**Title**: Using the Communication Complexity Scale to Assess Communication Skills in Young Children with Down Syndrome

**Authors**: Amanda Dimachkie Nunnally1, Vivian Nguyen1, Robyn Tempero Feigles1, Anna J Esbensen2, Jennifer Bekins2, Deborah J Fidler3, Madison Walsh3, Kaylyn Van Deusen3, Lisa A Daunhauer3, Carolyn B Mervis4,5, Angela M Becerra4, Leonard Abbeduto1, Angela John Thurman1

**Introduction**: Language delays are observed in nearly all individuals with Down syndrome (DS; Abbeduto et al., 2007) and are typically more pronounced than in other neurodevelopmental conditions (Finestack & Abbeduto, 2010; Finestack et al., 2013). However, considerable variability in expressive communication skills among children with DS is also observed, which complicates the assessment of early communication development, especially when compared to children with faster learning/growth profiles. Communication is crucial for supporting social functioning, academic achievement, cognitive growth, and adaptive functioning, making it a high-priority target for research and early intervention. Unfortunately, the lack of outcome measures validated for children with DS is a significant barrier to descriptive and treatment research (Esbensen et al., 2017). In the present study, we assessed the psychometric utility of the Communication Complexity Scale (CCS; Brady et al., 2012) in a sample of young children with DS. Although primarily intended to assess communication in individuals with limited spoken language and symbolic communication skills, the CCS’s unique focus on both pre-symbolic and symbolic communication skills makes it particularly relevant to assessing children with DS who demonstrate considerable variability in their transition to symbolic communication use.

**Method**: Participants were 64 children with DS (MAge= 4.85 years; range: 2.5 – 7.99 years) who completed both an initial test and a 2-week re-test visit. Videotaped administrations of the Early Social Communication Scale (Mundy et al., 2003), an assessment tool designed to evaluate the social communication skills of young children (particularly those with developmental delays), were coded using the Communication Complexity Scale (CCS) protocol (Brady et al., 2012), which assigns a score from 1 (lowest) to 12 (highest) to each of the child’s communication acts (with scores of 1-6 reflective of a pre-intentional communication level, 6-10 of an intentional nonsymbolic communication level, and 11-12 of an intentional symbolic communication level). Both the Optimal CCS score (the average of the child’s highest three communication act scores) and the Average CCS score (the average of the middle 50% of the child’s communication act scores) were considered. Validation measures included a clinical measure of the child’s communication level (Expressive Language Benchmark, Tager-Flusberg et al., 2009), standardized measures of communication skills (Vineland-3 Expressive Communication Growth Score Value and Preschool Language Scale-5 Expressive Communication Growth Score Value) and nonverbal cognition (Differential Ability Scales-II Picture Similarities Ability Score), and chronological age (CA). Study analyses focused on convergent validity, practice effects, and test-retest reliability.

**Results**: On average, the children with DS earned an Optimal score of 10.67 (range = 4.3 - 12) and an Average score of 8.64 (range = 1 - 12) during the initial visit. Both the CCS Average and Optimal scores demonstrated convergent validity when compared to other measures of expressive communication (*r*s = .64 - .77, *p* < .001), nonverbal cognition (*r*s = .48 - .49, *p* < .001), and CA (*r*s = .32 - .34, *p* < .001). Furthermore, no significant practice effects were observed for either score across the test and retest visits (*p*s > .30); significant bivariate correlations (*r*s = .843 - .880, *p* < .001) and Interclass Coefficients (α = .915 - .934) were also observed for the CCS Average and Optimal scores at the test and re-test visits.

**Discussion:** Considerable heterogeneity is observed in the early communication skills of children with DS, making the identification of valid assessment tools of primary importance. Such a tool must capture nuances in communicative behaviors that range from prelinguistic gestures to multiword utterances. Results from the present study provide an important step demonstrating the appropriateness of CCS scores as a measure of expressive communication for young children with DS. The CCS demonstrated strong correlations with standardized measures of expressive communication, limited practice effects, and strong test-retest correlations. Finally, for children with DS in the early phases of communication development (i.e., prelinguistic and first words stage) the CCS was able to measure communication skills effectively. Additional clinical and conceptual considerations will be discussed.

**References:**

Abbeduto, L., Warren, S. F., & Conners, F. A. (2007). Language development in Down syndrome: From the prelinguistic period to the acquisition of literacy. Mental Retardation and Developmental Disabilities Research Reviews, 13(3), 247-261.

Brady, N. C., Fleming, K., Thiemann-Bourque, K., Olswang, L., Dowden, P., Saunders, M. D., & Marquis, J. (2012). Development of the Communication Complexity Scale. American Journal of Speech Language Pathology, 21(10, 16-28.

Esbensen, A. J., Hooper, S. R., Fidler, D., Hartley, S. L., Edgin, J., d'Ardhuy, X. L., ... & Group, O. M. W. (2017). Outcome measures for clinical trials in Down syndrome. American Journal on Intellectual and Developmental Disabilities, 122(3), 247-281.

Finestack, L. H., & Abbeduto, L. (2010). Expressive language profiles of verbally expressive adolescents and young adults with Down syndrome or fragile X syndrome. Journal of Speech, Language, and Hearing Research, 53(5), 1334-1348.

Finestack, L. H., Sterling, A. M., & Abbeduto, L. (2013). Discriminating Down syndrome and Fragile X syndrome based on language ability. Journal of Child Language, 40(1), 244–265.

Mundy, P., Delgado, C., Block, J., Venezia, M., Hogan, A., & Seibert, J. (2003). Early Social Communication Scales (ESCS). Coral Gables, FL: University of Miami.

Tager-Flusberg, H., Rogers, S., Cooper, J., Landa, R., Lord, C., Paul, R., Rice, M., Stoel-Gammon, C., Wetherby, A., & Yoder, P. (2009). Defining spoken language benchmarks and selecting measures of expressive language development for young children with autism spectrum disorders. Journal of Speech, Language, and Hearing Research, 52(3), 643–652.

 University of California, Davis – MIND Institute

2 Cincinnati Children’s Hospital Medical Center

3 Colorado State University

4 University of Louisville

5 University of Pennsylvania