**Title:** Speech and Working Memory Impairments Explain Unique Variance in Adaptive Functioning Skills in Young People with Down Syndrome

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**Introduction:** Down syndrome (DS) is the most common genetic cause of intellectual disability (ID), occurring in ~1/700 live births, and is characterized by cognitive deficits and low adaptive abilities (Parker, Mai, Canfield et al., 2010; Marchal et al., 2016). Adaptive function skills in this lifelong neurodevelopmental disorder increase at a gradual rate and fall well below age expectations (Dressler, Perelli, Feucht, Bargana, 2010; Morgan, 1979). Therefore, research identifying lower level processes that are predictive of adaptive functioning skills in individuals with DS is needed to identify treatment targets that will assist in improving adaptive functioning for this population. The current research examined how two such processes, executive function and social/communication skills as measured by the Behavior Rating Inventory of Executive Function (BRIEF) and Children’s Communication Checklist – 2 (CCC-2), respectively, explain variance in adaptive functioning in a sample of young people with DS.

**Methods:** Thirty-two individuals with DS participated (17 females; Age: M=13.5 years; SD=5.5; IQ: M=53.2; SD=14.2). They were a part of a study on cognitive and brain development completed at the NIH. Parents completed the Adaptive Behavior Assessment System – 2 (ABAS-II), BRIEF (preschool and school-age version), and CCC-2. For the BRIEF, composite scores were created for Working Memory, Plan/Organize, Inhibit, Shift, and Emotional Control by pulling identical or very similar items on the BRIEF and BRIEF-Preschool and creating mean item rating scores (consistent with prior methods (Lee et al., 2015)). For the CCC-2, all 8 language scales (4 structural language, 4 social-communication or pragmatic language scales) and the Social Relations scale were evaluated.

To reduce the number of analyses completed, BRIEF and CCC-2 profiles were examined and the two scales with the greatest impairment on each instrument were utilized in regression analyses (consistent with prior methods (Wallace et al., 2016)) aimed at predicting variance in the ABAS-II Conceptual (ABAS-CON), Social (ABAS-SOC), and Practical (ABAS-PRAC) composites. For the BRIEF, the two areas of greatest impairment were working memory (WM) and inhibition (INH); for the CCC-2, these were speech (SP) and syntax (SYN). To examine the contributions of these four scales to the three ABAS Composite scores, stepwise multiple regression analyses were completed with two steps: Step 1: age, sex; Step 2: WM, INH, SP, SYN. Follow-up analyses were also completed with nonverbal IQ included in step 1.

**Results:** For each of the ABAS composites, the CCC-2 SP scale predicted unique variance beyond the effects of age, sex, and nonverbal IQ ($R^2$ change > .16 in all models; all $F$ change values > 6, all $p$s <.03). These findings were expected for the ABAS-CON composite, in particular, as this composite includes the Communication scale. However, these findings were not inevitable for the ABAS-SOC and ABAS-PRAC scales.

For the ABAS-CON and PRAC scales, the BRIEF WM composite also predicted unique variance ($R^2$ change > .05 in all models; all $F$ change values > 4, all $p$s <.05). However, when nonverbal IQ was included in the models, WM no longer added unique variance to the prediction of these composites.

**Discussion:** These findings suggest that speech and working memory skills are important to consider when identifying interventions that aim to improve adaptive functioning among individuals with DS. While speech-language therapy services are standard for children with DS, interventions targeting working memory skills are less common. Given its ties to adaptive functioning, WM is likely to be an important intervention target in future research with individuals with DS. Thus, the identification of factors (e.g., genetic, neurobiological) that underlie individual differences in WM and interventions (e.g., psychoeducational or pharmacological) and augment this cognitive process have important implications for increasing adaptive functioning and independence in this group.
References/Citations:


