**Title**: A Lesson in Unpredictability: Exploring factors associated with collection of evaluable brain imaging data in children with an elevated likelihood for intellectual and developmental disability

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**Introduction**: Neuroimaging research offers the promise of brain markers that will inform personalized treatment, allow prediction of future outcome, and optimize clinical trials, with the ultimate goal of improving the quality of life for children with intellectual and developmental disabilities (IDD). Historical exclusion of people with IDD from neuroimaging research – due to the assumption of an inability to complete study procedures – has limited the generalizability of study findings. A growing set of clinical and technical resources enables successful and high-quality non-invasive brain imaging data collection in children with neurodevelopmental disorders. The current study extends our previous work (Kuschner et al., 2021) with school-age children with IDD to identify characteristics associated with the collection of evaluable brain imaging data in preschool-age children with an elevated likelihood for IDD (IDD-EL), with the goal of identifying personalized support protocols to maximize collection of high-quality and evaluable imaging data as well as to optimize the child and family experience.

**Method**: Study data were obtained from an ongoing longitudinal neuroimaging study examining the latency of auditory cortex neural activity in 3-year-old children with IDD-EL diagnosis (e.g., genetic syndrome, autism spectrum disorder, epilepsy, prematurity). Twenty-eight children with IDD-EL (mean age=3.32 years, SD=0.23; 8F:19M, 1 not reported) completed a phenotyping visit and then moved forward to a brain imaging visit for magnetoencephalography (MEG) scan. Participants presented with a range of developmental/cognitive ability (mean=81.7, SD=26.6, range 55-121; measured by either the Bayley Scales of Infant Development, 4th Edition or Weschler Preschool and Primary Scale of Intelligence – 4th Edition) and language ability (mean=80.8, SD=29.9, range 50-141; measured by the Preschool Language Scales, 5th Edition). Phenotyping characteristics, parent report of potentially relevant child characteristics (e.g., inattention/hyperactivity, anxiety, aggressive behavior; as measured with the Child Behavior Checklist), responses to screening and scan visit preparation questions, and team ratings following MEG imaging visits were examined for associations with scan completion and data evaluability status.

**Results**: MEG data were acquired and considered evaluable for analysis in 78.6% of the children with IDD-EL. Evaluable completion status did not differ based on age, F(1,26)=0.002, *p*=0.97, developmental/cognitive ability, F(1,23)=1.88, *p*=0.18, language ability, F(1,24)=0.29, *p*=0.59, or parent ratings of aggressive behavior, F(1,19)=0.36, *p*=0.56, inattention, F(1,19)=0.40, *p*=0.53, and anxiety, F(1,17)=0.13, *p*=0.73. There was a trend toward an association between evaluable completion status and a primary or syndromic diagnosis of autism, χ2(1,N=28)=3.2, *p*=0.074. Exploratory analyses suggested that evaluable completion status may be associated with a screening question response regarding a child’s ability to hear a word and point to the related picture, χ2(1,N=14)=3.95, *p*=0.05. Evaluable completion status was not associated with other screening questions asking about whether a child is mesmerized by a TV or other visual activities, or the strategies that the parent believes could be effective for use with the child at the imaging visit (e.g., use of a token board, visual schedule, or first-then language), all *p*s=ns. Based on ratings from the study team following the imaging visit, the number of visit elements (e.g., changing into scrubs, digitization procedures, getting wires taped to the face) deemed ‘challenging’ for the child was not associated with evaluable completion status, F(1,26)=1.88, *p*=0.18. However, for children without complete and evaluable imaging data, the step of getting their head into the appropriate position in the MEG machine (to be necessarily proximal to the sensors for data collection) was more likely to be noted as a challenging component of the visit, χ2(1,N=26)=7.9, *p*=0.005.

**Discussion:** In this heterogeneous group of children with and without developmental delays alongside an IDD-EL diagnosis, the rate of acquired and evaluable data was consistent with rates previously observed in school-age children with IDD. Very few variables measured (both broadband and more granular) were associated with acquiring evaluable imaging data. This initial exploratory data supports a broadly inclusive approach to neuroimaging research and highlights that assumptions cannot be made about the likelihood for obtaining evaluable brain imaging data. Innovative research underway leveraging “wearable” brainwave scanning technology will advance the possibility for high-fidelity MEG recordings in freely moving children and remove the barrier identified within this dataset related to getting into position in the MEG machine. Future research will benefit from larger sample sizes for fully powered exploration of predictors, more sensitive measures of imaging data quality (e.g., evaluable imaging data length), as well as continued consideration of other variables, including a more nuanced understanding of autism characteristics and the impact of caregiver involvement during the brain imaging visit.

**References:** Kuschner ES, Kim M, Bloy L, Dipiero M, Edgar JC, Roberts TPL. MEG-PLAN: a clinical and technical protocol for obtaining magnetoencephalography data in minimally verbal or nonverbal children who have autism spectrum disorder. J Neurodev Disord. 2021 Jan 23;13(1):8.

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