**Title:** Early Differences in Sensory Responsiveness Predict Poor Play Skills in Infants at High- and Low-Risk for Autism

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**Introduction:** Children with autism spectrum disorder (ASD) often show differences in sensory responsiveness, or behavioral patterns of responding to sensory stimuli. These patterns can include hyporesponsiveness (i.e., reduced or absent responses to sensory stimuli), hyperresponsiveness (i.e., exaggerated responses to sensory stimuli), and sensory seeking (i.e., craving of certain sensory stimuli). It has been theorized that such differences in sensory responsiveness, especially early in life, may produce cascading effects on a child’s development in a number of domains, by affecting his/her ability to engage with or learn from his/her environment. This theory is challenging to test, in large part because we cannot always reliably diagnose autism in the earliest stages of life (i.e., in infancy). As a potential solution to this problem, many researchers are prospectively following infants who are known to be at heightened risk for ASD based on their status as infant siblings of children with ASD (Sibs-ASD).

In the present study, we use this approach to test whether early differences in sensory responsiveness may be producing cascading effects on play, an aspect of development that is critical for early engagement and learning and that is often impacted in children affected by ASD. We hypothesize that atypical sensory responsiveness (i.e., increased hyporesponsiveness, hyperresponsiveness, and/or sensory seeking) in infancy will predict future deficits in play skills in Sibs-ASD.

**Study 1 Methods:** Study 1 drew on extant data collected as part of a longitudinal correlational study at Vanderbilt University and University of Washington. Participants were 20 infant Sibs-ASD (8 male; 12 female). Early sensory responsiveness was assessed with the Sensory Experiences Questionnaire (SEQ) when infants were 18 months old. Future play skills were assessed using the Vineland Adaptive Behavior Scales (VABS) when participants were 24 months and 36 months old. Bivariate correlational analyses were run to evaluate the direction and magnitude of associations of interest.

**Study 1 Results:** SEQ total scores at 18 months were negatively correlated with play skills at 24 months ($r = -0.49$), indicating that increased sensory features on the whole predicted poorer play skills in Sibs-ASD. Follow-up analyses indicated that all three patterns of sensory responsiveness were predictive of play at this timepoint ($r$ values = -0.71, -0.57, and -0.43 for hyperresponsiveness, hyporesponsiveness, and sensory seeking, respectively). SEQ total scores at 18 months were not predictive of play at 36 months ($r = -0.21$). Only hyporesponsiveness at 18 months continued to significantly predict play skills at 36 months ($r = -0.47$; $r$ values for hyperresponsiveness and sensory seeking = -0.36 and -0.04, respectively).

**Study 2 Methods:** Study 2 aims to systematically replicate these results in an independent sample of younger Sibs-ASD (i.e., infants who were 12-18 months at study entry; $n = 20$) and a control group of chronological age- and sex-matched infants at relatively lower, population-level risk for ASD (Sibs-TD; i.e., infants with an older sibling who is typically-developing; $n = 20$). Early sensory responsiveness was evaluated using the SEQ, and play skills were evaluated 9 months later using the VABS. We further sought to extend these results by employing observational measures of early sensory responsiveness and future play skill: the Sensory Processing Assessment (SPA) and the Developmental Play Assessment (DPA), respectively. The SPA and DPA were coded by naive coders to derive indices of social and non-social hyporesponsiveness, social and non-social hyperresponsiveness, sensory seeking, and several commonly used indices of early play skill, including the number of different toys explored, number of different toys on which the child displayed functional play acts, and the number of different functional play acts displayed.

**Study 2 Results:** Preliminary analyses for Study 2 were run on the 26 participants (11 Sibs-ASD and 15 Sibs-TD) who have completed Time 2 data collection to date. In this younger sample, early sensory responsiveness as measured via parent report was not correlated with parent reported play skills 9 months later (zero-order correlations between SEQ and VABS = -0.01–0.15); associations did not vary by group. Early sensory responsiveness as measured from behavioral observation, however, was significantly associated with future play skill. Hyporesponsiveness predicted the broad range of play skills as coded from the DPA.
across groups ($r' = -0.38 \text{ – } -0.52$). Within the Sibs-ASD group, significant predictive associations with play were additionally observed for early hyperresponsiveness to social stimuli ($r' = -0.50 \text{ – } -0.70$) and sensory seeking ($r' = -0.43 \text{ – } -0.63$).

Discussion: Results of these studies provide increased empirical support for the theory that early sensory differences may produce cascading effects on the development of higher level skills such as play in children diagnosed with, or at heightened risk for, ASD. Across studies, it appears that parent report of atypical sensory responsiveness midway through the second year of life (at approximately 18 months of age) may be useful for predicting more impoverished play. These predictive links were present for all three patterns of sensory responsiveness over the short term (i.e., six months), with moderate to large effect sizes. Associations were attenuated over a longer timeframe but remained statistically significant for hyporesponsiveness, suggesting that this pattern of sensory responsiveness may have the most lasting influence on play development. Observational measures of sensory responsiveness may be more useful for predicting poor play skills earlier in life (i.e., in the 12-18 month period). Additional research is needed to determine whether the relations we have observed are causal in nature and to elucidate the mechanisms by which early sensory differences may impact play development. We suspect that the associations we have observed may be explained by the effects of early sensory differences on parent-child engagement; we are presently working to test this theory in our laboratory. Implications for research, theory, and practice will be discussed.

References: