing us to conclude from previous research that activation of ∝1ARs by alcohol causes an increase in calcium activity within astrocytes, leading to a potential glial transmission that activates wake promoting DA neurons.

Keywords (if any): astrocytes; alcohol; dopamine

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Woynaroski, Tiffany

Links Between Early Prelinguistic Communication and Later Expressive Language in Infants with Autistic and Non-autistic Siblings

Zoe M. Kiemel, Jennifer E. Markfeld, Olivia Jamieson, Bahar Keceli-Kaysili, Jacob I. Feldman, & Tiffany G. Woynaroski

Introduction: Autism is known to impact language and overall communication skills throughout the lifespan. Language skills by age five are highly predictive of later social and vocational success in autistic individuals (Yoder, 2015). Additionally, variability in joint attention, the ability to share focus on an object via eye gaze or other form of communication, is a feature of autism that emerges early in life. Complexity of child vocalizations, as well as joint attention skills, have been shown to be value-added predictors in expressive language growth in initially preverbal autistic children (McDaniel et al., 2018; Woynaroski et al., 2016). However, the predictive validity of early communicative behaviors in determining later language outcomes have yet to be longitudinally investigated in younger siblings of autistic children (i.e., Sibs-autism), who have an increased (approximately twenty-fold) likelihood of receiving a future autism diagnosis and/or language impairment themselves. Therefore, the present study aims to explore how early communicative behaviors predict later language growth in infant siblings at increased and population-level likelihood for autism.

Methods: The proposed study will analyze communication in a group of Sibs-autism (n = 28), and a control group of infants at lower likelihood for autism due to having an older non-autistic sibling (Sibs-NA; n = 23). Video recordings of researcher-infant interactions on the Communication and Symbolic Behavior Scales (CSBS), a naturalistic, structured play-based assessment, will be analyzed at multiple timepoints from an extant longitudinal dataset. Intentional communication and response to joint attention coded from Time 1 (infant age: 12-18 months) will be compared with language outcomes (i.e., grammatical complexity of spoken utterances) from Times 2 and 3 (infant ages: 21-27 months and 36-47 months, respectively). Growth curve analyses will be run to examine (a) how early communicative behaviors predict later language outcomes, (b) the trajectory of language growth in Sibs-autism and Sibs-NA, and (c) if language trajectories vary by factors such as sibling group and diagnostic status (i.e., if an infant receives an autism diagnosis) at Time 3.

Results: Due to ongoing transcription and coding, anticipated results will be presented. We hypothesize that a higher frequency of communicative behaviors at Time 1 will be highly predictive of language outcomes at Time 3, and that this association will be driven in part by sibling group as well as autism diagnostic status.

Discussion: The present project represents T0/preclinical research necessary to identify early aspects of communication with high predictive validity for later language outcomes. If our hypotheses are borne out, early intervention targeting communication skills could have great value for improving language outcomes in the Sibs-autism population. Additional clinical implications will also be discussed.

Keywords (if any): autism spectrum disorder; language development; infant siblings

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Theme: Systems Neuroscience
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Effects of Perceived Social Threat on Self-Other Boundary in schizophrenia: A Virtual Reality (VR) Study of Peripersonal Space

Hyeon-Seung Lee, Lauren Buck, Tatiana Baxter, Sunil Shenoy, Bobby Bodenheimer, Sohee Park*

Introduction: A coherent sense of the bodily self with a clearly defined boundary is a prerequisite for adaptive social interactions. The multisensory-motor buffer zone between the body and the external world is known as peripersonal space (PPS), a protective defensive space that, when breached, triggers alarm signals. A weakened self-boundary would make it difficult to differentiate one's own behaviors from those of others, leading to maladaptive social interactions. We examined parameters of PPS in social contexts to further understand self-disturbances in individuals with schizophrenia (SZ).

Methods: 23 SZ and 25 control subjects (CO) participated in a visuotactile response time (RT) task in immersive VR. The task required participants to detect tactile vibration while watching an avatar approach them at walking speed. Vibrations were delivered at different times corresponding to various distances from the avatar. The avatars represented varying degrees of threat: non-threatening and threatening humans and a monster. PPS was estimated from a sigmoid function generated by RTs; when a stimulus enters the PPS, there is a sharp drop in RT. Both the PPS size and the "slope" (the uncertainty of self-other boundary) were estimated. False alarm (FA) rates (responding ahead of the tactile vibration), clinical symptoms, paranoia, social phobia, and loneliness were also examined.

Results: SZ showed higher FA rates than CO, which was exacerbated by perceived social threat. PPS size did not differ between SZ and CO, however, for PPS slope, a group-by-slope interaction was found such that perceived social threat sharpened the self-boundary in CO, whereas it increased the uncertainty of the self boundary in SZ. In SZ, shallower PPS slope was associated with delusion, persecution, and loneliness but not in CO.

Discussion: Sharper self-boundary in response to threat in CO is considered adaptive. However, perceived threat resulted in a weakened self-boundary in SZ. Anomalous self-other boundary would result in maladaptive interactions. Increased FA rates in SZ suggest heightened anticipation. The associations of PPS slope and relevant clinical variables merit further investigation towards a better understanding of the role of self-disturbance in social outcome in SZ.

Keywords (if any): schizophrenia; multisensory processing; social threat

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Social Activity & Friendship for Adults with Disabilities: Ties to Level of Functioning

Edward LeMaster, Maria Mello, Bridgette Garcia, Robert Hodapp

Introduction: Although friendship and social activity are essential components of a happy life, adults with disabilities (compared to those without) engage in less social activity, have smaller social networks, and often have their immediate family and disability professionals as most of their friendships, rather than non-related peers. The current study examined friendships and social activities among adults with various disabilities, with special attention to how adults with disabilities' level of functioning impact their community involvement and friendship.

Methods: Responding to an online survey, 247 caregivers of adults with disabilities provided information in 5 areas: (1) respondent's own demographic characteristics; (2) the family member with a disability (including level of functioning-calculated using Activities of Daily Living--ADL items); (3) friendships (including # of friends with disabilities, without disabilities, and within the family); (4) community involvement (frequency of participating in 20 social activities and questions about often these activities occur with peers with disabilities, peers without disabilities, family, professionals, and disability organizations); and (5) school/education, employment, and residential status. Analyses compared adults with a disability who were in the bottom quartile to those in the top quartile of ADL scores.

Results: Overall, adults with disabilities most often engaged in watching TV or movies at home (3.55 on a 5-point scale); least often engaged in book clubs, including the (disability-oriented) Next Chapter Book Club (1.18) or other book clubs (1.08). For 15 of 20 community-based social activities, adults with low ADL scores participated significantly less than adults with high ADL. Adults with lower ADL also participated less often in activities with peers without disabilities and activities organized by disability organizations. Regarding friendship, adults with disabilities averaged 7.8 friends, most within their immediate families. Again, adults with low ADL scores had significantly fewer friends than adults with high ADL. Furthermore, 23.4% of adults with low ADL had zero friends outside of the family, compared to 11.3% of adults with high ADL scores, $X2$ (1, $N = 235$) = 6.1, $p = .013$.

Discussion: As one of the first studies comparing adults at different functioning levels, these findings have major implications regarding future activities and interventions. Since people with low ADL have fewer friends and engage in less social activity than adults with high ADL, future interventions need to focus in on this population to determine how we can close the gap. Ultimately, all adults with ID-regardless of their functioning levels-should enjoy the benefits of community-based activities and friends.

Keywords (if any): Activity; Friendship

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Theme: Cellular & Molecular Neuroscience
P.I/Advisor: Carter, Bruce

Assessing Expression of Jedi-1 in Model Microglia

Sophie Li, Matthew Houpert, Bruce Carter

Introduction: During the development of the mammalian nervous system, about half of the neurons will undergo apoptosis as a normal pruning process. Microglia play an integral role in neuronal corpse clearance, however, the exact mechanisms remain unknown. Recently, Jedi-1, an engulfment receptor, was shown in mice to play an important role in neuronal corpse clearance. Defective engulfment receptor proteins in the nervous system have been linked to multiple disorders in development and aging, as uncleared apoptotic cells can trigger an inflammatory response and disrupt homeostasis.

Methods: We studied the expression of Jedi-1 in BV2 cells to help us better understand microglial mechanisms. Preliminary data has shown that Jedi-1 expression increases in primary microglia during a microbead engulfment assay. BV2 cells are a common microglia cell line that has also shown engulfment receptor induction during engulfment, but whether Jedi-1 is expressed by these cells is unknown. Thus, this research investigates whether Jedi-1 can be induced in BV2 cells upon incubation with apoptotic SY5Y cells during different time points of engulfment. We examined this through engulfment assays and Western Blotting.

Results: These results will indicate whether or not Jedi-1 expression is induced in BV2 cells during the engulfment of apoptotic SY5Y cells. Because of its similarity to TREM-2, we expect Jedi-1 to be expressed in BV2 cells during engulfment.

Discussion: This will allow us to study Jedi-1 further and better understand neurodegenerative diseases.

Keywords (if any): microglia; jedi-1; neurodegenerative

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Cutting, Laurie

Kindergartner's non-symbolic magnitude processing and attentional abilities are associated with their neural representations of symbolic magnitude

Andrew Lynn, Laura A. Barquero, Kenny A. Tang, Gavin R. Price & Laurie E. Cutting

Introduction: Across the first 5 years of life, children are tasked with learning that Arabic digits correspond to exact numerical quantities, as well as how these newly learned symbolic magnitudes relate to one another. The conventional wisdom is that this developmental task is supported by the domain-specific ability to distinguish between approximate, non-symbolic quantities (i.e., sets of objects). However, emerging evidence suggests that children's development of numerical knowledge is also supported by domain-general executive functions. In the present study, we tested whether kindergartener's non-symbolic number processing and executive attention abilities are related to their neural representations of symbolic magnitude.

Methods: We tested 43 kindergarteners (M = 5.7 years) on out-of-scanner behavioral non-symbolic number comparison (i.e., which is greater of two sets of dots) and flanker tasks (i.e., which direction is the arrow pointing among distractors), and an in-scanner symbolic number comparison task (e.g., which digit is greater). For each child, we calculated symbolic magnitude representations using a whole-brain representational similarity analysis (RSA) approach by correlating the activation patterns for small and large ratio conditions during symbolic number comparison. We reasoned that relatively less similar patterns of neural activation between numbers closer together in magnitude (e.g., 4 and 5) versus numbers farther apart in magnitude (e.g., 2 and 5) would indicate a given brain region is better able to distinguish between these two types of stimuli, and therefore stronger neural magnitude processing. We then submitted these magnitude representation maps to a whole brain regression analysis with non-symbolic number comparison and flanker performance as predictors, controlling for in-scanner behavioral performance and motion.

Results: As a group, kindergarteners represented symbolic magnitude across bilateral parietal, left inferior temporal, and right occipital and middle frontal regions. Critically, we found distinct relations between domain-specific and domain-general abilities and neural representations of symbolic magnitude. Specifically, kindergarteners with stronger non-symbolic number processing abilities showed stronger symbolic magnitude representations across bilateral frontal brain regions and left ventral temporal regions. And, kindergartners with stronger executive attention abilities showed stronger symbolic magnitude representations across the right parietal lobule.

Discussion: Our findings demonstrate (1) the value of employing multivariate neuroimaging methods for detecting individual differences in brain-behavior relationships underlying numerical cognition development, and (2) both domain-specific and domain-general processes act via distinct neural substrates to shape children's emerging symbolic number processing at school entry. Future work will examine how these distinct regions interact across development, as well as how longitudinal changes in symbolic magnitude representations are related to children's executive function and math abilities across the first years of formal schooling.

Keywords (if any): number processing; executive function; child development

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Prepulse Inhibition as an acute behavioral measure of mild traumatic brain injury in young gulo-/-mice

Amanda L. Marino, Fiona E. Harrison

Introduction: Children and young adults are at increased risk for experiencing traumatic brain injuries (TBI). Injuries are often accompanied by both short- and long-term changes in behavior and cognition including changes in attention. Vitamin C (ascorbate) is a critical antioxidant important for maintaining redox balance in the brain and may be critical in the acute neural response to TBI counteracting the oxidative stress that perpetuates neuroinflammatory and excitotoxic processes. Therefore, we hypothesize that dietary deficiency of ascorbate may exacerbate behavioral deficits following traumatic brain injury.

Methods: 12-16 week old male and female gulo-/- mice lacking a functional copy of gulonolactone oxidase, the enzyme necessary for the endogenous synthesis of ascorbate, were maintained on depleted (0.03g/L, "low") or wildtype-equivalent (1.0g/L, "control") diet. Mice were exposed to a repeated mild blast injury (3x37-40 PSI) to the frontal cortex, or a sham injury (anesthesia and noise only). Prepulse Inhibition (PPI) is a widely used behavioral measure of sustained or selective attention thought to reflect inhibition of sensory overload by a mechanism of sensorimotor gating. Mice underwent the PPI task 4 and 24 hours following injury treatment. Mice were euthanized at 4 and 24 hours following injury and cortical and hippocampal tissue were assessed for gene and protein changes.

Results: We observed sex differences in PPI response with females displaying less PPI compared to males overall. In female mice that received low ascorbate diet, they showed significantly less PPI compared to the female mice on control diet. In the control diet female mice, there was a significant reduction in PPI in response to blast. In male mice, they had an opposite trend to females, with mice on low diet having an increase in PPI at the 4 hour time point, and this effect persisted to the 24 hour time point. No significant neuroinflammatory gene expression changes were found at the 4 hour timepoint for males or females according to TBI, ascorbate treatment, or sex. At this early timepoint, males show more neuroinflammatory gene expression changes than females according to ascorbate treatment, though not significant.

Discussion: PPI is conserved across multiple species including humans, and could be used to give a better understanding of sensorimotor and attentional changes following TBI. Our studies indicate sex-specific changes in PPI in mice on a depleted ascorbate diet following TBI. These changes could not be attributed to alteration in neuroinflammatory genes or glutamate clearance proteins. Future studies should examine cyclical changes relating to sex-specific hormones and how these relate to the PPI response.

Keywords (if any): Traumatic Brain Injury; Sex Differences; Behavior

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Woynaroski, Tiffany

Associations Between Caregiver Stress and Language Outcomes in Infants With Autistic and Non-Autistic Siblings

Jennifer E. Markfeld, Jacob I. Feldman, Samantha L. Bordman, Claire Daly, Pooja Santapuram, Kathryn L. Humphreys, Bahar Keceli-Kaysili, Tiffany G. Woynaroski

Introduction: Caregivers of autistic children present with higher stress levels, which are known to negatively impact language and communication of autistic children. However, we do not yet know how elevated caregiver stress may impact later language abilities in younger siblings of autistic children (Sibs-autism), who are at increased (approximately twenty-fold) likelihood of receiving a future diagnosis of autism and/or language impairment themselves. We hypothesized that caregivers with increased stress might speak less to their children, resulting in reduced communication abilities later in life. The present study explored the mechanisms by which caregiver stress influences later language outcomes of infant siblings at high and low likelihood for later autism diagnosis.

Methods: Participants were 50 infants, 28 Sibs-autism and 22 infants with non-autistic, otherwise typically-developing older sibling/s (Sibs-NA) who were followed longitudinally. Infants were excluded from participation if they had adverse neurological history, a known genetic condition, and/or preterm birth. All families spoke English as their primary language. During the first visit, at 12-18 months, caregiver stress was reported by the Parenting Stress Index Short Form (PSI-4 SF). Additionally, adult word count (AWC; a proxy for caregiver linguistic input) was obtained from Language ENvironment Analysis (LENA) recorders. Nine months later (21-27 months), language outcomes were assessed using aggregate receptive and expressive language scores derived from the Vineland Adaptive Behavior Scales, the Mullen Scales of Early Learning, and the MacArthur Bates Communicative Development Inventory: Words and Sentences. Mediation and moderation models were carried out to determine the degree to which the association between caregiver stress and later expressive and receptive language was mediated by caregiver linguistic input and to test whether these associations varied by sibling group.

Results: Mediation models indicated that the relation between caregiver stress and language was significantly mediated by AWC (receptive language 95% CI = [-0.0161, -0.0009]; expressive language 95% CI = [-0.0128, -0.0004), when controlling for caregiver education, consistent with our theoretical model. This indirect effect was "complete," meaning that the direct effect of caregiver stress on later language was non-significant when controlling for AWC. Moderated mediation models indicated that sibling-status was not a significant moderator of any of the relations relevant to the aforementioned indirect effect.

Discussion: These findings provide empirical support for the theory that caregiver stress levels influence later language outcomes in infants at both heightened and population-level likelihood for being diagnosed with autism. Results suggest that this relation is mediated by the adult language input that an infant receives in their home environment. Clinical and research implications, limitations, and future directions for this line of research will be discussed.

Keywords (if any): Autism; Language development; Stress

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Cutting, Laurie

Differential contributions of the Adult Reading History Questionnaire dimensions on children's reading and language skills

Amanda Martinez-Lincoln, Tin Q. Nguyen, Laurie E. Cutting

Introduction: Parents indubitably play a crucial role in children's reading development (e.g., Snowling & Melby-Lervåg, 2016); however, the subtleties of their contribution remain unclear. The parent-child relation in children's reading success arguably capitalizes on the complex interplay between parents' own childhood reading history and their role in shaping their children's early development through their environment (Inoue et al., 2018; van Bergen et al., 2016). Parents' reading history may be associated with children's reading ability directly and indirectly through home environmental factors, including parental reading ability and literacy practices (Snowling & Melby-Lervåg, 2016). The current study used indices of parents' childhood reading history and current adulthood literacy-related activities and performance to disentangle the extent to which each may influence children's reading development.

Methods: A two-year longitudinal study examined children's word reading (WR) and oral language (OL) abilities after first (N = 198; 53% girls) and second grades, and reading comprehension (RC) after third grade. Parents' self-report on the Adult Reading History Questionnaire (ARHQ; Lefly & Pennington, 2000), educational attainment, and reading performance were assessed at baseline. ARHQ dimensions were analyzed using factor analysis, and then subjected to path modeling approach to determine their unique contributions to children's reading and language outcomes. Children's demographic information (sex, nonverbal IQ, school information) were covariates.

Results: Findings revealed differential contributions of parental reading history and current adulthood literacy-related activities and performance on children's reading development. Parents' scores on Childhood Ability predicted parents' current reading performance, which in turn explained children's RC outcomes through their WR and OL differences. Parents' scores on Childhood Ability were associated with parents' Attitude/Exposure, which in turn was related to children's RC via their OL abilities.

Discussion: Results suggest that familial history of reading difficulties and literacy exposure have unique contributions to components of children's reading development. These findings could inform researchers and educators on nuanced instructional strategies that support the development of reading comprehension, particularly for struggling readers.

Keywords (if any): reading; language; environment

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Theme: Clinical, Behavioral, Educational, & Intervention Research
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Understanding Provider Needs for Treating Sleep Disorders in Autistic Adults

T. A. Meridian McDonald

Introduction: A majority (64-93%) of Autists experience sleep disturbances, including insomnia, at some point in their lives1. Insomnia is associated with cardiovascular disease, diabetes, psychiatric conditions, and mortality2. Autistic adults are at increased risk of all these conditions and addressing sleep may help reduce these co-occurring conditions. Cognitive Behavioral Therapy for Insomnia (CBTI) is the front-line treatment for insomnia; it is highly efficacious and cost-effective without the side effects of medication. However, little to no research has investigated the efficacy/effectiveness of CBTI with autistic adults. Additionally, it is unknown what provider experiences are with treating sleep disturbances with this population. Other types of service providers, such as cognitive behavioral therapy providers, report inadequate training, low competence, low confidence, and low intention to treat autistic adults. The Communication Opportunity and Motivation for Behavioral Change (COM-B) Model1 states that (provider) motivation to engage in a behavior (e.g., treat autistic patients) is contingent on the degree to which a person has the opportunity (e.g., referrals) and the perceived capacity (e.g., training, experiences, resources) to engage in the behavior). Therefore, a better understanding of sleep provider needs for treating this population is warranted.

Methods: This study employed a mixed methods survey/interview design to examine sleep providers' experiences, perceptions, and attitudes regarding the treatment of sleep in autistic patients. Participants were required to treat sleep disorders in adults within the U.S. The survey gathered demographic information (geographic region, age, gender/sex, race/ethnicity, education/profession designation, practice information). The survey used quantitative and open-ended questions to examine provider experiences, perspectives, and perceived needs in treating autistic patients.

Results: Eighty-five people (74% women; 1% non-binary; 85% White/European American) participated in the study. The majority held doctoral degrees (66%) and 25% held Masters degrees. Over 60% described having no training in autism; yet 29% treated autistic patients in the past 12 months and 72% reporting treating autistic adults during their career. Although 54% felt their therapy was effective for treating sleep issues in this population, all participants endorsed numerous challenges for treating sleep in this population. Providers indicated, in both quantitative and qualitative data, concerns with using standard delivery, lack of codified adaptations, the lack of research, and the lack of available training to work with this population.

Discussion: Providers are inadequately supported due to a lack of research, codified methods, and training to work with Autists. More CBTI research in autism is needed to examine efficacy, effectiveness, and the match of standard delivery with the social-communication and motivational needs of autistic adults. Future research on bridging provider and autistic patient needs for sleep treatment is needed.

Keywords (if any): Sleep Disturbance and Insomnia; Autist and Provider Needs; Implementation Science

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Neul, Jeffrey

Skewed paternal X-chromosome inactivation shows a minor correlation with reduced Rett Syndrome clinical severity

Jonathan Merritt, Steve Skinner, Mike Friez, Lucas Pozzo-Miller, Alan Percy, Jeffrey L Neul

Introduction: Rett Syndrome (RTT) is a severe neurodevelopmental disorder primarily caused by mutations in the transcriptional regulator Methyl-CpG Binding Protein 2 (MECP2). Although the features of RTT are distinctive, there is variation in clinical severity, and clear genotype-phenotype relationships can be observed on a group level. Despite this well defined genotype-phenotype relationship in RTT, there are individual "outliers" who are either less severely or more severely affected than the specific MECP2 mutation they carry would indicate. One possible source for this phenotypic variation is skewed X-chromosome inactivation (XCI) resulting in preferential expression of either the maternal or paternal MECP2 allele. With RTT-causing mutations primarily arising on the paternal MECP2 allele, skewed inactivation of the paternal X-chromosome is predicted to result in a milder clinical presentation.

Methods: To assess the influence of XCI on clinical severity, we evaluated XCI patterns in individuals with RTT and their mothers to establish directionality of skewing. Using a mixed effects model developed from over 1,000 girls and women followed by the Rett Syndrome Natural History Study, we established percentile scores of clinical severity for common MECP2 mutations to allow for comparisons independent of an individual's age at time of clinical observation. Applying the clinical severity percentile, we analyzed correlations between XCI and clinical severity for common MECP2 mutations.

Results: In general, increased inactivation of the paternal X-chromosome loosely correlates with decreased clinical severity across common MECP2 mutations. However, outliers to this trend suggest other factors beyond XCI influence clinical severity.

Discussion: While initial results point towards a small association between XCI and disease severity, more stringent analysis is warranted. Obtaining a complete Val66Met genotype profile for the described data may aid in providing a concrete view of XCI influence on disease severity. Preliminary findings hint at MECP2 mutation dependent effects of XCI on severity, though further analysis is required to formally establish an interaction. Normalized severity scores could see beneficial application beyond interrogating the role of XCI in disease severity and provides a useful phenotypic measure in analysis of ongoing RTT genetics, metabolomics, and transcriptomics studies.

Keywords (if any): Rett Syndrome; computational modeling

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The Complicated History (and Present) of Sexual Education and the Disability Community

Sophia K. Meschces

Introduction: Relationships are important for all people, regardless of whether or not they have a disability. Yet, despite the reality that young adults with intellectual and developmental disabilities (IDD) generally have romantic, platonic, and sexual relationships and desires like their peers without disabilities, it is a subject not often discussed. Even more, navigating relationships can be challenging for young adults in the disability community. Individuals with IDD are also at a higher risk for sexual exploitation and abuse (cite), making it crucially important that educational programs support youth in developing safe and healthy relationships.

Methods: I conducted a review of the literature, focused on four key questions: (1) To what extent have individuals with disabilities been included in sexual and relationship education? (2) What are the historical implications of this inclusion or exclusion? (3) What curriculum(s) are available for individuals with disabilities related to sexual and relationship education? (4) What key concepts should be addressed in sexual and relationship education for individuals with IDD? Research is presented across three different levels; Level 1: Current Resources and Statistics, Level 2: Modern Disability Rights, and Level 3: Immediate Action.

Results: Results from the literature review confirm that young adults with IDD have romantic and relationship-driven desires like those of the rest the population, but they are also more susceptible to sexual abuse (McRuer & Mollow, 2012). Due to misinformation, limited training, and limited resources, most group homes, special education classes, and day programs do not discuss romance or sexuality; in fact, romantic relationships and sexuality is often heavily discouraged in these settings for youth with IDD when it is mentioned (Schwartz & Robertson, 2018). Providing disabled adults access to sexual lives is important for life with dignity, and it is therefore an issue of fundamental social justice with far-reaching consequences for everyone (Kulick & Rydstrom, 2016).

Discussion: This literature review maps research focused on the inclusion (and exclusion) of individuals with IDD in sexual and romantic education. Gaining a better understanding of this existing knowledge is a critical first step to ensuring the development of strong educational programs to help support youth, young adults, and older adults with IDD in developing safe and healthy relationships. The findings of this literature review also suggest important areas for further research.

Keywords (if any): Sexuality; Disability; Relationships

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Black Families' Experiences of Autism Diagnosis: Preliminary Parent Feedback to Inform Culturally Competent Care

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Introduction: 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. 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. 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).

Discussion: 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.

Keywords (if any): autism; screening; black

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P.I/Advisor: Biggs, Elizabeth

Transition Experiences of Black Youth with Autism

Asya Miles, Samuel Oyerinde

Introduction: The period of adolescence and young adulthood that marks the transition to adulthood is an especially important developmental period, setting trajectories for functioning and quality of life outcomes throughout adulthood. Yet, prior research has revealed disparities in outcomes and health and educational service access for youth with autism and for youth who come from racial and ethnic minority groups (Eilenberg et al., 2019). Research is needed to better understand and address these gaps and improve outcomes for Black youth with autism and their families. Our goal is to understand issues of the lived experiences of these families and youth (aged 14-24) themselves, particularly related to (a) youth well-being, (b) family quality of life, and (c) facilitators and barriers to experiencing a successful transition to adulthood.

Methods: We are conducting a descriptive qualitative study focused on understanding the experiences of parents of Black youth with autism during the transition to adulthood. We are working to complete data collection and analysis by November 2022 with the aim of recruiting 10-20 parents of Black youth with autism. We will focus on stratifying recruitment to include parents of youth (a) who use verbal speech to communicate and (b) who are mostly nonspeaking. This will allow us to explore differences in experiences for parents of youth with complex communication needs who are often excluded from similar research (Tager-Flusberg & Kasari, 2013). Each participant will complete an in-depth interview, and data are being analyzed using an inductive approach to qualitative content analysis.

Results: Data collection and analysis are underway and will be completed or nearing completion by November 2022. In our emerging findings, it is clear that families are identifying determinants of success across system-levels. Examples include financial burden, transportation challenges, parental strain, importance of knowledge of resources, and lack of sufficient service provider training.

Discussion: This translational study focuses on improving health and quality of life for Black youth with autism and their families by understanding families' experiences. Although existing research highlights health and service access disparities for this population (Eilenberg et al., 2019), research is needed that uses the first-hand voices of those with marginalized identities to improve outcomes. This study uncovers contextual determinants acting as facilitators and barriers to outcomes for youth and their families. We foresee that next steps could be to analyze the experiences of a larger, more diverse sample and to extend this study to other minority groups to compare in what ways there may be shared experiences. Further, the knowledge produced from this research can also be used to address practice and policy changes across systems-levels.

Keywords (if any): Autism; Transition; Black

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Preclinical assessment of nonsense suppression therapeutics for Rett Syndrome: determination of the functional consequence of MeCP2 readthrough and the potential for phenotypic rescue

Zeljka Miletic Lanaghan, Jonathan K. Merritt, Jeffrey L. Neul

Introduction: Rett Syndrome (RTT) is a neurodevelopmental disorder caused by mutations in Methyl-CpG-Binding Protein 2 (MECP2). Several lines of evidence from rodent studies imply that restoring functional MeCP2 has the ability to improve disease phenotypes even after symptom onset. Nonsense mutations are found in 30% of individuals with RTT, mostly via one of four recurrent mutations: R168X, R255X, R270X, and R294X. One strategy for treating genetic diseases caused by nonsense mutations is pharmacologically induced nonsense suppression. Aminoglycoside antibiotics that reduce translation fidelity by inhibiting ribosomal proofreading were the first identified readthrough compounds. However, at dose levels adequate to induce readthrough for therapeutic proposes, antibiotic aminoglycosides cause unacceptable oto- and nephro-toxicity. To overcome toxicity, ribosome selective glycosides (e.g., ELX-02) were developed and are now being tested in clinical trials for a variety of diseases caused by nonsense mutations. However, it is not known whether the readthrough is sufficient to improve the phenotypes of RTT.

Methods: Immortalized Mecp2R294X/Y fibroblasts were treated by 200 µg/ mL of ELX-02 for 72 hours. Following the treatment, cells were collected, lysed and nuclei isolated. Western blotting of nuclear protein lysates was performed to determine the full-length MeCP2. Furthermore, hemizygous male Mecp2R294X/Y and male littermate controls were surgically implanted with an ICV cannula at 10 weeks of life. After one week recovery, mice were treated with two doses of ELX-02 (low- 100 µg and high-200 µg) and saline as a control, three times a week for 7 days. 72 hours after final drug administration, animals were humanely euthanized, and brains were collected to evaluate full-length MeCP2 protein levels by Western blotting.

Results: Our results show that following treatment with ELX-02, both cellular (in vitro) and mouse models (in vivo) of RTT containing the R294X mutation resulted in production of full-length MeCP2 protein.

Discussion: As previously observed in the experiments using standard aminoglycosides, ELX-02 treatment indeed successfully produced a full length MeCP2 protein in both cellular and animal models containing R294X mutation. However, further in vivo studies will need to be performed to determine possible rescue of Rett like phenotypes after ELX-02 readthrough.

Keywords (if any): Rett; readthrough; aminoglycoside

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Relations Among Behavioral and Cognitive-Affective Features of Stuttering in Preschool-Age Children

Ryan A. Millager, Robin M. Jones

Introduction: Developmental stuttering manifests with a range of cognitive-affective responses (e.g., Tichenor & Yaruss, 2018) as well as overt speech and nonspeech behaviors that are heterogeneous in nature and variable across contexts (Johnson et al., 2009). Although contemporary researchers have developed models of stuttering to account for the diversity of symptoms associated with stuttering (e.g., Smith & Weber, 2017), many questions remain about relations among different behavioral, cognitive, and affective manifestations of stuttering. For example, many studies have found little or no relation between cognitive-affective responses to stuttering and overt stuttering behaviors in older children and adults (e.g., Blumgart et al., 2012; Werle et al., 2021), but findings are mixed for young children (Beilby et al., 2012; Winters & Byrd, 2021). And although there is a substantial body of literature describing between-group differences among children who do and do not stutter (see Conture, 2001), there is less insight into how different features of stuttering may or may not be related within children who stutter. Therefore, the purpose of this study was to investigate relations among behavioral and cognitive-affective features of stuttering in preschool-age children who stutter.

Methods: Participants were n = 296 preschool-age children who stutter (n = 218 male, n = 78 female). Extant participant data were collected at Vanderbilt University Medical Center as part of ongoing large-scale investigations of linguistic and emotional contributions to developmental stuttering (e.g., Jones et al., 2017), with protocols approved by the Vanderbilt University IRB. Ordinal regression analyses were conducted between and among several behavioral indices of stuttering: frequency of stuttering- and non-stuttering-like disfluencies (SLDs and NSLDs), ratios of repetitions and prolongations/blocks out of total number of SLDs, associated nonspeech behaviors, and duration of stuttering events; as well as with several cognitive-affective indices for stuttering: the Communication Attitude Test for Preschool and Kindergarten Children Who Stutter scores (KiddyCAT; Vanryckeghem & Grutten, 2007), and a sub-scale of the Test of Childhood Stuttering (TOCS; Gillam et al., 2009). Exploratory k-means cluster analyses were also conducted among subsets of participants, with all variables included as input.

Results: Most indices of overt stuttering behaviors were intercorrelated (e.g., more SLDs were associated with higher ratio of repetitions). Among cognitive-affective indices, caregiver-reported TOCS Disfluency-Related Consequences Rating Scale scores were associated with stuttering behaviors, while self-reported KiddyCAT scores were associated only with physical concomitants and ratio of prolongations and blocks. Cluster analyses yielded two participant groupings: a larger group with less prominent stuttering features and a smaller group with more prominent features.

Discussion: Findings contribute to an increasingly comprehensive and nuanced understanding of the heterogeneous features of stuttering and their development. By examining a large cohort of children who stutter, we have identified significant relationships between communication attitudes and prolongations, blocks, and physical concomitants. We have also explored cluster analyses for this population, revealing possible routes for future research and analysis.

Keywords (if any): stuttering; regression; cluster analysis

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Behavioral Response to Social Evaluative Threat Assessed Longitudinally in Adolescents with Autism Spectrum Disorder

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Introduction: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication, making psychosocial changes associated with puberty challenging. The Trier Social Stress Test (TSST) is a well-established paradigm involving exposure to social evaluative threat known to elicit a cortisol response in typically developing (TD) adolescents. While previous research has shown blunted salivary cortisol in adolescents with ASD in response to social evaluative threat, limited research exists regarding behavioral manifestations of stress. Displacement behaviors are self-directed actions thought to promote coping during stressful situations. We investigated behavioral responses to the TSST for youth with ASD and TD longitudinally to explore hypothesized discrepancies, predicting increased displacement behaviors for TD compared to ASD.

Methods: Youth with ASD (n=60) and TD (n=67) ages 10 to 13, were enrolled in a four-year longitudinal study on puberty. Participants were recorded during the speech portion of the TSST, for which displacement behaviors were operationalized (lip press/bite, face contact, grooming, fidgeting, fumbling) and coded (Observer XT). A series of repeated measures ANOVA were conducted to explore diagnostic differences (ASD/TD) across two years, examining each behavior individually, time spent engaged on-topic, and total displacement behaviors. Inter-rater reliability was calculated for each behavior on a random sample of ten participants, with Cohen's Kappa established at $K = 0.80$.

Results: TD adolescents demonstrated significantly more displacement behaviors during the speech task ($F(1,124)=3.769$, $p=0.054$), with significantly greater grooming ($F(1,125)=10.298$, $p=0.002$) and trend-level significance for fidgeting ($F(1,125)=3.592$, $p=0.060$). However, adolescents with ASD exhibited significantly greater face contact ($F(1,125)=4.508$, $p=0.036$). No significant diagnostic differences were found for fumbling or lip press/bite ($p>0.050$). TD youth spent significantly more time engaged on-topic during the speech ($F(1,125)=10.402$, $p=0.002$), which held after controlling for full-scale IQ. Overall, there was a significant effect for time within-subjects, with total displacement behaviors increasing from Year 1 to Year 2 ($F(1,124)=35.244$, $p<0.001$).

Discussion: Differences were observed between groups, ostensibly reflecting distinct response to social evaluative threat. TD adolescents demonstrated a significantly greater frequency of specific displacement behaviors and on-topic engagement, whereas adolescents with ASD showed reduced behavioral response suggesting they did not perceive the TSST as stressful. This may be due to the task's structured nature and requirements, suggesting that youth with ASD may respond to more naturalistic social paradigms. Notably, total displacement behaviors increased over development regardless of diagnosis, which may suggest an accompanying increase in stress. Further longitudinal research is needed to elucidate how puberty and age may modulate the stress response in adolescents with ASD to inform how they can be supported in forming positive social relationships and navigating the transition to adulthood.

Keywords (if any): Autism; Stress; Behavior

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Understanding Information Sharing and Parent Experiences of Latinx Families to accessing ASD Care within a Family Navigation Model

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Introduction: Children from ethnically and linguistically diverse backgrounds with autism spectrum disorder (ASD) face numerous barriers to accessing care. In particular, Latinx families have a challenging time accessing diagnosis and services.1 In 2019 our team established a statewide Family Navigation Network dedicated to connecting underserved families to community resources and services. To better understand family utilization of our navigation model and barriers to care encountered after diagnosis, we examined contact notes for 243 Latinx caregivers of children with or at risk of ASD.

Methods: Families were referred for navigation by a primary care provider or early interventionist. Participants included 102 English-speaking and 141 Spanish-speaking Latinx caregivers (94.7% female) of children aged 15 months to 7 years. Navigators contacted families before and after diagnosis to offer support, resources, and listen to caregiver concerns. Contact notes were logged in a REDCap database and input into Dedoose, a qualitative data coding program. Conversations were coded through an iterative, ongoing process to code note content into three broad domains: Parent Needs, Parent Experiences, and Service Access. While the Parent Needs domain included resources that Navigators shared with families, the latter two categories comprised information spontaneously shared by caregivers with navigators during calls.

Results: Mean age at point of referral was 33.6 months (72.4% male, 27.6% female). Families lived in 30 different counties, 14 of which are medically underserved areas (46.7%), 11 of which have medically underserved populations (36.7%), and 16 of which are rural (53.3%). Navigators shared information about at least one resource with 73.3% of families. The resources shared most often were print resources (28.4%), online training videos (24.7%), caregiver training workshops (24.7%), school services (22.7%), and Tennessee Disability Pathfinder (21.4%) (Table 1). Almost half of caregivers (46%) shared their own questions, feelings, and experiences with the navigation team; 18.1% expressed concerns, 15.2% expressed knowledge or lack thereof of ASD, and 9.9% expressed confusion. In conversations regarding service access, 42.4% of families reported at least one barrier to care. Common barriers included language (8.6%), economic difficulties (8.2%), and technology (7.8%) (Table 2).

Discussion: Qualitative analysis of contact notes with Latinx families provided insight into caregiver needs and experiences before and after receiving an ASD diagnosis for their child. Navigators shared resources with nearly three quarters of families while families shared information about their lived experiences with navigators, highlighting the reciprocal relationship of family navigation. Future research should continue to expand on the navigation model to identify needs and create targeted ways to aid families with a child with or at risk for ASD.

Keywords (if any): Autism Spectrum Disorder; Family Navigation; Care Coordination

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Relating executive functions to situation model building and comprehension processes in expository text reading

Tin Q. Nguyen, Laurie E. Cutting

Introduction: Reading comprehension draws on readers' ability to construct a situation model of ideas described in a text. Constructing a coherent situation model is related to readers' sensitivity to ideas that are important, or central, to the text (versus those that are less important, or peripheral, to the text). Studies have linked differences in executive functions (EF) to comprehension performance, potentially more so for expository texts. EF, a set of goal-oriented behaviors, has been dissociated to include working memory (WM) and cognitive flexibility (CF). Whereas WM is thought to enable storage and manipulation of phonological and/or visuospatial information, CF refers to the ability to coordinate cognitive processes and shift between sources of information. This study aimed to evaluate the extent to which these EF components relate differentially to readers' situation model building and comprehension processes in expository text reading.

Methods: Data were drawn from 143 participants (9-15 years old; 55% girls). For each participant, WM was evaluated with Sentence, Digit, and Spatial Span tests, while CF was captured using Card Sorting test. Participants were also asked to read in-house passages, where free retell of the texts were assessed after each reading using a checklist, and then answer comprehension questions. Centrality of different idea units was determined by independent adult raters, and then used to identify which ideas the participants recalled were central to the passage to index situation model building. Comprehension questions were created for each passage to measure participants' abilities to answer about literal information or make interpretation about the contents. Analyses followed latent variable modeling strategies, where covariates included readers' demographic information (grade, biological sex, and parents' educational attainment), vocabulary knowledge, and word-reading efficiency.

Results: Results revealed that EF components were differentially related to situation model building processes, and in turn different types of comprehension questions. Analysis 1 found that WM but not CF was associated with recall of peripheral ideas. Both WM and CF were related to recall of central ideas, which in turn predicted readers' overall comprehension outcomes. Analysis 2 suggested that WM was associated with the link between peripheral ideas and responses on factual questions. WM and CF were related to the link between central ideas and performance on interpretation questions.

Discussion: These findings provide insights on how EF components may facilitate situation modeling building in text comprehension.

Keywords (if any): Reading Comprehension; Executive Functions

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Biggs, Elizabeth

Transition Experiences of Black Youth with Autism - Youth Wellbeing and Family Quality of Life

Samuel A. Oyerinde, Jr., Asya T. Miles

Introduction: The period of adolescence and young adulthood that marks the transition to adulthood is an especially important developmental period, setting trajectories for functioning and quality of life outcomes throughout adulthood. Yet, prior research has revealed disparities in outcomes and health and educational service access for youth with autism, and for youth who come from racial and ethnic minority groups (Eilenberg et al., 2019). Research is needed to better understand and address these gaps and improve outcomes for Black youth with autism and their families. The purpose of this presentation is to share the aim, method, and findings of research focused on understanding the experiences parents with Black youth with autism (aged 14-24) related to the transition to adulthood. Our goal is to understand issues of the lived experiences of these families and youth themselves, particularly related to (a) youth well-being and (b) family quality of life.

Methods: We have been conducting a Mixed Method Convergent Parallel study focused on understanding the experiences of parents with Black youth with autism during the transition to adulthood. We are working to complete data collection and analysis this fall (by November 2022), with the aim of recruiting 10-20 parents of Black youth and young adults with autism. We will focus on stratifying recruitment to include parents of youth (a) who use verbal speech to communicate and (b) who are mostly nonspeaking. This interest is to be able to explore differences in experiences for parents of youth with complex communication needs, particularly because approximately 30% of youth and young adults with autism are mostly nonspeaking, and this population has often been excluded from other similar research (Tager-Flusberg & Kasari, 2013). Each participant will complete an in-depth interview, and data are being analyzed using an inductive approach to qualitative content analysis (Thomas, 2006). The minor quantitative survey data that we are collecting on the side will be analyzed using basic descriptive statistics.

Results: Data collection and analysis are underway, and will be completed or nearing completion by November 2022. In our emerging findings, it is clear that families are identifying determinants of success across system-levels (e.g., familial factors, practice-level factors, policy and system-level factors). Examples include financial burden, transportation challenges, parental strain, importance of knowledge of resources, and lack of sufficient service provider training.

Discussion: This translational study focuses on improving health and quality of life for Black youth with autism and their families but understanding families' experiences. Although existing research highlights health and service access disparities for this population (Eilenberg et al., 2019), research is needed that uses the first-hand voices and experiences of those with marginalized identities (both related to disability and race) to improve outcomes). This study uncovers contextual determinants acting as facilitators and barriers to outcomes for youth and their families, including related to employment, independent and community living, youth psycho-social well-being, and family quality of life. We foresee that next steps within this area could be to analyze the experiences of a larger and more diverse sample and to extend this study to other minority groups to compare in what ways there may be shared experiences. Further, the knowledge produced from this research can also be used to address practice and policy changes across systems-levels that would make it easier for marginalized youth with disabilities and their families to experience the best possible quality of life.

Keywords (if any): Autism; Transition; Black

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Evaluation of the therapeutic potential of ketamine in a mouse model of Rett syndrome

Michelle K. Piazza, Ege T. Kavalali, Jeffrey L. Neul, Lisa M. Monteggia

Introduction: Rett syndrome (RTT) is primarily caused by mutations in the gene methyl-CpG binding protein 2 (MECP2), representing the second leading cause of intellectual disability in females. Multiple lines of investigation have implicated the N-methyl-D-Aspartate receptor (NMDAR) in the pathophysiology of RTT, as dysfunction of MeCP2 alters the development of NMDARs, contributing to an imbalance of inhibitory and excitatory neurotransmission. Interestingly, both genetic manipulation and pharmacological blockade with the NMDAR antagonist ketamine have shown efficacy in reversing electrophysiological deficits, while a small number of studies have demonstrated an ability of systemic ketamine treatment to rescue behavioral symptoms of RTT and extend lifespan in an animal model. However, a thorough characterization of ketamine's modulation of RTT symptoms and its molecular underpinnings are warranted. Our lab has demonstrated that ketamine administration causes desuppression of brain derived neurotrophic factor (BDNF) protein synthesis in the mouse hippocampus, enhancing glutamatergic activity and alleviating depression-like symptoms. As BDNF is similarly down-regulated in animal models of RTT, it is plausible that this mechanism may be convergent between these disparate disorders.

Methods: We explored this possibility utilizing biochemical and electrophysiological paradigms in an Mecp2 constitutive knockout mouse model. We used western blotting to quantify protein expression of BDNF. Neurotransmission phenotypes were assessed via measurement of local field potentials in both excitatory and inhibitory circuits of the hippocampus.

Results: Indeed, our findings show an up-regulation of hippocampal BDNF protein expression in wild type and Mecp2 knockout mice following systemic ketamine treatment. Furthermore, electrophysiological examination of field excitatory post-synaptic potentials (fEPSPs) revealed a concomitant potentiation of the fEPSP response in wild type and knockout animals. However, ketamine induced potentiation of fEPSP responses is blunted in animals lacking expression of functional MECP2 protein. Interestingly, this effect appears to be dynamic across development in Mecp2 knockout mice. On the contrary, we also measured field inhibitory post-synaptic potentials (fIPSPs) of the hippocampus and revealed a modest ketamine induced depression of inhibitory activity in both wild type and MeCP2 KO mice.

Discussion: This study demonstrates for the first time, to our knowledge, the effect of ketamine treatment on inhibitory signaling in the hippocampus. Furthermore, our parallel investigation of excitatory and inhibitory signaling in the hippocampus provides an important perspective on ketamine's modulation of the balance of neurotransmission in both wild type mice and mice modeling Rett syndrome. Taken together, this study contributes to the growing investigation of ketamine's therapeutic efficacy and putative molecular action in RTT.

Keywords (if any): Rett syndrome; neurotransmission; ketamine

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Kaiser, Ann

Durability of Early Communication Interventions: A Meta-analysis

Natalie S. Pak, Kelsey M. Dillehay, Jason C. Chow, Caroline Wilkerson, Ann P. Kaiser

Introduction: Early communication interventions can be effective for children with a variety of etiologies of language impairments (Fuller & Kaiser, 2020; Hampton & Kaiser, 2016; Heidlage et al., 2020; Roberts et al., 2019). Determining whether effects persist beyond the end of intervention is essential to understanding the overall efficacy of these interventions. In the current systematic review and meta-analysis, we investigated whether early language and communication interventions were effective when outcomes were measured at least 3 months post-intervention.

Methods: We conducted a systematic search for experimental and quasi-experimental group design studies involving young children with language disabilities. We coded study characteristics (design, participants, experimental conditions, results) and calculated standardized mean differences (SMD) at long-term measurement points. We then meta-analyzed these effect sizes using robust variance estimation (RVE). RVE accounts for dependence among effect sizes, thus allowing inclusion of multiple effect sizes from each study in the analysis (Hedges et al., 2010). We also explored the influence of potential moderators.

Results: Twenty studies with 129 effect sizes were included in analyses. Interventions were 1-13 months long (M=3.8), and most (k=14) were caregiver-implemented. The average age of child participants was 33.9 months (10.6-58.3 months). The etiologies of children's language impairments were primary language impairments (n=640) or autism spectrum disorders (ASD) (n=999). Studies were conducted in seven different countries, but race/ethnicity and home languages were underreported. Long-term measures were collected 3-71 months after the end of intervention (M=10.3). The overall effect size at long-term timepoints was small and significant (g=.218). Significant moderators included the type of outcome and the effect size at post-test. Effects on prelinguistic outcomes were larger than effects on linguistic outcomes overall and effect sizes for linguistic outcomes were larger for children with primary language impairments than for children with ASD. Larger post-test effect sizes were associated with larger long-term effect sizes.

Discussion: Findings from this meta-analysis provide modest evidence that intervention effects persist and potentially improve children's longer term communication development. Specifically, long-term effects were significant for prelinguistic outcomes when measured with children with ASD and for linguistic outcomes when measured with children with primary language impairments. Larger posttest effects were associated with larger effects persisting over time.

Keywords (if any): Language and Communication; Early Intervention; Meta-Analysis

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Cutting, Laurie

The Relation Between Reading and Externalizing Behavior: A Correlational Meta-Analysis

Sage E. Pickren, Laurie E. Cutting

Introduction: Reading proficiency is important because it has life-long consequences and influences success in other academic areas. Many students with behavior problems are poor readers and many students with learning disabilities have more behavior problems than their typical peers. Prior systematic reviews have revealed that students with reading disabilities have higher levels of internalizing and externalizing behavior than their typical peers. While these reviews report the level of internalizing and externalizing behavior for poor readers, they do not examine the association or correlation between the constructs of reading and externalizing behavior in a heterogenous and representative population.

Methods: We conducted a correlational meta-analysis to examine the concurrent and longitudinal association between reading and externalizing behavior in students ages 5-12. We identified 32 studies that reported 86 effect sizes. We used a random-effects linear regression model with robust variance estimation to aggregate the effect sizes both concurrently and longitudinally.

Results: We found a significant, negative correlation ($r = -0.1747$, $SE = 0.0117$, $p < .0001$) between reading and externalizing behavior. We tested several moderators related to measurement and sample characteristics. We found that rater type, behavior dimension (e.g., aggression), time between longitudinal measurement points, age of the sample, and percentage male of the sample moderated the relation between reading and behavior. Whether the reading assessment measured comprehension or word reading and socioeconomic status of the sample did not moderate the relation.

Discussion: Understanding the association between reading and externalizing behavior has implications for disability identification and intervention practices for children in elementary school. Future research should examine shared cognitive factors and environmental influences that explain the relation between the constructs.

Keywords (if any): reading; externalizing behavior

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Cascio Carissa

Identifying and Describing Subtypes of Spontaneous Empathic Facial Expression Production in Autistic Adults

Jennifer M. Quinde Zlibut, Anabil Munshi, Gautam Biswas, Carissa Cascio

Introduction: It is unclear whether atypical patterns of facial expression production metrics in autism reflect the dynamic and nuanced nature of facial expressions across people or a true diagnostic difference. Further, the heterogeneity observed across autism symptomatology suggests a need for more adaptive and personalized social skills programs. Towards this goal, it would be useful to have a more concrete and empirical understanding of the different expressiveness profiles within the autistic population and how they differ from neurotypicals.

Methods: We used automated facial coding and an unsupervised clustering approach to limit inter-individual variability in facial expression production that may have otherwise obscured group differences in previous studies, allowing an "apples-to-apples" comparison between autistic and neurotypical adults. Specifically, we applied k-means clustering to identify subtypes of facial expressiveness in an autism group (N=27) and a neurotypical control group (N=57) separately. The two most stable clusters from these analyses were then further characterized and compared based on their expressiveness and emotive congruence to emotionally charged stimuli.

Results: Our main finding was that a subset of autistic adults in our sample show heightened spontaneous facial expressions irrespective of image valence. We did not find evidence for greater incongruous (i.e., inappropriate) facial expressions in autism. Finally, we found a negative trend between expressiveness and emotion recognition within the autism group.

Discussion: The results from our previous study on self-reported empathy and current expressivity findings point to a higher degree of facial expressions recruited for emotional resonance in autism that may not always be adaptive (e.g., experiencing similar emotional resonance regardless of valence). These findings also build on previous work indicating that facial expression intensity is not diminished in autism and suggest the need for intervention programs to focus on emotion recognition and social skills in the context of both negative and positive emotions.

Keywords (if any): autism spectrum disorders; facial expression production; empathy

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Theme: Cellular & Molecular Neuroscience
P.I/Advisor: Ess, Kevin

Fighting the Fire: HIKESHI-mediated hypomyelinating leukodystrophy

Sudiksha Rathan-Kumar, Grant Westlake, Kevin C. Ess

Introduction: Heat shock response is the cellular response to physiological stressors such as temperature changes, oxidative stress, and infection. During the response, chaperone proteins work to fold and refold damaged proteins to maintain cellular integrity. HIKESHI is a nuclear import carrier that carries the chaperone protein, HSP70 into the nucleus during heat shock response. Mutations in the HIKESHI gene resulting in homozygous loss of function lead to a rare hypomyelinating leukodystrophy with symptoms including developmental delay, microcephaly, paraparesis, and increased sensitivity to febrile illness. We hypothesize that lack of HIKESHI protein leads to altered localization and function of HSP70 resulting in the hypomyelinating leukodystrophy phenotype.

Methods: Skin biopsies were collected from an affected homozygous patient, their non-symptomatic heterozygous parent, and a healthy (wild-type) individual and fibroblasts were generated. The fibroblasts were exposed to no heat shock, heat shock, and recovery conditions. Immunofluorescent staining and western blots for various protein markers were conducted. RNA Sequencing was performed to analyze expression levels under the different conditions. Fibroblasts were also reprogrammed into iPSCs to be differentiated into neurons and oligodendrocytes for further analysis.

Results: Western blot data indicated that heterozygous carrier cells produced half the amount of HIKESHI protein implying that only partial restoration of protein was required to alleviate the leukodystrophy phenotype. Immunofluorescent staining indicated that compared to wild-type and heterozygous phenotypes, Hsp70 and other heat-shock proteins displayed altered localization in the homozygous phenotype. RNA sequencing indicated changes in homozygous protein expression levels under different conditions.

Discussion: Thus, loss of HIKESHI results in Hsp70 mislocalization and heat shock mechanism changes. Future analysis on restoration of function or drug alternatives could provide therapeutic treatments for HIKESHI-mediated hypomyelinating leukodystrophy.

Keywords (if any): Leukodystrophy; Neurodegenerative

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Schizophrenia Spectrum Disorders in Middle Eastern and North African Populations

Katrina Rbeiz, Salma Khaled, Sohee Park

Introduction: Psychotic disorders present a leading public health problem and have a lifetime prevalence of 7% globally. Middle Eastern and North African (MENA) individuals are among the most vulnerable populations, as they have been historically understudied due to the erasure of representation in key demographic questionnaires, leading to major gaps regarding the culturally specific ethnic trauma they endure. Even less is known on why or how MENA populations develop psychotic symptoms and disorders.

Methods: We conducted an extensive literature review using the following search terms: (MENA OR "Middle Eastern" OR "Arab American" OR Arab OR "Middle East") AND (schizo* OR psychosis OR schizophrenia OR schizotypy OR psychotic).

Results: Several publications supported the view that discrimination, traumatic life experiences, and stress are associated with increased psychosis experiences. The literature also linked key psychosocial factors, like migration, ethnic and religious identity to an increase in psychotic experiences in MENA populations. The literature further revealed the increase in stigma MENA populations face due to the lack of resources and acceptance of psychosis within their culture, family, and religious structures.

Discussion: Through centering MENA identities, we urge for future research to examine the relationship of ethnic trauma with experiences of psychosis. This research not only promotes the inclusion of an understudied ethnic identity, but also presents a public health concern for MENA populations who are unable to access resources that may promote resiliency and protection. Cross-cultural interventions and studies are needed to address this social justice issue and to better understand the risk and protective factors for this given population.

Keywords (if any): Schizophrenia Spectrum Disorders; Middle Eastern and North African; Psychosocial

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Gray Matter Volume Associations with ADHD Subtypes in Early Adolescence

Gabrielle E. Reimann, Hee Jung Jeong, E. Leighton Durham, Tyler M. Moore, Randolph M. Dupont, Antonia N. Kaczkurkin

Introduction: Attention-deficit/hyperactivity disorder (ADHD) is among the most common neurodevelopmental conditions in the United States, affecting more than six million children (1). As such, it is imperative to understand the neurobiological etiology of ADHD and its core features (predominantly inattentive, predominantly hyperactive/impulsive; 2). While existing literature reports cortical and subcortical reductions in gray matter volume among those with ADHD, studies often do not differentiate between ADHD's core features of inattention and hyperactivity/impulsivity which may have important structural distinctions (3;4). The present study sought to examine the neurostructural heterogeneity of ADHD's inattention and hyperactivity/impulsivity features.

Methods: We analyzed over 10,000 9-to-10-year-old children from the Adolescent Brain Cognitive Development (ABCD) Study. We implemented a confirmatory factor analysis (CFA) on item-level data from the Child Behavior Checklist (CBCL) to operationalize inattentive and hyperactive/impulsive features as two continuous factors of ADHD. Using structural equation modeling, we then examined these inattentive and hyperactive/impulsive factors' associations with the gray matter volumes of 68 cortical and 19 subcortical regions. Sensitivity analyses accounted for socioeconomic status, medication status, and in-scanner motion, as well as total intracranial volume.

Results: The CFA model achieved adequate fit (CFI = .91, RMSEA = .04, SRMR = .04) and included 15 ADHD-related CBCL items (e.g., talks too much, fails to finish things; 5). Following false discovery rate (FDR) correction for multiple comparisons, the hyperactivity/impulsivity factor was inversely associated with gray matter volume in 25 out of 68 cortical regions (pfdr-values ≤ .046). Further, hyperactivity/impulsivity symptoms were inversely associated with gray matter volume in 10 out of 19 subcortical regions (pfdr-values ≤ .027). There were no significant associations between gray matter volume and the inattentive factor. When accounting for socioeconomic status, medication status, and in-scanner motion, hyperactivity/impulsivity significance was retained for 9 of the cortical regions (pfdr-values ≤ .045) and 6 of the subcortical regions (pfdr-values ≤ .027); however, results did not survive when accounting for total intracranial volume.

Discussion: Prior ADHD work complements the present study's associated structural deficits, such as cortical reductions in middle temporal, superior temporal, and precentral gyri, as well as subcortical reductions in the caudate, hippocampus, and cerebellar cortex (3,4,6). Notably, the present study extends prior work by underscoring neural specificity of these deficits to hyperactive/impulsive features. Past literature has highlighted the need to determine biologically homogenous groups within the broader heterogeneous disorder of ADHD (7). Findings from the present study could refine our understanding of ADHD subtypes, allowing for greater usefulness of subtype diagnosis in research and clinical fields.

Keywords (if any): ADHD; Gray matter volume; early adolescence

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Kaiser, Ann

Telehealth Caregiver-Mediated JASP-EMT for Toddlers with ASD: Examining Generalization and Maintenance in a Second Iteration

Mary E. Rodgers, Kathryn M. Bailey, Emily D. Quinn, Suzanne Thompson, Jennifer Nietfeld, Kimberly McCulla, Ann P. Kaiser

Introduction: The primary purpose of this study was to evaluate the effects of telehealth training on caregivers' use of language support strategies in interactions with their young children with autism, while incorporating changes informed by the first iterations social validity measures. The secondary purpose of this study was to evaluate the effects of training on caregiver's generalization and maintenance of language support strategies in interaction with their young children with autism outside of the treatment context. The secondary purpose and related research questions will be discussed in this poster session. Research Questions: Do caregivers generalize the language support strategies outside of the treatment context with their young children with autism? Do caregivers maintain the language support strategies outside of the treatment context with their young children with autism?

Methods: Three toddlers with ASD with limited language and their caregivers participated. Intervention targeted caregiver use of core JASP-EMT strategies (i.e., Engagement, Language, Play, Prompting) in a multiple baseline across behaviors SCD. Following training on a JASP-EMT strategy, therapists coached caregivers to implement strategies with their children. Formative social validity data were collected in an initial demonstration of this protocol. Those data were used to inform the current study. Our team updated materials, procedures, and training protocols to reflect caregiver preferences. The lead therapist conducted all teaching and practice sessions through the six phases of the study (i.e. Baseline, Engagement, Language, Play, Prompting, Maintenance). Generalization data were collected for a minimum of 20% of all sessions for each phase. Maintenance data were collected five times one month post caregiver training. Sessions followed a systematic coaching protocol, Teach-Model-Coach-Review. Visual analysis of caregiver fidelity data was used to inform phase change decisions and identify the presence of functional relations. Formative social validity were collected weekly using the MyCap data capture tool. Summative social validity on caregiver experience was collected through a semi-structured exit interview with an experienced staff member of the research lab.

Results: All caregivers increased their use of EMT strategies above baseline levels. Caregivers responded positively to the adaptations of the second iteration. Generalization and maintenance data indicate that caregivers can generalize and maintain the strategies outside of the treatment context.

Discussion: The results of this study allowed us to explore the generalization and maintenance of caregivers' use of language support strategies in interactions with their young children with autism. Caregivers could use JASP-EMT strategies at adequate levels of fidelity outside of coaching sessions, over time, and without therapist support. These results have been used to inform a third iteration of this line of research.

Keywords (if any): Autism; Intervention; Telehealth

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Carter, Erik

Disability Ministry Leaders Study

Erik Carter, Hannah Rowley, Caroline Parker, Haley Bower, Allison Koehler

Introduction: The purpose of this qualitative study is to explore the current landscape of disability ministry and its impact. Our findings could provide practical guidance to individual churches, to denominations, to seminaries, and to parachurch ministries that are seeking to increase congregational inclusion. Our research questions are as follows: 1. What are the diverse forms that disability ministry takes and why? 2. What are the challenges and complexities in this area of ministry? 3. What resource and training needs do ministry leaders identify as most pressing? 4. What is the impact of this ministry on people with disabilities and their families? 5. What is the impact of this ministry on the church as a whole? This poster will focus on the fourth of these questions (What is the impact of this ministry on people with disabilities and their families?)

Methods: This study has involved individual interviews with disability ministry leaders and volunteers. These took place both virtually and in person. The interviews gathered background data and then addressed nine primary topics: ministry description, roles and responsibilities, church motivation, views on inclusion, complexities and tensions, impact on people with disabilities and families, impact on the church, resource needs, and wrap-up questions. Finally, we also took an intake survey to gather basic data.

Results: While this project is still going on, the results are not finalize. However, here are some areas of impact that families and individuals with disabilities have discussed: connectedness, increased involvement, changed mindsets, and others. Each of these areas above serve as umbrellas to more specific areas of impact (i.e. increased attendance, building friendships, etc.)

Discussion: These results imply that churches and individuals benefit from the church stepping into the area of ministry. Additionally, some of the areas of impact imply that more training may be needed for churches to be able to step into these areas. Finally, the results also imply that not all disability ministries will look the same.

Keywords (if any): Disability; Ministry;

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P.I/Advisor: Park, Sohee

Trauma is Associated with Psychosis-Risk and Felt Presence in the General Population

Sangimino, M., Lee, H., Baxter, T., Griffith, T., & Park, S.

Introduction: Trauma has been linked with increased risk for mental health conditions including psychosis. Having traumatic experiences is known to affect mood, stress sensitivity, and subjective wellness in social interactions, but its link to self-disturbance and psychotic symptoms is still unclear. In the current study, we first examined the relationship between trauma and psychosis in the general population. We then focused on the potential role of trauma in felt presence experience (FPE)- a specific subset of psychotic-like experiences.

Methods: We conducted two anonymous online surveys examining trauma, general mental health, and psychosis risk. In the first survey (n=347; mean age=31.4; 83.5% women), we collected information on the presence of past trauma from the participants. Depression, Anxiety, and Stress Scale (DASS), the UCLA Loneliness Scale and the Prodromal Questionaire-16 (PQ-16) were also administered to assess mental health. In the second survey (n=172; mean age= 36.6; 61% women), the Brief Trauma Questionnaire (BTQ), the DASS, UCLA, and PQ-16 were administered. We also asked about felt presence experiences using a self-report measure. Bonferroni correction was applied to minimize Type I errors.

Results: In the first survey, 52% of participants reported experiencing at least one traumatic event in the past and this group was majority females and younger. Participants with a history of trauma scored higher on the PQ-16, DASS, and UCLA loneliness; trauma was associated with psychosis-risk, depression, anxiety, stress and loneliness. In the second survey, 64% of participants reported experiencing at least one traumatic event in their lives and this group were older than those who reported trauma in the first survey. In the second study, participants with a history of trauma scored higher for PQ-16 and DASS depression but not DASS anxiety, DASS stress, or UCLA loneliness. Importantly, trauma was associated with experiencing felt presence.

Discussion: Participants who reported trauma demonstrated worse mental health profiles in both surveys including elevated risk for psychosis and depression. In addition, younger participants with trauma were also more likely to report increased anxiety, stress and loneliness than those without trauma. In older participants from Survey 2, those with trauma were also more likely to report felt presence experiences. These findings suggest that experience of trauma is associated with increased psychosis-risk and worse mental health across different age groups. However, it would be important to further examine types of trauma and individual differences in resilience despite trauma, and to investigate the role of felt presence in psychosis-risk in the future.

Keywords (if any): Trauma; Psychosis-Proneness; Felt-Presence

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Biggs, Elizabeth

Parent-Child Interactions During Home Shared Book Reading Activities for Children Learning to Use Speech-Generating Devices

Kendra E. Scotti

Introduction: A common activity between parents and their child is to participate in shared book reading. Shared book reading is an activity in a child's natural environment that provides a frequent opportunity for parents to support their child's communication, language, and emergent literacy development and is correlated to later life outcomes in literacy (Beukelman & Light, 2020). However, when a child has complex communication needs, back-and-forth interactions may not come as easily for parents as they would if their child did not have a communication disability (Biggs & Maedan, 2018). The goal of my study is to better understand the communicative nature of elementary-aged children (K-4th grade) during parent-child shared reading, these children have complex communication needs and are learning to use speech-generating devices (SGD). Additionally, this study will also examine how the rate of children's linguistic communication is associated with features of parent talk.

Methods: Participants are approximately 18 families whose children had access to a speech-generating device at home, that were involved in a larger longitudinal mixed method study focused on language and literacy learning of children with complex communication needs during the COVID-19 pandemic. Using Systematic Analysis of Language Transcripts (SALT), video observational data was coded based on the features of parent and child communication (i.e. form, function, focus, responsivity, frequency, rate, and use of SGD) during shared book reading interactions. The data will be analyzed using SPSS to determine (1) the nature of communication for children learning to use speech-generating devices during shared book reading with their parents and (2) if there are associations between the rate of children's linguistic communication and the features of parent talk that occurs during parent-child shared book reading.

Results: The prior recorded shared book reading videos are currently in the process of coding and data analysis and will be completed or near completion by the end of October 2022. In initial findings, the amount of scaffolding parents use during shared book reading affects children's linguistic communication.

Discussion: This study focuses on what features of parents' linguistic talk during shared book reading can improve the rate and frequency of their child's linguistic communication (i.e., with speech and/or the SGD). A stronger understanding of this association can provide parents, who have previously said that they do not feel comfortable with using AAC at home (Berenguer et al., 2022), with a way to support their child's communication. Additionally, this study addresses the previously stated need for more future research on parent-child shared reading interactions that involve AAC (Fleury & Hugh, 2018; Tipton et al., 2017; Westerville et al., 2020).

Keywords (if any): Shared Book Reading; Augmentative and Alternative Communication; Speech-Generating Device

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Mind the NIH-Funding Gap: Structural Discrimination in Physical Health-Related Research for Cognitively Able Autistic Adults

Audrey M. Scudder, T.A. Meridian McDonald

Introduction: Autistic adults experience disparities in physical health and health care access. A major barrier to addressing these disparities is a lack of federal funding for research on this topic. In seeking funding from the National Institutes of Health (NIH), we discovered nodes that contribute to structural discrimination in physical health-related research for autistic adults.

Methods: To examine this structural discrimination, we systematically searched funded research on all physical health-disparity conditions in autistic adults identified by Crown et al. (2015) using NIH RePORTER. The abstracts of the returned grants were then examined and categorized.

Results: Among the 61 unique studies returned by our searches, only 12 explicitly included autistic adults in their target population. None focused on improving the relevant physical health condition through intervention, programs, or services for autistic adults.

Discussion: The lack of NIH-funded research addressing health disparities in autistic adults demonstrates that we need updated policies and procedures that support research on physical health disparities in populations with developmental or mental health conditions.

Keywords (if any): Autism; Discrimination; Physical Health

References:

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P.I/Advisor: Lense, Miriam

Vocal Temporal Dynamics of Parent-Child Interactions in Autism throughout a Parent Coaching Program: An Exploratory Study

Yunah Song, Camila Alviar, Miriam Lense

Introduction: Timing is essential for successful parent-child social interactions for both autistic (ASD) and typically developing (TD) children. It involves the rhythm and frequency of individuals' vocalizations and the relative timing between the two partners' vocalizations. TD and ASD parent-child dyads show differences in the acoustic hierarchical temporal structure (HTS) of their vocal interactions, a measure of nested clustering of acoustic events across multiple timescales (Boorom, Alviar et al., 2022). In TD dyads, HTS decreases with increasing child language skills, reflecting increasingly flexible interactions. In contrast, ASD dyads exhibit greater HTS than TD dyads of similar developmental or expressive language levels, suggesting social reciprocity also plays a role in interaction dynamics. In the current study, we explore whether HTS can capture meaningful changes in parent-child dynamics during a parent coaching intervention for parents of children with developmental delays targeting skills to more effectively engage with their child.

Methods: Three mother-child dyads (2 ASD, 1 language delay) participated in a 10-week parent-coaching intervention (1 telehealth and 2 in-person). 10-minute free-play interactions were video recorded weekly for baseline, treatment, and follow-up sessions. We denoised the audio signals and measured their HTS using a novel automated metric. Allan Factor (AF) analysis extracts peak amplitude events from acoustic signals and measures their variability at 12 logarithmically-spaced timescales (0.0146-second to 30-seconds). We fitted a quadratic polynomial to the relationship between variability and timescale to quantify nestedness of events across timescales or HTS. The linear slopes for each available session were calculated for each dyad, and the changes in slopes throughout the intervention were visually inspected for common patterns across dyads.

Results: Preliminary exploratory analyses indicate high inter- and intra-individual variability in HTS across sessions and dyads throughout the intervention. However, similarities were present across sessions focused on increasing parent non-verbal engagement, in which parents also perceptibly reduced their vocalizations. For example, AF slopes were greater for all dyads during the session focused on teaching parents to contingently imitate their child's play.

Discussion: Vocal HTS reflects the changing interactional dynamics during dyadic exchanges, as reflected in the high intra and inter-individual variability in HTS. Increased HTS during sessions where parents vocalized less indicates volubility is a contributor to HTS, and highlights vocal AF's limitations in measuring non-verbal reciprocity. Consistent with prior studies (Boorom et al., 2022), overall HTS was elevated in dyads with autism and language delays. Future directions include examining behavioral correlates (e.g., parent-child shared engagement, frequency of vocalizations, and parent mental health) of observed changes in HTS throughout the intervention to explore other relevant variables affecting HTS.

Keywords (if any): Parent-Child Interactions; Hierarchical Temporal Structure; Interaction Dynamics

References:

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Theme: Cellular & Molecular Neuroscience
P.I/Advisor: Broadie, Kendal

FMRP coordinates pMad and Insulin signaling for glial clearance of developmentally-transient brain neurons

Chunzhu Song, Kendal Broadie

Introduction: Fragile X syndrome (FXS) is a leading neurodevelopmental disease condition most frequently caused by epigenetic loss of Fragile X Mental Retardation Protein (FMRP). In the well-established Drosophila FXS disease model, we showed neuronal FMRP activates insulin signaling to drive glial phagocytosis for the clearance of developmentally transient brain neurons (Vita et al., 2021). However, the mechanism of this neuronal FMRP-driven glial clearance is complex and still being elucidated. More recently, we showed FMRP is also required to restrict neuronal phospho-Mad (pMad) signaling (Song et al., 2022). As an activated transcription factor, pMad directly targets insulin receptor DNA in ChIP assays. We therefore hypothesized neuronal FMRP regulates pMad-insulin signaling to drive glial phagocytosis of neurons.

Methods: In this study, we use pigment-dispersing factor-Tri (PDF-Tri) neuron removal by glia as our experimental system. The cellular interaction between neurons and glia is imaged with confocal fluorescent microscopy. We measure PDF-Tri neuron clearance with multiple targeted RNAi manipulations to test how neuronal FMRP-pMad-insulin signaling mediates glial phagocytosis. We use qPCR, Western blots and RNA-immunoprecipitation to test molecular interactions in the pathway.

Results: We discover that neuronal FMRP limits insulin receptor (InR) expression by restricting Bone Morphogenetic Protein (BMP) signaling which, in turn, regulates the neuronally-secreted "eat me" signal pretaporter (Prtp) and "digestion" signal β amyloid protein precursor-like (APPL) mediating glial phagocytosis. Previous published work indicates secreted, cleaved APPL ingested by glia activates glial phagocytosis function. With RNA-immunoprecipitation, qPCR and Western blot assays, we find that loss of FMRP elevates transcription factor mothers against decapentaplegic (Mad) mRNA levels to increase phosphorylated Mad (pMad) signaling. With ChIP assays, pMad binds protein kinase B (Akt) and InR. We find targeted reduction of pMad in neurons elevates phospho-Akt levels and reduces InR expression, phenocopying the loss of neuronal clearance caused by neuronal FMRP knockdown. Consistently, both neuronal FMRP and Mad knockdown cause decreased Prtp expression, an increase in the number of neuron-associated glia, and loss of glial-mediated neuronal clearance. Consistently, neural knockdowns of Akt and InR cause the opposite phenotypes. Based on these findings, we suggest FMRP works in the BMP and insulin signaling pathways to coordinately regulate neuron-to-glia "eat me" and "digestion" signals that control glial phagocytosis for developmental neuronal clearance.

Discussion: We propose an FMRP-pMad-InR-APPL signaling cascade regulated glia-mediated clearance of the developmentally transient PDF-Tri neurons in the Drosophila FXS model. This new pathway suggests potential molecular targets for devising novel FXS patient treatments.

Keywords (if any): Fragile X Syndrome; Fragile X Mental Retardation Protein; Neuron-to-glia communication

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Theme: Systems Neuroscience
P.I/Advisor: Miriam Lense

The use of blink timing as a prosodic communicative marker in infant-directed singing interactions

Aparna M. Srinivasan, Miriam Lense

Introduction: Infant-directed singing is a universal form of social communication between a parent and their young child. Infant-directed singing better captures and maintains infant's attention compared to infant-directed speech particularly when presented in an audiovisual format. Prior work from our lab indicates that infant-directed singing entrains infants' visual behavior with infants increasing their gaze to the eyes of the singer timed to the rhythmically salient moments (metrically strong beats). However, less work has considered how parents structure their visual social communicative cues when singing to their infants. In the current study, we consider one specific cue, the timing of parents' blinking when singing. When a speaker blinks, they lose access to the visual world around them, as well as block the listener's access to the information expressed by the speaker's eyes.

Methods: Participants included fourteen parent-infant dyads of nine month-old-infants. Parents were instructed to sing naturally to their child like they did at home. Parents sang an average of two songs to their infants (average total duration of singing across parents = 81.76 seconds). The timing of beats and blinks were manually coded from the audio and video files. Peristimulus time histograms were used for data analysis to analyze the alignment of the blinks and the metrically strong beats and phrase starts and ends.

Results: Parents' average blink rate was 18.2 blinks/minute. However, blinks were not evenly distributed across their singing. Preliminary analyses reveal that parents' blink rate at the metrically strong beats did not differ from chance; however, parents' blink rate significantly increased before and after the strong beats, consistent with the times around the beats being of reduced salience relative to the strong beats themselves. Blinks also increased between song phrases with increased probability of blinking before singing a new phrase.

Discussion: Despite individual differences in how parents sang to their infants (e.g., song choice, tempo, etc.), we observed synchronization in blink timing across parents. Parents increased their blink rate at the times before and after the metrically strong beats relative to chance levels of blinking. Times before/after beats are of reduced salience relative to the beats themselves. When singing to their infants, parents unconsciously time their blinks based on the rhythmic structure so that their eyes (important for social cueing) are available at rhythmically important moments. In future directions, we will investigate this alignment of visual cues to rhythmic structure in parent-child dyads of toddlers with and without ASD to examine how developmental status and social communicative attunement impact parent behavior during multimodal singing interactions.

Keywords (if any): infant-directed singing; parents; infants

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Acute and Chronic Neurological Effects of Military-Related Vibrational and Percussive Forces

Amy Stahl, Katherine Rodzak, Douglas Terry, Janette Meyer, David Koester, Douglas Adams, Tonia Rex

Introduction: The crew of certain military aircrafts have reported a wide variety of neurosensory and neurocognitive symptoms after engaging in routine flight exercises. These symptoms typically last 1-2 days and include cognitive impairment (e.g., memory, attention), headaches, dizziness/disorientation, auditory symptoms (e.g., tinnitus and/or hearing loss), visual symptoms (e.g., blurred vision), dental injuries, skin conditions, and persistent cough. Here, we seek to characterize the acute and chronic neurological effects of the vibrational and percussive forces the aircrew members are exposed to onboard military aircrafts. Understanding these effects will aid in their mitigation, improve aircrew readiness, extend aircrew service life, and minimize long-term health effects of service members.

Methods: During the seed phase of this study, assessments of neurologic function were conducted using assays of hearing function (distortion product otoacoustic emissions), ocular motor function (accommodation, convergence, saccades, gaze), vestibular ocular reflex (VOR) function (vHIT), and cognitive function on aircrew members pre- and post-flight exercise. The goal was to identify metrics that quantitatively and objectively capture the aircrew's self-reported symptoms. Future phases of this study will utilize these metrics to correlate changes in neurological function with exposure to vibrational and percussive forces. This will be completed in both aircrew members (to measure acute effects) and animal models that are exposed to equivalent, simulated forces (to measure chronic effects).

Results: Despite wearing a helmet, protective eyewear, and hearing protection, deficits in hearing, ocular motor function, and vestibular ocular reflex function were observed. Clinically significant decreases in hearing function were found from 1.5-4 kHz that did not fully recover one day post-flight. These hearing deficits appeared to correlate with measurements of over-pressure in the aircraft during the flight exercise, which had the greatest magnitudes at 1.5 and 2 kHz. Decreased amplitude of accommodation and near point of convergence were also detected. Similar to the hearing deficits, the decreases in amplitude of accommodation did not fully recover one day post-flight. Hyper functional VOR function with compensatory saccades were detected in 1 aircrew member. Finally, evidence of decreased performance on assessments of working memory and executive function was detected.

Discussion: Assessments of neurological function were identified that may be useful in objectively and quantitatively capturing self-reported symptoms of aircrew members after flight exercises. These assessments will be used in a future pilot study to further understand and identify strategies to mitigate the acute and chronic neurological effects of vibrational and percussive forces. Notably, the approach utilized here to optimize the neurological health of aircrew members has applications that extend beyond military aircrafts, including warfighters who are exposed to similar forces in tanks and other large weaponry.

Keywords (if any): Neurotrauma; Neurosensory; Neurocognitive

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Theme: Clinical, Behavioral, Educational, & Intervention Research
P.I/Advisor: Taylor, Julie Lounds

Depression in Transition-Aged Youth on the Autism Spectrum Who Have A Low IQ

Virginia Sullivan, M.A., Joanna Bellan, B.S., Eman Durrani, B.S., Somer Bishop, Ph.D., Ryan Adams, Ph.D., Julie Lounds Taylor, Ph.D.

Introduction: Young adults with an autism spectrum disorder (ASD) experience higher rates of depression than typically developing peers (Hudson et al., 2019; Muskett et al., 2019). However, much of the extant research on depression in this group only includes those youth who can self-report on their own depressive symptoms. Far less is known about rates of depression diagnosis and elevated depressive symptoms among youth with autism who are minimally verbal or are otherwise unable to self-report on their symptoms. This study examines the frequency of depression diagnosis and elevated depressive symptoms in a sample of youth with autism who were unable to report on their own depressive symptoms (all with IQ < 70).

Methods: Data for this study were taken from a cross-sectional survey investigating contributors to mental health for transition-aged youth with autism who are unable to self-report. Participants included 267 caregivers of youth with autism ages 15-25 and an IQ lower than 70. Participants were primarily recruited through Simons Foundation databases (SSC, SPARK). The mean age of caregivers was 50.2 years, ranging from 31.4 to 81.9. Caregivers identified primarily as female (n = 249, 93.3%). Mean age of youth was 19.3 years. Youth primarily identified as male (n=214, 80.1%). Youth depression was measured via caregiver-report using the DSM-oriented depression subscale of the Achenbach Adult Behavior Checklist (ABCL; Achenbach & Rescorla, 2003) or the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001).

Results: 16.4% of youth with autism and a low IQ met clinical criteria for depression on the DSM-oriented depression subscale, and an additional 11.5% fell within the borderline range. 13.8% (n = 37) had a reported diagnosis of depression. Of those youth whose depression scores met the clinical cut-off, in 63.6% of cases their caregiver reported that they had not been diagnosed with depression. 25.0% of caregivers reported that they did not believe the youth was depressed, and 29.5% reported that they did not know whether their youth was depressed. Of those who fell within the borderline range, 74.2% of caregivers reported that they did not believe the youth was depressed, and 22.6% reported that they did not know.

Discussion: Diagnosing depression is difficult due to overlapping symptoms with ASD, and caregivers may be unaware of their child's depression. Previous research suggests that youth with intellectual disability have more difficulty expressing feelings to caregivers and clinicians due to limited social and cognitive skills (Mayes et al., 2011; Turygin et al., 2013). They may also demonstrate more irritable moods and challenging behaviors, which can make identifying depression more difficult (Mayes et al., 2011; Turygin et al., 2013).

Keywords (if any): Depression; ASD; Intellectual Disability

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P.I/Advisor: Harrison, Fiona

Manganese exposure in risk mechanisms for neuropsychiatric disorders

Adriana A Tienda, Fiona E Harrison

Introduction: Attention Deficit Hyperactivity Disorder (ADHD) affect approximately 9% of the population, although this varies by sex, ethnicity and geographical region. Genetic variants implicate dysregulation of dopaminergic (DAergic) function in the underlying neuropathological pathways. However, the strength of the genotype-phenotype relationship is strongly impacted by environmental factors including exposure to toxicants through air pollution and contaminated water. While in the population overall the outward behavioral traits of ADHD are more strongly expressed or clinically recognized in males, females may be more sensitive to aspects of pollution and metal exposure. Excess manganese (Mn) exposure from water, air and soil is linked to adverse behavioral outcomes in children and this relationship may be stronger in females. Chronic high exposure to Mn is linked to neurodegenerative disorders via alterations in DAergic and other neurotransmitter systems, but less is known about developmental changes associated with chronic lower exposure levels.

Methods: Mn was administered to male and female C57Bl/6J mice either through diet (control (70 ppm) or high (2400 ppm)) or by subcutaneous injection (saline or 50 mg/kg MnCl2-tetrahydrate). Experimental diets were administered from weaning through to the end of the experiment. Injections were given 7, 4 and 0 days prior to the start of behavioral testing. At 8 weeks of age mice underwent assessment of marble burying and nest building behaviors. Locomotor activity was measured for 3 hours, with a scopolamine challenge (1 mg/kg) after 1 hour to measure drug-induced hyperactivity. Mn accumulation in the brain was measured via mass spectrometry, and expression of key proteins relevant to dopamine synthesis and transport were assessed using western blot.

Results: Dietary Mn increased marble burying, in particular in female mice, and was also associated with increased nestlet shredding. In contrast, these behaviors were both decreased by injected Mn. Dietary Mn did not impact locomotor activity at baseline but increased sensitivity to scopolamine in female mice. Injected Mn significantly decreased exploratory activity at baseline but did not affect response to scopolamine. Both dietary and injected Mn altered proteins related to dopamine synthesis and transport.

Discussion: Chronic low dose Mn acquired through dietary exposures had a greater impact on female mice compared to male littermates and impacted repetitive behaviors and response to pharmacological alteration of dopamine and acetylcholine. In contrast, high dose Mn may have had an acutely neurotoxic impact on behavior leading to decreased activity in all tasks. These data highlight a role for chronic low dose dietary exposures to metals in the development of activity-related behaviors. They also highlight the importance of testing in both sexes, and using translationally appropriate exposure approaches in animal studies.

Keywords (if any): Dopamine; Manganese; Locomotor activity

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P.I/Advisor: Wallace, Mark

Diversity in autism: The role of sensory processing in language outcomes

Sarah G. Vassall, Omair Khan, Mark T. Wallace

Introduction: Autism is a neurodevelopmental disorder that is characterized by social communication impairment and patterns of restricted and repetitive behavior1. However, autism presentation is highly diverse, and a number of other associated features occur with high frequency in this population. It is now understood that sensory processing differences are correlated with social communication impairment2-4 and restricted and repetitive behaviors3,5,6 and are also considered part of the broader autism phenotype. Furthermore, increased endorsement sensory hyposensitivity, hypersensitivity, and seeking are all predictive of poorer language outcomes7. While these results are useful for demonstrating the role of sensory function in language outcomes, it remains to be seen how these sensory features contribute to language function in a given sensory modality. This lack of evidence concerning the unique contributions of each sensory modality to language outcomes leaves us with an incomplete picture as to the role of sensory factors in language function in autism.

Methods: To begin to address this question, we mined the National Database for Autism Research for research participants for whom both language and sensory data were available. We then conducted a correlation analysis to evaluate the relationship between each domain of sensory processing and language outcomes, as well as a regression analysis to predict composite, receptive, and expressive language outcomes. Finally, we compared data between males and females, who are known to exhibit differences in autism presentation8-11, using a bootstrap analysis.

Results: Our analyses revealed that across all sensory domains, increased endorsement of sensory processing differences predicted poorer language outcomes, but this negative relationship was stronger in the female group. Importantly, our bootstrap analysis comparing males and females revealed evidence of differences for nearly all sensory, language, and social factors. Finally, we found that expressive and receptive language scores were better explained by sensory factors than social ones. Specifically, sensory attention and avoidance, as well as oral sensory processing, were factors that were highly important in explaining both language outcomes.

Discussion: Combined, this research indicates that specific sensory factors may contribute unequally to language outcomes, and that future research and clinical practice should be mindful of how sex differences play a role in sensory processing and language development in the autistic population.

Keywords (if any): autism; language; sensory processing

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P.I/Advisor: Sando, Richard

Imaging endogenous synaptic proteins during neural circuit assembly

Shane Watson, Krassimira Garbett, Richard Sando

Introduction: Synapses are the fundamental information transferring units in the nervous system. Trillions of diverse synaptic connections self-assemble into stereotyped circuits during mammalian brain development, and these circuits are continuously refined by our experiences and maintained throughout life. Understanding mechanistic principles of synaptic formation, maintenance, and elimination can be greatly facilitated by imaging of tagged endogenous synaptic proteins. However, no approaches currently exist to visualize and monitor pre- and postsynaptic assembly concurrently using endogenous markers in live cells.

Methods: For that purpose, we have applied a novel CRISPR/Cas9-mediated protein labeling strategy for efficient and precise genomic knock-in in postmitotic neurons called Targeted Knock-In with Two guides (TKIT). We have generated a set of viral-mediated constructs that allow us to knock-in tags-of-interest at the N-terminal of the pre-synaptic protein Bassoon, the excitatory post-synaptic protein Homer1c, and the inhibitory post-synaptic protein Gephyrin. These constructs were packaged in Adeno-associated viruses (AAVs) and delivered to cultured mouse primary hippocampal neurons.

Results: The tagging efficiency for each target gene was estimated to be between 1-10 tagged mRNA copies per 100 non-tagged, which provides a sufficient number of labeled cells for imaging. Our in vitro analyses also demonstrated that the proper synaptic localization of the tagged proteins was not perturbed by the addition of a tag. Furthermore, TKIT AAVs were stereotaxically injected into the hippocampus of 5-week old adult mice, and each of the tagged proteins were readily observed solely at the injection site 14 days post injection.

Discussion: We are currently utilizing this approach to introduce live imaging tags into these endogenous synaptic proteins and monitor synapse assembly in real time. Thus, we have generated a powerful imaging tool for studying both excitatory and inhibitory synapse dynamics in mammalian model systems.

Keywords (if any): Synapse; imaging; CRISPR/Cas9

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Controversies of Applied Behavior Analysis and Neurodiversity in Autism: A scoping review

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Introduction: Applied behavior analysis (ABA) is promoted as the gold standard for autism treatment1; however this treatment was developed without input from autistic adults. Many autistic adults decry the use of ABA in autism2. ABA proponents claim that ABA is needed to teach autistic children and adults social communication skills and reduce challenging behavior to improve their functioning and outcomes in society. A systematic review of the literature is needed to organize ethical arguments regarding this controversy.

Methods: We conducted a systematic review of ABA ethics in relation to claims of neurodiversity through academic journals and journalist magazines and newspapers using abstracts from over 100 academic databases, including PubMed Medline, EBSCO, OVID, PsycINFO, Proquest Central, ERIC, Social Science Premium Collection, Web of Science, and Google Scholar. We excluded articles that did not refer to neurodiversity claims. We used Abstrackr to double-screened all abstracts based on inclusion/exclusion criteria. All authors discussed and resolved conflicts through consensus. We extracted data on a) source type; b) ethical claims (arguments, rebuttals, common ground); and c) positionality (e.g., autist, provider, researcher). We present our preliminary findings.

Results: Of the 492 abstracts, we included 116 (24%) papers for full review (in progress) and data extraction (in progress). Of the 38 papers fully reviewed to date, we excluded 24 papers because they did not discuss neurodiversity claims or ethics of ABA. We sorted the 14 remaining papers (8 peer-reviewed and 6 news articles) into three categories: pro-ABA, anti-ABA, or neutral. Only two autists disclosed authoring source material; researchers, BCBA providers, reporters, and one lawyer comprise the remaining authors. Pro-ABA: These papers, which did not include autistic authorship, emphasize that ABA is needed to teach skills to autistic children to help them function in society and to reduce parenting/family stress. Some articles argue that activists misrepresent ABA by focusing on "bad actors" who do not represent the field. Anti-ABA papers: Autistic authors advocated for neurodivergent representation and acceptance in society. One of the authors experienced ABA and discusses the negative impact it has had on his life as a result of the serious stress it caused him, while the other argues that ABA intervention invalidates autistic identities. Neutral papers: One paper discusses how counselors consider ethics in different ways when implementing ABA with autists and the other discusses several court cases regarding the Lovaas method, a precursor to ABA.

Discussion: Autistic voices are underrepresented in the discussion of ethics in ABA. Research is needed to better understand Autistic views and how ABA proponents conceptualize and address the concerns raised by autistic people and neurodiversity proponents.

Keywords (if any): Applied Behavioral Analysis; Neurodiversity; Autism

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Analyzing the Expression of Protein Kinase C Delta in the Bed Nucleus of the Stria Terminalis After Acute and Chronic Stress

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Introduction: Understanding how the bed nucleus of the stria terminalis (BNST) regulates stress is crucial in developing treatments for psychological disorders like anxiety, depression, and substance use disorder.1 The BNST contains subpopulations of neurons that have different and sometimes opposing effects on stress and anxiety. The role that protein kinase C delta (PKCd) cells play in stress is not well understood, but previous work in the lab has shown that PKCd RNA increases with exposure to stress.3 These changes have not been shown to translate to proteins after a single stressor. In order to further understand PKCd's role in stress regulation, we investigated changes in PKCd cell expression after chronic stress.

Methods: 26 mice were split into 4 groups for experimenting. The first group received no restraint stress, the second group received 1 hour of restraint stress, the third group received 1 hour of restraint stress for 5 consecutive days, and the fourth group received 1 hour of restraint stress for 10 consecutive days. The brains of each mouse were sliced using a cryostat, stained for PCKCd and diamidino-phenylindole (DAPI) using immunohistochemistry, imaged using a fluorescent microscope, and the number of PKcD and DAPI cells were counted for each sample.

Results: When reviewing the raw number of PKCd cells, not accounting for the total number of cells in the BNST, there was a significant correlation between the amount of stress that a mouse received and its PKCd cell expression in females. This correlation, however, did not translate to the PKCd cell expression when accounting for the total number of cells in the BNST. There was no correlation between the amount of stress that a mouse received and the total number of cells in the BNST.

Discussion: There are definitely trends in PKCd cell expression changes relating to stress exposure. The variance in the number of PKCd cells between male and female samples is probably due to the disparities in the size of the BNST between sexes. In the future, we could test for PKCd protein expression levels rather than testing for presence versus absence and for activation of PKCd cells.

Keywords (if any): Protein kinase C delta; Bed nucleus of the stria terminalis; Restraint stress

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The Prevalence and Correlates of Somatic Symptoms, DSM-5 Somatic Symptom Disorder, and Functional Somatic Syndromes in Autistic Adults

Zachary J. Williams, Carissa J. Cascio, Tiffany G. Woynaroski

Introduction: 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.

Methods: : Independent autistic adults aged 18-60 years (n=830, MAge=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≥9 and SSD-12≥23 was used to classify participants as meeting SSD criteria (Toussaint et al., 2020). 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≥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, CrI95% [0.100, 0.374]), more symptoms of decreased sound tolerance (IHS; d=0.298, CrI95% [0.174, 0.425]), a higher prevalence of distressing tinnitus (OR=2.46, CrI95% [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, CrI95% [-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.

Discussion: 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.

Keywords (if any): Autism; Somatic Symptoms; Functional Disorders

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Learning from expository text: the role of temporal context in recall

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Introduction: People group retrieved memories based on their time of occurrence, a phenomenon referred to as the "contiguity effect" (Kahana, 2016). A substantial literature demonstrates that this effect is ubiquitous regardless of experimental manipulations (e.g., visual vs. auditory presentation), age, and IQ (Healey, Long, & Kahana, 2019). This temporal ordering of information increases with expertise and recall ability and is interpreted as reflecting the automaticity of encoding processes. In particular, literature suggests that greater temporal-based ordering reflects deeper encoding of information at the time of learning. While the contiguity effect has been examined in single word lists and stories, to our knowledge no studies to date have examined the contiguity effect in the context of expository text (e.g., medical textbook) comprehension in adults.

Methods: Therefore, in our current study, we tested whether the link between the contiguity effect is present in free recall of expository texts (i.e., medical texts), and whether the effect is predictive of recall ability. In order to quantify the temporal context-based organization, we examined participants' recalls using analysis of lag-conditional response probability (lag-CRP; Kahana, 1996) and temporal clustering using temporal factor scores (Polyn et al., 2009).

Results: From our pilot analysis, we found evidence of temporal context-based organization: upon recalling an idea unit from a passage, participants were more likely to recall another idea unit that was presented nearby in time than from a distant part of the passage. Most notably, increase in temporal context-based clustering correlated with gains in participants' recall performance.

Discussion: Our results suggest that contiguity is a predictive factor in successfully extracting new information from texts. These findings could additionally provide insights into how readers form internal models (i.e., "situation models") of non-narrative texts in order to successfully encode information into long-term memory.

Keywords (if any): temporal context; memory retrieval; expository text

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Investigating Fusiform Face Area Development in Infants with Differentiating Risks of ASD

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Introduction: The link between early brain differences and later social processing in Autism Spectrum Disorder (ASD) remains unclear due to 1) individual variability and 2) limitations in infant brain imaging. Face recognition is one sensory-perceptual hallmark yet to be investigated. It develops in the first year of life, overlapping with when cortical structural differences emerge in ASD. To understand early correlates of face perception abilities, we focus on the Mid-Fusiform Sulcus- a recently discovered landmark that predicts the fusiform face area 80% of the time (Weiner, 2019). In this study, we investigate the timing of MFS development in an infant sample.

Methods: We utilize data from the Infant Brain Imaging Studies (IBIS) Network, with structural images from 314 infants- at high and average likelihood for autism - at 6 months, 12 months, and 24 months of age. For this project, we focused on 30 subjects that have all three longitudinal time points. We identify the MFS on bilateral cortexes by searching for an omega-shaped pattern, usually positioned between the occipitotemporal sulcus (OTS) and collateral sulcus (CoS) on coronal slices. Mixed effects logistic regression was used to examine the relationship between MFS presence, brain hemisphere (left or right), and time points.

Results: Out of 30 subjects, we have identified the right MFS on 29 subjects and the left MFS on 21 subjects at 6 months, the right MFS on 30 subjects and the left MFS on 28 subjects at 12 months, and the right MFS on 30 subjects and the left MFS on 29 subjects at 6 months. A mixed effects model showed that brain hemisphere (Right > Left, $b = 13.08$, $p < 0.01$), the linear term of age ($b = 9.25$, $p < 0.01$, and the quadratic term of age ($b = -3.56$, $p = 0.047$) were all significant predictors of MFS presence.

Discussion: The right MFS was more readily identified than the left MFS, aligning with known trends in development: the left fusiform gyrus is involved in processing printed forms of words, which develops later in time. Findings by age suggest that the proportion of subjects with developed MFS increased in both left and right hemispheres over time; the quadratic term of age showed that the rate of this change decreases over time (i.e., most subjects have developed both MFS by 12-24 months). Future work will investigate the correlation between developmental features of the MFS- measured in cortical thickness (CT) and sulcal depth (SD)- and risks of ASD in infants across these time points.

Keywords (if any): Fusiform Face Area (FFA); Development; Autism spectrum disorders

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Examining the Role of Non-Verbal Working Memory in Second-Language Learning

Yidan Zhang, Brianna L. Yamasaki, James R. Booth

Introduction: Previous studies have shown that individuals with higher working memory show faster and more accurate second language (L2) learning. Most have used measures of phonological short-term memory or verbal working memory to explore this relation. One limitation to this work is that performance on these verbal-based measures is a result of the interaction between linguistic and domain-general memory skills, making it difficult to determine the unique contributions of working memory. In addition, the role of working memory has been shown to interact with prior knowledge, but few studies have explicitly compared learning outcomes between L1-Similar and L1-Dissimilar conditions. The current study aimed to address these two gaps by examining whether non-verbal working memory is predictive of L2 learning outcomes and, further, whether this relation varies based on familiarity with the L2 structures.

Methods: 58 participants completed a 4-day language training paradigm in which they were asked to learn the meaning of 72 novel words in an artificial language. The words were evenly distributed between three conditions: Simple, L1-Similar, and L1-Dissimilar, depending on whether the words were monomorphemic (or simple) and if not, whether the complex morphological structure within the words was consistent with English (participants' L1). Prior to the training paradigm, participants completed the Rotation and Operation Span tasks, which index non-verbal working memory capacity. Two learning outcomes were calculated: (1) Overall Learning, the difference between reaction time on the first pre-test and the last post-test, normalized over reaction time on the first pre-test, and (2) Learning Rate, the linear slope of a line fit to participants' accuracy over the course of the twelve training blocks.

Results: Results showed that non-verbal working memory, as measured by a Rotation Span and Operation Span composite score, did not predict overall learning ($p = .331$) or learning rate ($p = .257$) when outcomes were averaged across conditions. Within conditions, no significant correlation was found for overall learning (L1-Similar: $p = .234$; L1-Dissimilar: $p = .224$) or learning rate for the L1-Disimilar condition ($p = .264$). However, a trend for a positive relation was observed for L1-Similar learning rate ($p = .087$).

Discussion: These findings suggest that the correlation between working memory and L2 learning found in previous studies might be driven by the linguistic aspects of the working memory tasks used. Furthermore, while not a robust effect, the difference observed in the magnitude of the relation between working memory and learning rate for the more and less familiar condition may suggest that prior linguistic knowledge contributes to the role of working memory in L2 learning.

Keywords (if any): Second-Language Learning; Working Memory

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Do Children Use Music for Emotion Regulation?

Gabija Zilinskaite, Daniel E. Gustavson, Reyna L. Gordon

Introduction: While healthy emotion regulation helps us react to emotional stimuli at an appropriate time and level of intensity (Matthews, Webb, & Sheppes, 2021), maladaptive emotion regulation has the potential to lead to social isolation, avoidance coping, and externalizing emotion with symptoms of anxiety and depression (Silverman 2020). Emerging literature suggests that music can support suppression and enhancement of positive and negative emotions in adults, leading to an ability to modulate the intensity of such emotions. Despite this, we still don't understand when and how music emerges as a tool for emotional regulation. If music assists emotion regulation in adults, is this also reflected in children? To what degree do children report using music listening to self-regulate mood or emotion?

Methods: In a correlational study of children ages 6-12 (anticipated N=80), we will investigate whether children use music as an emotional regulator using the the Music and Emotional Regulation Questionnaire (MERQ). The survey was designed using the Adaptive Functions of Music Listening Scale (Groarke & Hogan, 2018). We drew two questions each from four subsections of emotional regulation, including stress regulation, anger regulation, rumination, and strong emotional experiences elicited by music. To collect responses, we employed the 5 Degrees of Happiness Smiley Face Likert Scale, which was shown to effectively encourage use of all scale points (Hall, Hume & Tazzyman, 2016). In addition, two versions of the scale will be administered to parents (one set of questions asking about how parents use music for emotion regulation and another set asking parents to report about their children's use of music for emotion regulation).

Results: Data collection is anticipated to be completed in December 2022, but we will present preliminary results based on available subjects. We predict that children's reports about their use of music for emotion regulation will correlate positively with parent reports of self and about the child. There will be a positive correlation displayed between participants' joint-emotion score and strong emotionality, and higher music engagement scores will correlate with higher music and emotion regulation scores.

Discussion: Children identify and modulate their emotions early in development. Music, an art form and skill closely tied to emotionality, reward processing, and prosocial behavior, can be a useful tool for emotion regulation. Exploratory analyses will consider the role of DLD in these associations, and may reveal increased music use in children struggling to communicate their feelings through language. We will also examine how parent reports relate to the responses of their children. We hope to further illuminate the intersection of music with internal affect, as healthy emotion regulation habits are tied to mental health, school readiness, and social competence in the long term.

Keywords (if any): Music cognition; Emotion regulation

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Putting the self in context: a preliminary study of interoceptive-exteroceptive integration in autistic and neurotypical individuals

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Introduction: The perception of cues signaling biological needs (i.e., interoception) is crucial for maintaining physical/emotional health. Autistic individuals experience sensory differences in other modalities, so understanding whether these differences extend to interoception may help promote autistic individuals' health. However, individual differences in interoception have been difficult to study, partly since internal signals often do not reach conscious awareness outside of biologically relevant contexts. Measures of interoceptive-exteroceptive (IE) integration may help to understand the perception of these signals relative to environmental cues that contextualize their interpretation, such as perceiving and interpreting a heart rate change in a gym versus home environment.

Methods: To study different aspects of IE integration, we analyzed relationships between three tasks with different stimulus modalities and time scales: a Method of Constant Stimuli (MCS) task to test perceived synchrony of individual heartbeats and visual stimuli as a function of temporal offset (Brener and Ring, 2016), Legrand et al.'s (2022) heart rate discrimination (HRD) task to test discrimination of heart versus auditory rate changes (not requiring perception of individual beats), and Walsh et al.'s (2019) respiration integration task to test whether breathing synchronized with a moving visual stimulus improves subsequent visual speed discrimination relative to an exteroceptive-only baseline. Participants included n = 9 neurotypical (7 female, 2 male) and n = 3 autistic adults (1 female, 2 male) who had biologically plausible parameter values in all three tasks.

Results: Across groups, wider temporal binding windows between heartbeats and visual stimuli were highly correlated with less sensitive heart rate discrimination ($r = 0.72$, $p < 0.01$). Though improvements in detecting visual speed changes with synchronized breathing were not significantly correlated with either cardiac task, there was a slight tendency for individuals with wider cardiovisual bindings windows (i.e., more generous integration tendencies) to improve more in the breath synchronization condition ($r = 0.17$, n.s.).

Discussion: Our results suggest that these tasks may indeed index some shared and some distinct aspects of IE integration; for example, single heartbeat integration may impact the ability to contextualize heart rate changes related to threat. Future work in larger samples will study relationships between these measures, diagnostic group status, and physical/emotional health outcomes.

Keywords (if any): Interoception; Autism; Multisensory integration

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