Title: Profile and Predictors of Adaptive Functioning Skills in 2- to 7-Year-Old Children with Down Syndrome

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Introduction: With a prevalence of 1 in 707 live births, Down syndrome (DS) is the most common neurogenetic syndrome associated with intellectual disability. At every level of description and developmental stage, a wide range of variability is observed among individuals with DS. At the same time, common areas of challenge are often observed, such as delays in development (e.g., nonverbal, verbal, and motor skills) and increased rates of sleep difficulties, autism spectrum disorder (ASD) symptoms, and other behavioral challenges. Each of these areas can influence adaptive functioning, a broad term referring to the conceptual, social, and practical skills that people learn and use in their daily lives. Weaknesses in adaptive skills can limit an individual's ability to function independently. Elucidating the nature of adaptive functioning skills in young children with DS, and the factors supporting their development will provide insights into interventions to enhance those skills and support independence. In the present study, we sought to: (1) characterize the profile of adaptive functioning and the profile of maladaptive behaviors in young children with DS and (2) examine the child characteristics that may predict adaptive functioning and/or the extent of maladaptive behaviors.

Method: Participants were 44 children with DS, for whom English was reported to be the primary language of the home, ranging in age from 2.50 – 7.99 years (*M* = 4.66 years, *SD* = 1.46, 22 females/22 males). The mean General Conceptual Ability score (similar to IQ) for our sample was 50.95 (*SD* = 11.45). Data from the Vineland Adaptive Behavior Scales-3 (VABS-3) Comprehensive Interview Form were used to assess adaptive skills, as well as internalizing and externalizing behaviors. In addition, measures of nonverbal cognition (Differential Ability Scales-II Special Nonverbal Composite), expressive vocabulary (MacArthur Communicative Development Inventories-Words and Sentences expressive vocabulary checklist), motor skills (VABS-3), sleep disruption (Children's Sleep Habits Questionnaire), and ASD symptomatology (Social Responsiveness Scale-2) were considered. Participants' caregivers provided all informant report data.

Results: Analyses comparing mean standard score performance across the VABS-3 Communication, Daily Living Skills, and Socialization domains demonstrated a significant effect of domain, with significant differences observed between all pairs of domains ($F(1,43) = 1740.34$, $p < .001$). Specifically, we found that standard scores were highest for the Socialization domain (*M* = 77.43, *SD* = 12.04), followed by the Daily Living Skills domain (*M* = 67.34, *SD* = 10.99), and finally lowest for the Communication domain (*M* = 60.16, *SD* = 15.35). It is important, however, to recognize that considerable heterogeneity is observed across children with DS. Indeed, considering children's scores on an individual level, although 52% of the same demonstrated SSs that were in the same rank order as what was found in the group level analyses (i.e., Socialization>Daily Living Skills> Communication), only 15.9% of the present sample showed significant differences between SSs in all three domains. Analyses comparing mean v-scale scores for the internalizing versus externalizing domains indicated no significant effect of subscale, ($F(1,36) = 0.002$, $p = .96$. At the individual level, 47.7% of the sample demonstrated elevated internalizing scores and 29.5% demonstrated elevated externalizing scores; none of the participants demonstrated clinically significant scores on these scales.

We also considered the participant characteristics that might predict adaptive skills, as well as internalizing and externalizing behaviors. Bivariate associations between the putative predictor variables and adaptive functioning, internalizing and externalizing scores were considered first; putative predictors that were significantly correlated with the dependent variables were then entered into regression models to further consider their contributions. Results of the Communication skills regression model demonstrated that motor skills ($p = .02$), expressive vocabulary ($p = .02$), and ASD symptomatology ($p = .02$) all significantly contributed to this model ($F(4, 38) = 8.95$, $p < .001$, $R^2_{adj} = .46$); nonverbal cognition was not a significant unique predictor ($p = .15$). With regard to Daily Living Skills, motor skills ($p = .001$), but not expressive vocabulary ($p = .11$), significantly contributed to the model ($F(2, 41) = 9.39$, $p < .001$, $R^2_{adj} = .29$). Results of the Socialization skills model demonstrated that ASD symptomatology ($p = .001$) was the only significant unique contributor to this model ($F(3, 38) = 10.95$, $p < .001$, $R^2_{adj} = .44$); the influences of nonverbal cognition ($p = .06$) and motor skills ($p = .07$) were marginal. Regarding internalizing behaviors, both

nonverbal cognition (p = .04) and sleep disruption (p = .005) were significant and unique predictors ($F(2, 33) = 8.99$, $p = .001$, $R^2_{adj} = .33$). None of the factors considered correlate with externalizing behaviors; thus, no regression model was computed.

Discussion: The overall results show that significant differences are observed between all domains of adaptive functioning at the group-level, with Socialization>Daily Living Skills> Communication. This pattern, significant differences across domains in this order, was only observed to be accurate at the individual level for 15.9% of our sample, highlighting the importance of considering individual differences among young children with DS. In addition, we observed variability in the characteristics that predicted adaptive functioning in the different domains and the presence of internalizing and externalizing behaviors. These data inform our understanding of the nature of adaptive skills in DS and suggest that different mechanisms may be underlying development across these adaptive domains. Thus, different interventions may be warranted for individuals with DS to support the development of independent functioning.

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