**Title**: Understanding symbolic functioning in toddlers with Down syndrome: Object use, motor skills, and communication

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**Introduction**: Early object use encompasses both functional and symbolic interactions with objects, and is important for the development of toddler cognition and communication1. For children with Down syndrome (DS), delays in motor development may limit opportunities for object exploration during early childhood2,3. Infants with DS often exhibit fewer exploratory behaviors with objects compared to typically developing peers matched on mental age (MA), demonstrating more visual than motor-based manual exploratory behaviors4. This limited object exploration can lead to fewer mental representations of objects, their properties, and affordances, which may ultimately impact the formulation of conceptual categories necessary for early language acquisition5. Attenuated object use in toddlers with DS may, therefore, cascade into broader challenges with symbolic representation abilities that undergird the development of language and communication in young children with DS6. This study explores the early concurrent associations between object use, motor skills, and communication in toddlers with DS.

**Methods**: Participants were 31 children (*mean* chronological age (CA) = 20.52 months, *sd* = 1.46, *range* = 18.13-23.59; *mean* MA = 10.96 months) with a confirmed DS diagnosis. Data was collected at multiple sites across the US. Caregivers completed the CSBS-DP Infant-Toddler Checklist (CSBS-DP)7, designed to measure and monitor early communication and symbolic skills in infants and young children, and screen for potential developmental delays, as well as the Vineland Adaptive Behavior Scales 3rd Edition (Vineland)8 interview, designed to measure adaptive behavior skills across multiple domains. Children were assessed directly using the Bayley Scales of Infant and Toddler Development 4th Edition (Bayley-4)9. Associations between raw scores on the CSBS-DP Object Use subscale and motor and communication skills, as measured by both parent report and direct observation, were examined through a series of correlation analyses. To control for the possibility of false discoveries resulting from multiple comparisons, the Benjamini-Hochberg procedure was applied to adjust the resulting *p*-values.

**Results**: Significant positive associations were observed between the CSBS-DP Object Use scale and various subscales of the Vineland: Gross Motor (*r* = 0.52, adj-*p* = .02), Fine Motor (*r* = 0.61, adj-*p* = .007), Receptive Communication (*r* = 0.45, adj-*p* = .04), and Expressive Communication (*r* = 0.62, adj-*p* = .007). Additionally, positive associations were observed between the CSBS-DP Object Use scale and the Bayley-4 Receptive Communication (*r* = 0.45, adj-*p* = .03) and Expressive Communication (*r* = 0.44, adj-*p* = .04) subscales. When controlling for the effects of CA, these associations remained significant: Vineland Expressive Communication (*r* = 0.51, *p* = .01), Bayley-4 Receptive Communication (*r* = 0.41, *p* = .04), and Bayley-4 Expressive Communication (*r* = 0.42, *p* = .03).

**Discussion:** Results support the link between object use and measures of communication and motor skills in children with DS. Expanding this investigation longitudinally could clarify the bidirectional association between motor and communication development and early symbolic functioning, including object use. Early assessment of symbolic abilities using tools like the CSBS-DP can help identify potential delays and inform phenotype-informed early intervention efforts10, ultimately supporting a child's overall developmental trajectory. Future studies should examine these associations longitudinally to test a cascading effects hypothesis.

**References:**

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