Title: Screening for Autism Spectrum Disorder: Factorial Invariance in Preterm Infants on the First Years Inventory

Authors: Elizabeth Choi1, John Sideris1, Claire Chen1, Emily Campi1, Valentina Vera Carrasquero1, Amanda Wiles1, Cristin Holland1, Linda Watson2, Elizabeth Crais2, Grace Baranek1

Introduction: Preterm infants are at increased risk for adverse outcomes, including autism spectrum disorder (ASD), cognitive impairment, cerebral palsy, and other neurodevelopmental disorders (Vogel et al., 2018; Kuzniewicz et al., 2014). In the U.S., approximately 1 in 10 infants are born prematurely (Centers for Disease Control and Prevention, 2019), and the estimated prevalence of ASD in preterm infants is 7% (Agrawal et al., 2018). Lower gestational age is associated with increased rates of ASD, and extremely preterm infants (<27 weeks gestational age) are almost three times more likely than full-term infants to receive a diagnosis of ASD (Kuzniewicz et al., 2014). Additionally, preterm infants are exposed earlier than term infants to the extrauterine environment, and they exhibit atypical development in sensory processing (Cabral et al., 2016; Wickremasinghe et al., 2013), language functions (van Noort-van der Spek et al., 2012), and social communication (Johnson & Marlow, 2011), key domains related to risk for ASD. Given the increased prevalence of ASD and risk for adverse outcomes in preterm infants, it is crucial to test for factorial invariance in measures designed to screen for risk for ASD that may be used with this population. Testing for factorial invariance (i.e., testing whether the latent variables are being measured in the same way across groups) is an important step toward determining whether a validated measure performs similarly in preterm infants as it does in full-term infants.

Method: We analyzed a core set of 27 items from the First Years Inventory version 3.1 (FYI 3.1), a parent-report questionnaire designed to identify infants at risk for an eventual diagnosis of ASD. The questions ask parents to rate children’s social communication (SC) and sensory regulatory (SR) behaviors on a scale from 1-5 (1=“never”; 3=“sometimes”; 5=“always”). We conducted invariance testing via confirmatory factor analysis to determine whether SC and SR items loaded similarly for preterm (n=400) and full-term infants (n=4,568). Due to ongoing research (Chen et al., in progress) which suggests that some items on the scale are developmentally sensitive, we ran separate analyses for two preterm infant groups: “9-month” adjusted age range (8-10 months adjusted; n=219) and “12-month” adjusted age range (11-13 months adjusted; n=181). Common practice in invariance testing follows a series of models that increasingly restrict portions of the model to equality between groups (e.g., Putnick & Bornstein, 2016; Widaman & Grimm, 2014). Configural equivalence across the groups was first tested for the proposed structure as the baseline model followed by metric, scalar, and residual invariance models with various levels of constraints on factor loadings and thresholds. We evaluated model fit using chi-square estimates, comparative fit index (CFI), and root mean square error of approximation (RMSEA). We considered CFI>.90 and RMSEA<.08 (Hu & Bentler, 1999) to be a good fit. We assessed chi-square differences between invariance models to test whether the assumptions of the invariance constraints were violated.

Results: In the 9-month groups, we found the models to be invariant at the most restrictive level, indicating that factor loadings, item thresholds, and item residuals were equal across both groups on both domains. Further, there were small but non-significant differences in the variances of the latent variables. Mean differences between groups showed significantly more problems in SC and marginally more problems in SR for the preterm group. In the 12-month groups, we found that the factor loadings were equal but that there was partial invariance at the threshold and residual levels. For partial invariance, some parameters were freed (i.e., allowed to be unequal) between groups. The model indicated significantly more variance in SC between groups. There were no differences in the group averages for either SC or SR.

Discussion: The results of this study demonstrate that the FYI 3.1 is tapping the constructs of social communication and sensory regulation similarly across 9- and 12-month preterm and full-term groups in our sample. That is, parents of preterm infants and full-term infants in this sample interpret the measure’s SC and SR questions similarly. This suggests that the FYI 3.1 can also be used in the preterm population to examine levels of SC and SR as indicators of risk for ASD. Of note, the presence of item level bias in our tests for scalar invariance for the 12-month group of preterm infants on both SC and SR domains reflect differences in average levels of responses (on a scale of “never” to “always”) as a function of prematurity. On certain SC and SR items, parents of preterm infants in the 12-month range did not rate their children at the same level that full-term parents did when their
children exhibited the same degree of overall SC and SR levels. In our poster presentation, we will further explore the differences in parent responses on the specific items that demonstrate bias. Additionally, significant differences in the variances of latent variables suggest that the distributions of SC skills in preterm infants are more variable than in full-term infants. As the FYI 3.1 is a parent-report measure, it is unclear whether these findings are due to true differences in preterm infants’ average skill levels or differences in parents’ expectations or understanding of behaviors that then impact their responses. For instance, parents of preterm infants may be more likely to give responses toward either extreme (i.e., closer to “never” or “always”). It may also be the case that some SC behaviors benefit from experience rather than developmental maturity and that preterm infants examined at adjusted age have experienced more SC opportunities than their chronologically matched full-term peers. Future research will explore whether these differences change as a function of gestational age and whether similar findings of distributions in skills are reflected in observational data as well.

References:


1 University of Southern California
2 University of North Carolina at Chapel Hill