Title: Foundations of Cognitive Control in Down Syndrome

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Introduction: There is growing evidence of specific impairment in the cognitive control (CC) skills required for goal-directed behavior in Down syndrome (DS; Lanfranchi et al. 2010). At present, little is known about the developmental origins of CC challenges in DS, however, there is evidence that infant cognition is predictive of later CC performance in typically developing (TD) children (Hendry, Jones, & Charman, 2016). The current study will compare the performance of infants with DS and TD controls on four foundational CC dimensions: attention shifting, sustained attention, early planning, and processing speed. Although these skills have been examined in TD infants, this study is the first to examine the set of cognitive skills in both TD and DS samples. Comparing the performance of infants with DS to TD controls will facilitate the identification of areas of early cognitive risk within DS.

Method: Participants were 58 infants with DS, ages 5 to 17 months, M chronological age = 11.3 months, SD = 3.5; M developmental age = 7.9 months, SD = 2.8, and 48 TD infants, ages 3 to 13 months, M chronological age = 7.8, SD = 3.2; M developmental age = 7.7 months, SD = 3.5. Infants were equated on cognitive developmental age using the Bayley Scales of Infant and Toddler Development-III, t (88.7) = .29, p = .77. Laboratory measures were used to assess early aspects of CC. Attention shifting was assessed by examining the mean latency to shift attention between two objects presented to the right and left of the infant’s midline (Mullen, 1995). Sustained attention was measured by coding the percent time the infant was visually attending to a red teether with multiple textures (Needham, Barrett, & Peterman, 2002). Early planning was evaluated by averaging the infant’s latency to reach and grasp for two differently textured balls, placed at the midline one at a time (Barrett, Traupman, & Needham, 2008). Processing speed was measured using a classic habituation task during which a child-sized spoon was presented to the infant in a series of three 30-second trials. Duration differences in visual attention between the first and third trials were calculated (Barten & Ronch, 1971).

Results: Groups differed on the dimensions of attention shifting, t (88.6) = 3.2, p = .002, and sustained attention, t (104) = 4.03, p = <.001. Infants with DS shifted their attention more slowly (DS group M = 2.8 seconds, SD = 2.1; TD group M = 1.8 seconds, SD = 1.2) and looked for longer amounts of time during the sustained attention task (DS group M = 57.9% time looking, SD = 20.6; TD group M = 41.1% time looking, SD = 22.4). Between group differences on the planning measure were observed using Mann-Whitney U tests, U = 782.0, p = .02, due to the non-normal, positively skewed distribution of the scores. Infants with DS had a longer latency to contact the balls on average, M = 4.4 seconds, SD = 6.1, compared to the TD infants, M = 3.4 seconds, SD = 4.6. There were no significant between-group differences for processing speed, t (84) = -.54, p = .59.

Discussion: This study provides evidence that differences are observable in multiple areas of CC during infancy in DS, even when controlling for overall cognitive developmental level. It is critical to identify specific cognitive skills that infants with DS have challenge with to inform the development of time sensitive, phenotype-specific early interventions. One limitation of the study is that estimates of infant CC were assessed using only one laboratory measure. Future studies should explore long-term cognitive outcomes to determine which domains of early CC in DS cascade onto later developmental skills in childhood.

References:


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