**Background**

- While Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) do not share any diagnostic features in common, children with one diagnosis often show elevated levels of the other, and between 17-43% of children with ASD meet full criteria for a comorbid ADHD diagnosis (Sunén et al., 2012; Suppekar et al., 2017).
- Children with comorbid ASD/ADHD exhibit a more severe behavioral phenotype with higher levels of ASD symptomatology and lower adaptive functioning skills (Craig et al., 2015; Rao & Lande, 2014; Simone et al., 2009).
- Both ASD and ADHD lie at the extreme ends of dimensional trait continua in the general population (Constantino & Todd, 2003; Marcus & Barry, 2011).
- A single study to date has examined the relationship between dimensional ASD/ADHD traits and adaptive functioning (Ashwood et al., 2015).
  - In a group of truly ASD, ADHD, or comorbid ASD/ADHD, all subscales of the Vineland Adaptive Behavior Scales – Second Edition (VABS) were significantly predicted by ASD but not ADHD symptoms scores.
  - The predictive ability of ASD symptoms severity remained after controlling for ADHD symptom scores.

This investigation seeks to replicate and expand upon the work by Ashwood et al. by:
- Utilizing a sample with both males and females.
- Controlling for sex and full-scale IQ in the regression analyses.
- Employing total ADHD symptoms rather than inattention and hyperactivity separately.
- Including typically-developing (TD) to span the entire range of dimensional traits.

Regression analyses performed with and without the TD children included in the sample, so as to more closely expand upon prior analyses.

**Method**

**Participants:**
- 110 intellectually-able (FSIQ > 70) children and adolescents between 7 and 18 years of age evaluated as part of various electrophysiological studies at the Yale Child Study Center.
- 37 TD, 33 ASD only, 30 ASD/ADHD – ASD diagnosis confirmed using gold-standard instruments (ADOS+ADI-R).
- ASD diagnoses determined using parent-reported DSM symptoms on Child and Adolescent Symptom Inventory – 2 (CASI-2).
- An additional 10 children were enrolled as either TD or suspected ASD but were diagnosed with ADHD instead. These children were retained for dimensional analyses only.

**Variables:**
- Socialization
- VABS – Communication
- Total (0-54)
- CASI-5 ADHD
- SRS-2 Total
- (FSIQ)
- Center age evaluated as part of various electrophysiological studies at the Yale Child Study Center.
- Age evaluated as part of various electrophysiological studies at the Yale Child Study Center.

**Statistical Analysis:**
- Stepwise hierarchical linear regressions performed with each VABS domain standard score and the VABS ABC as dependent variables.
  - Step 1: Age, Sex, and FSIQ entered as covariates.
  - Step 2: SRS-2 Total Score and CASI-5 ADHD Total entered in stepwise manner.
  - Analyses repeated twice, once with entire sample and once just with the ASD and ADHD groups.

**Regressions: Whole Group**
- All of the regression models succeeded in predicting the DV of interest ($R^2=0.41–0.65$).
  - Age is a significant predictor in all models, and IQ significantly predicted VABS ABC and all subscales except for Daily Living Skills ($p=0.059$).

**Regression performed without TD children (ASD, ADHD, and ASD/ADHD groups only)**
- All of the regression models succeeded in predicting the DV of interest ($R^2=0.41–0.65$).
  - Age serves as a significant predictor in any of the models.
  - SRS-2 Total Score, but not CASI-5 ADHD score was added in step 2 of all four models and significantly improved the fit of each model ($ΔR^2=0.26–0.54$, $p<0.05$).
  - SRS-2 Total Score remained a significant predictor in all models after CASI-5 ADHD score was added in a third step.
  - Among the three domains the addition of SRS-2 Total to the model caused the largest $ΔR^2$ for the Socialization subscale, followed by Communication, then Daily Living Skills.

**Conclusions**
- Dimensional ASD and ADHD symptoms are significantly associated with reduced adaptive functioning across domains.
- ASD symptomatology was a superior predictor of all VABS domains and the ABC score after controlling for age, sex, and full-scale IQ.
- However, when only the clinical children were included in the sample, ADHD symptoms were most related to impairment in two of the three VABS domains.
- Although the use of a clinical-only sample brought our analysis more in line with that performed by Tyre and colleagues, the exclusion of control children caused our findings to diverge from theirs.
- Further research is needed to discern the relationships between dimensions of ASD and ADHD while accounting for other sources of impairment such as comorbid psychopathology, academic difficulties, or peer rejection.
- Additionally, given pronounced effects of age in the various models, understanding the differential influence of symptom clusters over the lifespan may allow for better clinical management of both ASD and ADHD.

**Table 1: Group Statistics**

<table>
<thead>
<tr>
<th>Sex Ratio (M/F)</th>
<th>Age (years)</th>
<th>Sex (M/F)</th>
<th>IQ (VABS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19:17</td>
<td>12.7 (2.8)</td>
<td>12:2 (2.7)</td>
<td>102.5 (12.7)</td>
</tr>
<tr>
<td>22:11</td>
<td>13.3 (3.0)</td>
<td>12:3 (2.4)</td>
<td>102.5 (12.4)</td>
</tr>
<tr>
<td>10:20</td>
<td>13.2 (2.4)</td>
<td>12:3 (2.7)</td>
<td>102.5 (13.6)</td>
</tr>
</tbody>
</table>

**Table 2: Final regression models for the VABS Adaptive Behavior Composite with and without incorporating the TD group**

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictors*</th>
<th>$R^2$ (Step 1)</th>
<th>$R^2$ (Step 2)</th>
<th>$ΔR^2$ (Step 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VABS ABC</td>
<td>Age, Sex, IQ</td>
<td>0.184</td>
<td>0.628</td>
<td>0.444</td>
</tr>
<tr>
<td>VABS ABC1</td>
<td>Age, Sex, IQ CASI-5 ADHD</td>
<td>0.317</td>
<td>0.481</td>
<td>0.164</td>
</tr>
</tbody>
</table>

**Figure 2:** Scatter plot of SRS-2 Total vs. VABS Composite Score. Trends are superimposed for a) the entire sample and b) only the clinical children (ASD, ADHD, and ASD/ADHD groups only).

**Figure 3:** Regression performed without TD children (ASD, ADHD, and ASD/ADHD groups only).