Title: Behavioral Inflexibility and Cognitive Inhibition Differentiates Children with ASD and ADHD

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Introduction: Attention Deficit/Hyperactive Disorder (ADHD) and Autism Spectrum Disorder (ASD) are two neurodevelopmental disorders (NDDs) with a high degree of comorbidity and phenotypic overlap. Between 30 to 50% of individuals with ASD also display behaviors characteristic of ADHD (Davis and Kollins, 2012). Areas of development that show promise for understanding common and distinct features of ASD and ADHD are executive functioning deficits (EFd), cognitive ability impairments, and behavioral inflexibilities (BI) (Martel, Nikolas, & Nigg, 2007; Corbett, Constantine, Hendren, Rocke, & Ozonoff, 2009). BI refers to the inability to tolerate change when the situation calls for it and may be another important area of overlap across NDDs. BI is relatively well defined in ASD (Sethi, Harrop, Zhang, Whitten, Pritchett, Boyd, 2019), but not in ADHD. The goal of this study is to understand phenotypic overlap and distinctions between those with ASD and ADHD by profiling EFd using the NIH Toolbox Cognition Battery (NIH-TCB) and characterizing BI using the Behavioral Inflexibility Scale (BIS; Boyd, Bodfish, Lecavalier, & Harrop, 2018). This approach enables us to accomplish the following aims: (1) characterize profiles of EF across developmental disorders, (2) test the hypothesis that BI, when using a measure sensitive to NDDs, differentiates those with ASD, ADHD, and those who are TD, and (3) identify the areas of BI that are most problematic in the ADHD population. Through a better understanding of the specificity and overlap between ASD and ADHD, we can begin to develop and evaluate cross-diagnostic intervention approaches – a vital need given the impact of both EFd and BI on daily functioning and academic achievement in ASD and ADHD (Rao & Landa, 2013).

Method: Participants for this study were ages 3-17 and recruited from two samples: 17 child/adolescents with ADHD from an ongoing study investigating EF and BI in children with ADHD; 127 child/adolescents with ASD and 93 typically developing (TD) from a previous study (R01:HD082127; PI: Boyd). 40% of children in our ASD sample has a co-occurring ADHD diagnosis, therefore we separated this group into ASD (N = 76) and ASD+ADHD (N = 51). By April 2020, we will have 40 children/adolescents with ADHD. All child/adolescent participants completed the Stanford-Binet (SB-5) abbreviated intelligence quotient (ABIQ) and a battery from the NIH-TCB consisting of the Flanker Inhibitory Control and Attention (Flanker; inhibition), Dimensional Change Card Sort (DCCS; cognitive flexibility), Pattern Comparison Processing Speed (PCPS; processing speed), and Picture Sequence Memory Test (PSMT; episodic memory). Parents/caregivers completed a series of questionnaires that included a basic demographic form, questionnaires relating to ASD symptomatology, and the BIS. This BIS has been normed on a large sample of children 3 to 17 with a diagnosis of ASD (N = 943). Given the unequal sample sizes between groups (17 ADHD, 76 ASD, 51 ASD+ADHD, and 93 TD), groups were compared using the Wilcoxon signed-rank test of differences.

Results: Children with ADHD did not differ from TD children in terms of ABIQ, processing speed, episodic memory, or cognitive flexibility (p>.05). However, they did perform significantly worse (p<.001) on cognitive inhibition. Children with ASD performed significantly worse than the ADHD group on both ABIQ (W=200, p<.001) and cognitive inhibition tasks (W=0, p<.001), but performed similarly on all other tasks (p>.05). Interestingly, while children with ASD+ADHD performed significantly lower than those with only ADHD on tests measuring ABIQ (W=200, p<.001), cognitive inhibition (W=0, p<.001), and cognitive flexibility, they performed similarly on processing speed and episodic memory (p>.05). Children with ADHD demonstrate significantly more BI than the typically developing group (W=1000, p=.01) and significantly less BI than children with ASD and ADHD (W=200, p<.001) as well as those with pure ASD (W=200, p<.001). Given the ability of the BIS to differentiate between each group, the most endorsed items were examined for each group and will be presented. Additionally, following collection of our full sample, a linear discriminant analysis (LDA) will be performed to further highlight the discriminating items.

Discussion: In this modest-sized study, we verified our hypothesis that EFd, namely cognitive inhibition, and BI play a significant role in differentiating these NDDs (ASD, ASD+ADHD, ADHD, and TD). This important finding suggests that EFd remains a meaningful target for cross-diagnostic intervention approaches. Additionally, this innovative application of a BI measure across NDDs enables us to characterize the profile of BI specific to ADHD. These findings should be interpreted with caution given this
preliminary sample. However, we find it promising that BI differentiates the four groups. This suggests that while BI may be a common feature across those with ADHD and those with ASD, the profile and magnitude of BI differentiates these developmental disorders.

References:


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