Children with high-functioning autism spectrum disorder (HFASD) are characterized by significant social deficits despite having intact cognitive abilities. Executive function (EF) deficits have been implicated in contributing to many unique behaviours seen in individuals with HFASD, such as poor behavioural regulation and inflexibility. However, limited studies are robust in their measurement and comparison of EFs in this population. The present study is an investigation of the relationship between EF and problem behaviours in 20 children between 8-12 years with HFASD (HPA, AD, and POD NSD) and 20 age- and gender-matched typically-developing comparison children. EF was evaluated through both task-based performance (Delis-Kaplan Executive Function System) and parent-reported behaviour ratings (Behaviour Rating Inventory of Executive Function). Problem behaviours were evaluated through parent-report (Behaviour Rating Scale for Children, Second Edition). Preliminary results indicate significant dysfunction on task- and parent-report EF measures, and greater problem behaviours in children with HFASD. Follow up correlational analyses point to potential relationships between these EF deficits and problem behaviours. Results will be discussed, including implications and directions for future research.

### Hypotheses

1. Children with HFASD exhibit greater externalizing behaviours than typically developing children.
2. Do children with HFASD exhibit task- and/or behaviourally-based impairments in EF?
3. What is the nature of the relationship between externalizing behaviours and EF as measured by laboratory-based tasks of EF in children with HFASD? Is this relationship different than for typically-developing children?
4. What is the nature of the relationship between externalizing problems and EF as measured by behaviour-based parent reports of EF in children with HFASD? Is this relationship different than for typically-developing children?

### Results

- **Nonparametric Mann-Whitney U analysis indicated that children with HFASD demonstrate significantly greater externalizing problems than the comparison sample.**
- **Significant differences were also seen between groups for measures of EF.**
- **Task-Based**: Children with HFASD performed significantly poorer on verbal/visual inhibition and switching (DKEFS – CW).
- **Behaviour-Based**: Children with HFASD exhibit significantly more behavioural regulation problems as seen in the BRIEF Behavioural Regulation Index and the Inhibit, Emotional Control, and Shift Subscales.
- **Follow-up parent-reported (BRIEF) analysis did not find significant relationships between task-based EF measures and Externalizing Problems.**
- **In both the HFASD and Comparison sample, a significant, positive relationship (p < .01) was found between behaviour inhibition and Emotional Problems.**
- **Finally, relationships were found in the HFASD sample that were not present in the Comparison sample, specifically, between Emotional Control and Externalizing Problems (p < .01), and between the Behavioural Regulation Index and Externalizing Problems (p < .01).**

### Table 1. Descriptive / Demographic Information of Sample, and Nonparametric Mean Comparisons (Mann-Whitney U)

<table>
<thead>
<tr>
<th>Variable</th>
<th>HFASD Sample</th>
<th>Comparison Sample</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>10.7 ± 4.5</td>
<td>10.9 ± 4.0</td>
<td>.773</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>18</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>VIS*</td>
<td>134.8 ± 12.1</td>
<td>156.3 ± 13.3</td>
<td>.863</td>
</tr>
<tr>
<td>PFS**</td>
<td>123.1 ± 24.6</td>
<td>122.9 ± 22.1</td>
<td>.213</td>
</tr>
<tr>
<td>VIS**</td>
<td>120.9 ± 13.0</td>
<td>146.3 ± 10.0</td>
<td>.271</td>
</tr>
<tr>
<td>BRIEF VIS – Category Switching Accuracy***</td>
<td>9.8 ± 3.9</td>
<td>11.3 ± 2.7</td>
<td>.193</td>
</tr>
<tr>
<td>BRIEF CW – Inhibition / Switching Accuracy***</td>
<td>8.7 ± 2.8</td>
<td>10.5 ± 3.8</td>
<td>.046</td>
</tr>
<tr>
<td>BRIEF Behavioural Regulation*</td>
<td>68.0 ± 11.9</td>
<td>61.7 ± 7.8</td>
<td>.000</td>
</tr>
<tr>
<td>BRIEF Emotional Control†</td>
<td>62.2 ± 13.9</td>
<td>69.6 ± 8.9</td>
<td>.000</td>
</tr>
<tr>
<td>BRIEF Inhibit†</td>
<td>61.7 ± 13.8</td>
<td>47.5 ± 7.0</td>
<td>.000</td>
</tr>
<tr>
<td>BRIEF Inhibit Error†</td>
<td>8.1 ± 13.5</td>
<td>47.5 ± 7.0</td>
<td>.000</td>
</tr>
<tr>
<td>BRIEF-2 Externalising Problems</td>
<td>58.1 ± 13.5</td>
<td>69.7 ± 7.1</td>
<td>.082</td>
</tr>
</tbody>
</table>

**Nonparametric Correlations (Spearman’s r)**

<table>
<thead>
<tr>
<th>BRIEF Sample</th>
<th>BRIEF-2 Externalising Problems</th>
<th>r</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIEF Sample</td>
<td>BRIEF-2 Externalising Problems</td>
<td>r</td>
<td>Significance</td>
</tr>
<tr>
<td>Comparison Sample</td>
<td>BRIEF-2 Externalising Problems</td>
<td>r</td>
<td>Significance</td>
</tr>
<tr>
<td><strong>.</strong>* = (p &lt; .05)</td>
<td>(p &lt; .01)</td>
<td>(p &lt; .001)</td>
<td></td>
</tr>
</tbody>
</table>

### Discussion

- The results partially supported the first hypothesis, in that children with HFASD demonstrate greater externalizing behaviours than their typically developing peers.
- In regards to EF, children with HFASD did not differ significantly from their peers on a task-based measure of verbal relational processing. However, they did have significant challenges with a verbal/visual switching task. Children with HFASD demonstrated significantly more problems on all domains of a parent-report scales of EF (emotional regulation, inhibition, shifting, and overall behavioral regulation).
- Despite some significant differences between groups, the second hypothesis was also partially supported.
- The nonparametric reported (BRIEF) analysis did not find significant relationships between task-based measures of EF and externalizing behaviours in either sample.
- However, significant relationships with externalizing behaviours were seen on three of four parent-report scales of EF, including those measuring inhibition, emotional regulation, and overall behavioral regulation. Specifically, a moderate, positive relationship was seen in both groups for inhibition and problem behaviours. Uniquely, moderate positive relationships were observed between both emotional regulation and overall behaviour regulation in the HFASD group, but not in the TD group.
- The outcomes from this study add to the literature suggesting that deficits in EF exist in children with HFASD, using both task-based and behaviour-based measures.
- Furthermore, the results suggest that impairment with emotional regulation may contribute to externalizing problems in children with HFASD; however, these behaviours may be more distinct in origin and control mechanisms in typically developing children.

### Future Directions

- The results of this study are part of a larger project examining aspects of functioning (e.g., Theory of Mind, Emotional Intelligence, and EF) in children with HFASD and relationships of these factors to social skills and resilience.
- Longitudinal research is needed to better understand both the nature of and potential relationships between EF and externalizing problems over time (i.e., as children mature and develop).
- It will also be important for future research to examine the relationship between externalizing problems and other task-based EF tasks (i.e., self-regulation, planning, etc.) to determine whether a relationship exists.
- We call for a better understanding of the relationship between EF and problem behaviours in children with HFASD. It will be important for such work to build on this information by developing targeted interventions to improve and strengthen EF abilities and ultimately decrease problem behaviours. Specifically, early intervention efforts (beginning in preschool) may help tackle problem behaviours before they begin impacting their schooling, home life, and peer interactions.
- Additionally, as children with HFASD already face numerous social challenges without the added component of problem behaviours, difficulty picking up on social cues, intervention efforts that target EF and problem behaviours (at any age) concurrently may decrease the number of barriers that stand in the way of these children being able to establish and maintain friendships and ultimately experience success in social situations.

### References

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9. This research is also supported by the CIHR Training Program in Genetics, Child Development and Health and the Alberta Children’s Hospital Research Institute (ACHRI).
10. We gratefully acknowledge all of our participants and their families as well as our community partners. For further information concerning this study, write to aclomar@ucalgary.ca

### Measures

- **Inclusionary Measures**
  - Wetherick Abbreviated Scale of Intelligence (WASI); Autism Diagnostic Interview – Revised (ADI-R)
- **Externalizing Problems**
  - Behavior Assessment System for Children, Second Edition (BASC-2)
  - Parent-rating form: Externalizing Behaviours Composite
- **Executive Function**
  - Behaviour Rating Inventory of Executive Function – Parent Form (BRIEF) (Inhibit, Shift, and Emotional Control Subscales; Behavioural Regulation Index Scale Task-Based: Delis-Kaplan Executive Function System (D-KEFS))
  - Verbal Fluency (Category Switching); Color-Word Interference (Switching)