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## Early adversity and positive parenting: Predicting executive functioning in children with ASD

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A thesis submitted in partial fulfillment of the requirements for the Master of Arts degree in Education

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## **Abstract**

Children with Autism Spectrum Disorder (ASD) are statistically more likely to experience early adversity; however, little is known about which types of adversity are most prevalent, the role of parenting as a protective factor, and how this early life stress impacts cognitive outcomes. We assessed adversity and parenting styles in 238 children (ASD=82) aged 6–16 years using parent report. Intellectual abilities were assessed using the WISC-V. Children with ASD had increased incidence of familial stressors compared to Typically Developing (TD) children. Positive parenting was associated with significant decreases in familial adversity for all children. Environmental stressors were associated with cognitive impairments, but only in young children (6–11 years) with ASD. Findings suggest children with ASD may be at higher risk for familial adversity and potential cognitive deficits than their TD peers. All children benefit from positive parenting which may mitigate the negative effects of familial stress.

**Keywords**

Autism Spectrum Disorder

Early Adversity

Cognitive Outcomes

Executive Functioning

Parenting

## **Summary for Lay Audience**

Some key features of Autism Spectrum Disorder (ASD) include difficulties with communication and social impairments. This means that children with ASD may be more likely to experience early adversity (stressful events which take place during childhood) than children without ASD. Research in typically developing (TD) children has shown that experiencing more stressful events in childhood can cause changes in the brain, which can potentially impact the child's memory, reasoning, and decision-making skills later in life. However, evidence suggests that having a nurturing relationship with a parent can offset the negative impacts of childhood adversity. In our study, we found that children with ASD are more likely to experience family-related stress compared to TD children. Having a positive relationship with a parent was associated with experiencing fewer incidences of familial stress less often for children with ASD and TD children. We also found that stressors related to environmental factors like financial instability were associated with lower cognitive abilities in children with ASD under 6-11 years old. Understanding how these factors interact and differ in children with ASD can help to build stronger families and help children with ASD to thrive throughout their development.

### **Co-Authorship Statement**

This thesis contains a submitted manuscript titled “Early adversity and positive parenting: association with cognitive outcomes in children with ASD” which can be found in Chapter 2. A version of the manuscript is currently under review by the peer-reviewed journal *Autism* and Dr. Diane Seguin, Dr. Rob Nicolson and Dr. Emma Duerden are co-authors. Drs. Seguin, Nicolson and Duerden were involved in the study design. The data for the study were collected by researchers at the Child and Mind Institute in New York and were made publicly available in an open access database through the Healthy Brain Network. As first author, I completed all data analysis and wrote the manuscript independently, while my co-authors provided valuable edits and feedback on my final draft.

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## Chapter 1

### 1.1 Introduction

The impact of childhood experiences can last a lifetime. Negative life events can have an enormous impact on a child's mental health and development and have been associated with a variety of mental health issues. Early life stress and maltreatment have been linked to a higher rate of depression in adolescence (Markowitz, 2017). Other longitudinal studies have shown that children with high levels of familial adversity, such as frequent conflict or parental mental health issues, displayed more risk-taking behaviours as teenagers than those who experienced little or no familial adversity (Cosco et al., 2019). In a broader sense, a greater number of adverse childhood experiences has been shown to predict anxiety disorders, Obsessive Compulsive Disorder (OCD), and psychopathology in non-clinical adult populations (Hayward et al., 2020).

#### 1.1.1 Early adversity in typical development

The mechanisms underlying the alterations in behaviour and mental health remain unknown – however alterations in brain development may be a contributing factor. Prolonged periods of extreme stress in childhood impact three main regions of the brain: the hypothalamic-pituitary-adrenal (HPA) axis, the amygdala and the prefrontal cortex (Fisher et al., 2016, Taylor, & Rogers, 2005). While the HPA axis and amygdala are associated with controlling one's stress responses, the prefrontal cortex is associated with cognitive abilities (Friedman & Miyake, 2017). Childhood trauma has been shown to impede other areas of executive functioning responsible for skills such as working memory, decision-making, planning and organization, and emotional regulation (Glaser, 2000; Carrera et al., 2019, Wesarg et al., 2020). These higher-order thinking skills are not only instrumental in academic success, but are used throughout all stages of life.

Evidence suggests a strong link between early adversity and poor physical health in adulthood. Previous studies have established an association between financial adversity (or low socioeconomic status) in childhood and increased risk for diabetes and cardiovascular disease in young adulthood (Wickrama, Bae & O'Neal, 2017; McEwen &

Gianaros, 2010). While environmental factors such as nutrition and exercise no doubt play a role in the development of diabetes and heart disease, other research has shown that there are a variety of physical health risks associated with childhood adversity, aside from socioeconomic status. For example, the neurodevelopmental changes associated with high levels of stress in early childhood have been linked to increased inflammation in adults due to alterations in the Autonomic Nervous System (ANS) (Chiang et al., 2015), the body's system to respond to threatening events. Additionally, a longitudinal study in the US showed that when controlling for socioeconomic status, people who experienced familial, financial or health-related adversity in childhood were more likely to receive employment disability funding in adulthood (Laditka & Laditka, 2019). While there are certainly individual differences in the type, severity and duration of adversity, it seems clear that negative life events experienced in childhood are associated with long-term effects on both psychological and physical health.

### **1.1.2 Autism spectrum disorder and mental health**

Currently in Canada there are estimates that approximately 1 in 66 children are diagnosed with Autism Spectrum Disorder (ASD) (Public Health Agency of Canada, 2018).

Symptoms characteristic of the disorder include deficits in communication and social interaction, as well as stereotypic behaviours such as rocking back and forth, narrow interests and self-injury (American Psychiatric Association, 2013). Because of the nature of the disorder children and adolescents may struggle in social situations and are more likely to experience social adversity like bullying (van Schalkwyk, et al., 2018; Sterzing et al., 2012). The potential increase in adversity may impact mental health outcomes.

Recent research has estimated that as high as fifty-four percent of adolescents with ASD experience depression and between forty and fifty percent have anxiety (Mackay, Shochet, & Orr, 2017; White et al., 2009). Although this is a high percentage of the population (almost double the incidence of these disorders in the typically developing population), little previous research has explored the association between mental health and adversity in children with ASD. The lack of focus on this population's unique mental health needs may translate to the practical treatment of these individuals. A 2010 study conducted in the United States compared community-based mental health services given

to children with ASD and typically developing children. Their results showed that seventy percent of children with ASD had a comorbid psychiatric disorder, yet they received the same psychotherapeutic services as their typically developing (TD) peers. Very few therapists implemented research-supported practices specific to ASD or any comorbid disorder, perhaps due to the lack of knowledge and training necessary for supporting children with the disorder (Brookman-Frazee, Taylor & Garland, 2010). This problem is also seen in terms of recognizing how children with ASD respond to trauma, as many common symptoms of PTSD (such as lack of eye contact, difficulty conveying emotion, and self-injury) are typically pre-existing among the ASD population (Stack & Lucyshyn, 2019).

### **1.1.3 ASD and executive functioning**

Another common characteristic among the ASD population is deficits in executive functioning. A meta-analysis has shown that children with ASD have higher impairments in working memory than typically developing peers (Wang et al., 2017). Deficits in executive function often present themselves as mental inflexibility and perseverative behaviours (South, Ozonoff & McMahon, 2007). Beyond causing external symptoms, some research has also shown that lower executive functioning skills in children with ASD predict lower social cognition skills, and more difficulty recognizing emotion in others when compared to control groups (Sivaratnam, Newman, & Rinehart, 2018). In this way, executive functioning deficits may be a large contributor to potentially increased social adversity for children with ASD. Furthermore, as suggested by Mackay, Shochet & Orr in 2017, lower executive functioning abilities also often mean impaired coping abilities. Under this model, children with ASD are not only more likely to experience adversity, but are less equipped for resilience than their peers.

### **1.1.4 Protective factor: parenting**

The nature of the relationship between child and parent may protect children against the cognitive, physical, and psychological consequences of negative early life events. In both human and animal research, having a stable, nurturing relationship with a parent can mitigate the negative impact of trauma, even reverting the neurobiological changes

caused by increased stress (Van Der Kolk, 2003; Meaney & Szyf, 2005). Parental relationships are also associated with physical health differences; having a secure parental attachment can moderate the level of salivary inflammation caused by adversity in infants, even as early as seventeen months old (Measelle & Ablow, 2018). Similar results were found when observing hormonal stress responses in children experiencing health-related adversity: children who were born with a physical disability whose parents exhibited a more nurturing parenting style showed a significantly greater ability to process and adapt to stress than those with parents who used a harsh parenting style (Bugental, 2004).

The presence of a positive parental relationship can also have a potential impact on the behavioural outcomes for children who have experienced early adverse life events. When looking at the prevalence of problem behaviours among children with intellectual disabilities, longitudinal studies have shown that closer parent-child relationships predicted lower behavioural problems in later childhood and adolescence (Totsika, Hastings, Emerson, & Hatton, 2019; Totsika, Hastings, Vagenas, & Emerson, 2014). Landmark research in early adversity was conducted through the longitudinal study of English-Romanian Adoptees (ERA). When following a cohort of children who were raised in an institutionalized setting after being adopted in the UK, it was observed that six percent of the sample developed some ASD-like patterns of behaviour resembling autism symptomology. Children exhibited difficulties with social interaction and mental inflexibility, hallmark features of ASD (Rutter et al., 1999). Seven years after being adopted, however, ten percent of the ERA children with extreme social impairments no longer displayed these symptoms (Rutter et al., 2007). While these results are ultimately promising, little research has specifically considered the role of positive parenting in moderating adversity among an ASD population.

## **1.2 Aims**

1. *Examine the types of adverse life events commonly experienced by children with ASD compared to typically developing children.*

While the current literature indicates that children with ASD are more at-risk for experiencing early adversity, it is less clearly established which types of adversity are most prevalent amongst the ASD population. The first aim of the current study was to identify the types of negative life events to which children with ASD are more susceptible when compared to their typically developing peers.

2. *Identify if early adversity predicts cognitive deficits in children with ASD.*

Although it is well-established that early adversity can alter neurodevelopment and impede cognitive skills in typically developing children, little research has been conducted on whether the same pattern exists among children with ASD. Because executive functioning deficits can be symptomatic of ASD, it may be difficult for caregivers and practitioners to differentiate between deficits caused by the neurological disorder, as opposed to those caused by trauma. In fact, it is possible that children with ASD are more vulnerable to cognitive deficits due adverse experiences than those who are typically developing. With this in mind, we sought to analyze whether early adverse events were a predictor of cognitive outcomes for children with ASD.

3. *Identify whether the parental relationship is a protective factor against stress and early adversity scores for children with ASD.*

As children with ASD are more likely to experience adversity than their typically developing peers due to common social deficits, understanding and promoting protective factors is essential. Additionally, establishing a nurturing, high quality relationship between parents and children with ASD may be more challenging than with typically developing children due to possible communication and social difficulties and lower executive functioning skills responsible for emotional regulation. Therefore, our final goal was to analyze the role of the parent-child relationship and the family system in the face of adverse circumstances.

### **1.3 Hypotheses**

Based on previous literature, our predictions for the results of the study were as follows:



*H1: Children with ASD will experience a higher number of familial and socially adverse events than typically developing participants.*

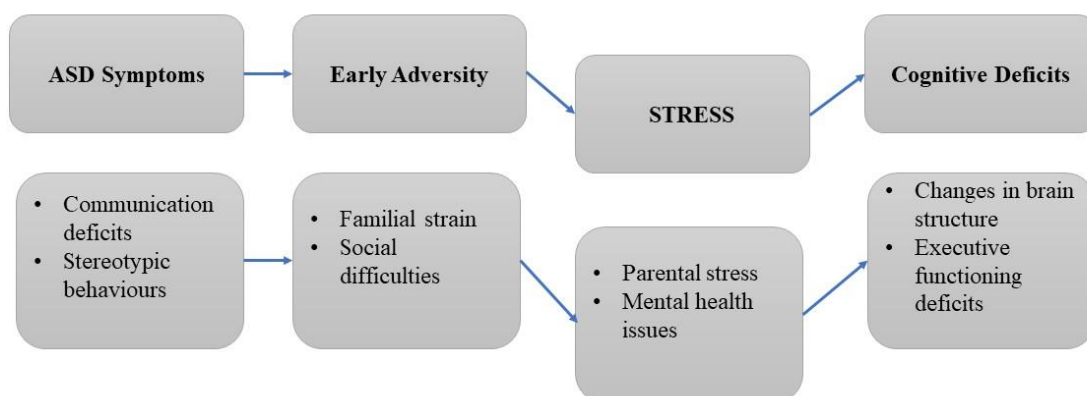
The first hypothesis suggests that due to the nature of the symptoms of ASD, children with the disorder are more likely to experience familial stress and social difficulties. We predicted that children with ASD would be more likely to experience social adversity due to impairments in social interaction, narrow interests, stereotypic behaviour and emotional regulation difficulties. These common features of ASD could make it much more difficult for these children to create meaningful friendships and even alienate them from their peers. We predicted that these symptoms, along with the communication difficulties which are symptomatic of ASD, would also be associated with increased number of adverse events within the family unit.

*H2: A higher number of adverse life events would predict lower executive functioning in children with ASD.*

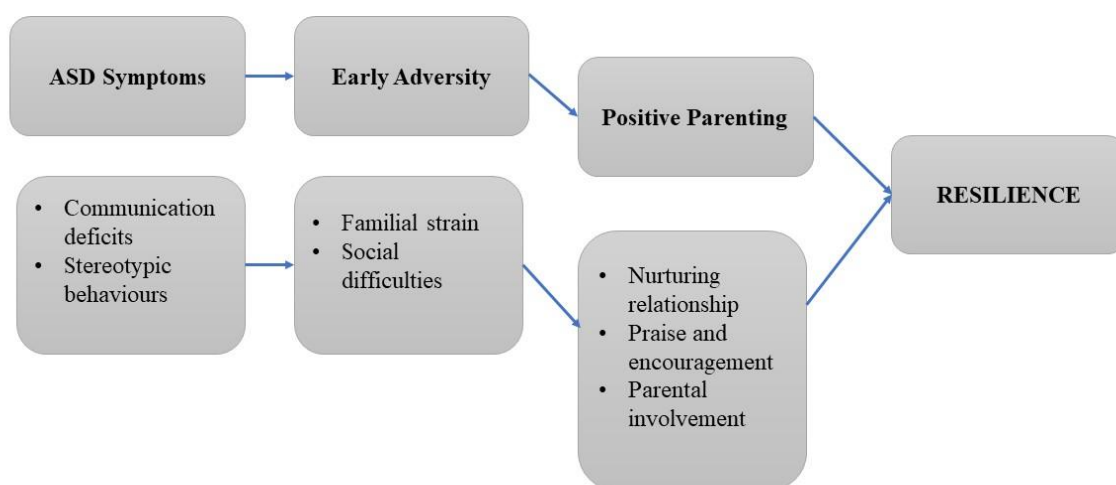
With increased adversity, we predicted children with ASD will experience greater deficits in their executive functioning abilities. This will follow the pattern seen in typically developing children, potentially due to alterations in the development of the prefrontal cortex. We predicted that higher stress levels caused by negative life events will alter neurodevelopment, exhibited by lower executive functioning skills (see Figure 1).

*H3: Positive parenting scores will modify the stress caused by negative life events.*

Similar to trends seen with both typically developing children and those with intellectual disabilities, we predicted that the presence of a nurturing parental relationship would moderate the amount of stress experienced by children with ASD during adversity. This positive relationship not only protects against the negative impacts associated with trauma, but will promote adaptive coping mechanisms and resilience among this population (see Figure 2).



**Figure 1: Children with ASD experience adversity, leading to increased stress and cognitive deficits**



**Figure 2: Positive parenting promotes resilience**

### **1.4 The Current Study**

By conducting this study, we hope to gain a better understanding of the relationship between ASD symptomology, early adversity and executive functioning. Greater insight into which forms of adversity present higher risk for children with ASD will provide caregivers, educators and medical professionals the knowledge necessary to help protect these children against the psychological and intellectual effects of these events. As children with ASD are more susceptible to developing mental health issues as a result of adverse experiences, it is vital to have a full understanding of the unique challenges these children face as they develop into adolescence. Furthermore, examining the impact of adversity on cognitive development of children with ASD may provide a possible explanation for the decreased coping abilities seen within this population. Since executive functioning deficits are typically pre-existing in children with ASD, it is important to consider how (if at all) these higher-order thinking skills are impacted by the prolonged stress caused by adversity.

Aside from better understanding the impacts of adversity, the results of this study could emphasize the importance of the parental relationship in the growth and development of children with ASD. As observed in studies conducted with children with intellectual disabilities, it is possible that a secure, nurturing relationship with a parent in early childhood can have a positive impact on behavioural outcomes for this population into adolescence. Furthermore, the results of this research could provide evidence to support parenting as a protective factor against adversity and help establish whether the same mechanisms are present for children with ASD as has been observed in typically developing children. Finally, survey data could allow us to isolate specific practices of parenting which are most effective in protecting against adversity. This information can be used practically by parents with ASD in order to enable positive relationships with their children, while simultaneously promoting resilience.

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## Chapter 2

### 2 Early adversity and positive parenting: association with cognitive outcomes in children with ASD

Negative experiences in childhood can have significant and long-lasting impacts on development. The Centre for Disease Control and Prevention, defines early adversity as any “aspects of the child’s environment that can undermine their sense of safety, stability, and bonding such as growing up in a household with substance use, mental health problems, or instability due to parental separation or incarceration of a parent, sibling or other member of the household” occurring before eighteen years of age<sup>1</sup>. Evidence suggests that external stressors such as financial instability can also alter a child’s development. Previous studies have established an association between low socioeconomic status (SES) in typically developing (TD) children and altered neurodevelopment and adverse cognitive outcomes<sup>2,3</sup>. Prolonged periods of stress in childhood are associated with altered development of the hypothalamic-pituitary-adrenal (HPA) axis, hippocampus, amygdala and the prefrontal cortex<sup>4,5</sup>. Consequently, children who have experienced childhood adversity can demonstrate executive functioning deficits, including impairments in working memory, decision-making, planning and organization, which has been attributed to alterations in hippocampal and prefrontal cortex development<sup>6-9</sup>.

Current estimates indicate that approximately 1 in 54 children in the United States are diagnosed with Autism Spectrum Disorder (ASD)<sup>10</sup>. Symptoms characteristic of the disorder include deficits in communication and social interaction, as well as stereotypic behaviours<sup>11</sup>. Social communication impairments in children with ASD may predispose these vulnerable children to experiencing increased difficulty in social situations; particularly as children and adolescents with ASD are more likely to experience peer victimization than their TD peers<sup>12,13</sup>. The risk for altered stress responses and atypical brain development may be higher for children with ASD, as previous research has demonstrated that children with ASD experience higher levels of stress during social situations than their TD peers<sup>14</sup>. ASD symptomatology may also contribute to increased

stress within families<sup>15</sup>. One previous study showed that children with ASD are significantly more likely to experience adversity than their neurotypical peers<sup>16</sup>. However, some studies have reported that children with ASD are more likely to come from higher SES households<sup>17, 18</sup>. It is possible this association may be due to increased access to testing and earlier diagnoses among families with greater financial resources<sup>19</sup>. Children with ASD from lower SES households may be limited in their ability to access services in the community. The association of financial instability and SES with cognitive outcomes within the ASD population remains underexplored.

Several protective factors have emerged in the literature that may mitigate the potential negative impacts of early adversity on child wellbeing. Having a stable, nurturing relationship with a parent can moderate the negative impact of trauma, even moderating the neurological changes caused by increased stress<sup>20, 21</sup>. Helpful comparisons can be drawn between the preterm and ASD populations, as children who were born prematurely are at high risk for neurodevelopmental disorders<sup>22</sup>. Among children born preterm, supportive parenting has been shown to be a protective factor, decreasing the likelihood of executive functioning deficits within this population<sup>23, 24</sup>.

While the current literature indicates that children with ASD may be at higher risk for experiencing early adversity, it is less clearly established which types of adversity are most prevalent amongst the ASD population, or how this adversity in combination with parenting practices impacts cognitive outcomes. With this in mind, our central aim was to examine the types of adverse life events commonly experienced by children with ASD compared to TD children, and identify whether the parental relationship is a protective factor for these children. Additionally, we hoped to determine whether early adversity predicts cognitive deficits such as executive functioning skills in children with ASD. Our hypotheses were as follows: 1) children with ASD will experience a higher number of familial and socially adverse events than their TD peers, 2) positive parenting scores will modify total negative life events, and 3) adverse life events will predict executive functioning abilities in children with ASD.



## **2.1 Methods**

### **2.1.1 Participants**

Children ages 6 – 16 years old were recruited as part of a large-scale prospective cohort study to examine brain-behaviour relationships in typically and atypically developing children in the state of New York through the Child Mind Institute's Healthy Brain Network study<sup>25</sup>. Testing was completed at three study sites. Exclusion criteria included: impaired cognitive ability ( $IQ < 66$ ) or impaired verbal or behavioural skills (i.e., nonverbal, self-harm) required to meaningfully complete all assessments. The research ethics board at the Child Mind Institute approved the study. All children under the age of 17 required the ability to verbally assent to participating, in addition to receiving informed consent from a parent or guardian.

Children and adolescents who received ASD as their primary diagnosis by a clinician on the Autism Diagnostic Observation Schedule (ADOS) and the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS) were included in the ASD group ( $n = 98$ ). Children without a clinical diagnosis based on the KSADS were included in the typically developing (TD) group ( $n = 204$ ). Children who received a clinical diagnosis other than ASD were excluded. Both the TD and ASD groups were reflective of the sex differences within their respective populations; 53.9% of the control group were male, while the ASD group had a much larger proportion of male participants at 81.6% (see Table 1)<sup>26</sup>.

**Table 1 Participant Demographics**

		ASD	TD
n, (%)		98 (32.5)	204 (67.5)
Males, n, (%)		80 (81.6)	110 (53.9)
Age, years		9.4	9.3
	<i>IQR</i>	7.4 - 12.6	7.9 - 11.7
Barratt Total		50.5	53
	<i>IQR</i>	37.8 - 62	45 - 61
NLES-P			
	<i>Total Events (%)</i>	6 (28.6)	5 (23.8)
	<i>Relational Stressors</i>	4	3
	<i>Environmental Stressors</i>	2	2
APQ-P			
	<i>Positive Parenting (IQR)</i>	27 (24 - 29)	26
	<i>Involvement (IQR)</i>	40 (36 - 43)	41
WISC-V			
	<i>FSIQ (IQR)</i>	94 (77 - 106.5)	104 (90.5 - 104)
	<i>VCI (IQR)</i>	98 (84 - 113)	107 (95 - 116)
	<i>VSI (IQR)</i>	97 (84 - 108)	100 (89 - 111)
	<i>FRI (IQR)</i>	97 (88 - 109)	106 (91 - 115)
	<i>WMI (IQR)</i>	88 (79 - 101.5)	100 (91 - 110)
	<i>PSI (IQR)</i>	89 (75 - 105)	100 (89 - 111)

Table 1. Values reflect the medians. NLES, negative life events scale. APQ, Alabama Parenting Questionnaire. WISC-V, Wechsler Intelligence Scale for Children, Fifth Edition. FSIQ, full scale intelligence quotient VCI, Verbal Comprehension Index. VSI, Visual Spatial Index. FRI, Fluid Reasoning Index. WMI, Working Memory Index. PSI, Processing Speed Index.

## **2.1.2 Measures**

### **2.1.2.1 Negative Life Events Scale**

To determine the types of early adversity experienced by the sample, parents completed the Negative Life Events Scale (NLES-P). The NLES-P is a self-report questionnaire comprised of 21 items. The items included a wide range of adverse events, such as having a fight with a sibling or parent, changing schools, experiencing a major illness, death of a close friend or family member, financial difficulties, or incarceration of a parent within the last year. Parents answered yes or no with the maximum score being 21. A full list of the items included in the NLES-P can be found in Appendix A.

### **2.1.2.2 Alabama Parenting Questionnaire**

Parenting practices were assessed through parent-report surveys using the Alabama Parenting Questionnaire (APQ-P). The APQ-P is a 42-item questionnaire comprised of five unique composites: Positive Parenting, Involvement, Poor Monitoring/Supervision, Inconsistent Discipline Practices, Corporal Punishment and Other Disciplinary Practices. A full list of the items included in the APQ-P can be found in Appendix B.

Items from the Positive Parenting (PP) subscale include activities such as how often the parent typically plays games with their child, helps with homework, or praises their child when they have done something good (see Supplementary Table 1, Appendix C).

### **2.1.2.3 Wechsler Intelligence Scale for Children**

As a measure of cognitive outcomes, the Wechsler Intelligence Scale of Children, Fifth Edition (WISC-V) was administered to all participants who were between the ages of 6 years, 0 months and 16 years, 11 months. Standardized scores from the WISC-V were used to measure various areas of cognition. The Full-Scale Intelligence Quotient (FSIQ) was used as a measure of cognitive ability within our analysis, while more specific cognitive data was measured using the five composites.

### 2.1.3 Statistical Analysis

Statistical analyses were conducted using SPSS (v26, IBM, Armonk, NY). In order to develop composite scores of early life adversity, data reduction methods were applied to the NLES-P data. A hierarchical cluster analysis using Ward's linkage was applied to the 21 items of the NLES-P data. The 21-item questionnaire consists of binary items, measuring whether specific adverse events had occurred within the child's life. Composite measures were developed from the results of the hierarchical cluster analysis by summing the number of events occurring in each category.

To determine whether the composite scores from the NLES-P differed between children with ASD and TD children, a series of General Linear Models (GLM) were used. First, the composites created from the cluster analysis of the NLES-P were used as the dependent variables in two separate models, using the primary diagnosis group as the independent variable and adjusting for age, sex, SES, and study site. SES was measured using the Barratt Simplified Measure of Social Status (Barratt). Next, the moderating effects of parenting were measured by using scores from the significant composites from the APQ-P, and the interaction between Positive Parenting (PP) scores and primary diagnosis group were examined. High and Low PP groups were created using the median score, with the Low PP group having an average score of 23.05, and the High PP group having an average score of 28.47.

In consecutive GLMs, cognitive outcomes as measured by the WISC-V were used to identify if there was an association between intelligence scores and negative life events or an ASD diagnosis. FSIQ was used as the dependent variable within the model and adversity composites and primary diagnosis group were independent variables to measure the main effects. All models adjusted for age, sex, study site, SES and PP scores. In order to determine which areas of cognition were most impacted by childhood adversity, the same models were run for each composite of the WISC-V. A final model was used to observe the effect of the interaction between types of adversity and primary diagnosis group on WISC-V scores. We used a p-value of .05 to indicate significance.

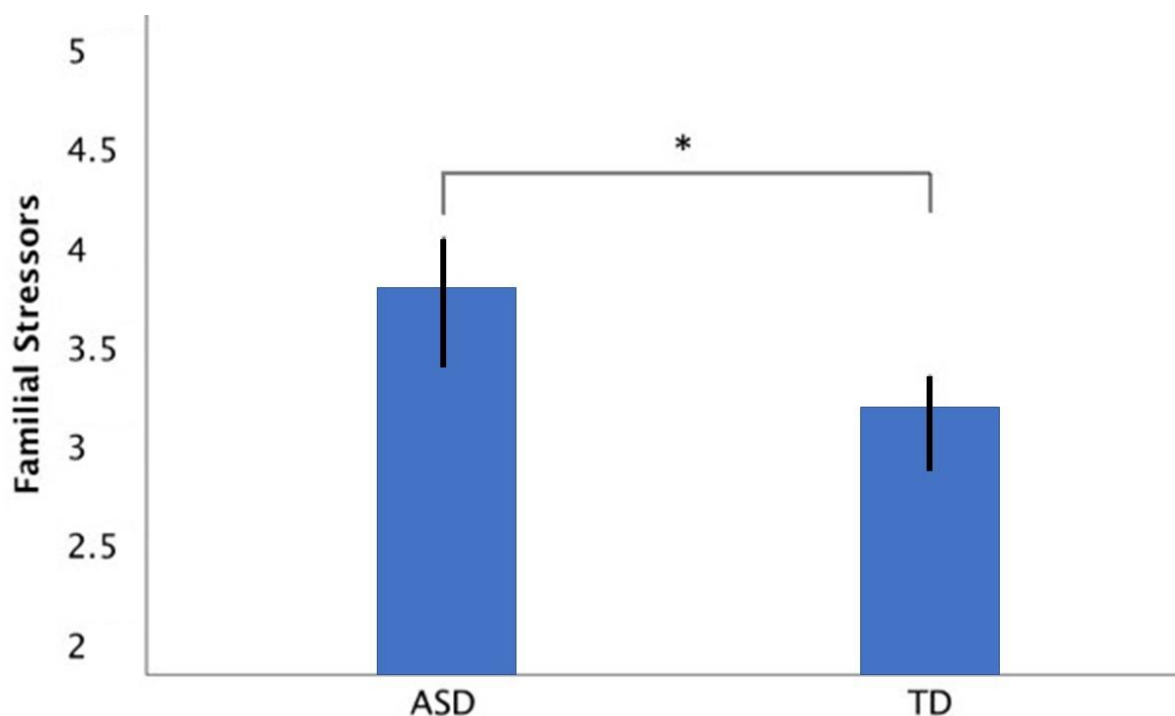
## **2.2 Results**

### **2.2.1 Environmental and familial factors**

The hierarchical cluster analysis of the NLES-P items revealed two main factors according to the overall themes of the items (see Supplementary Table 2, Appendix C). The first cluster, familial stressors, consisted primarily of familial or social challenges (i.e., parents or siblings very upset by the child's actions, having a sibling in serious trouble). The second cluster, environmental stressors, consisted of struggles within the child's home or school life (i.e., loss of a parent's job, serious financial difficulties, changing schools).

### **2.2.2 Relationship between early adversity and ASD diagnosis**

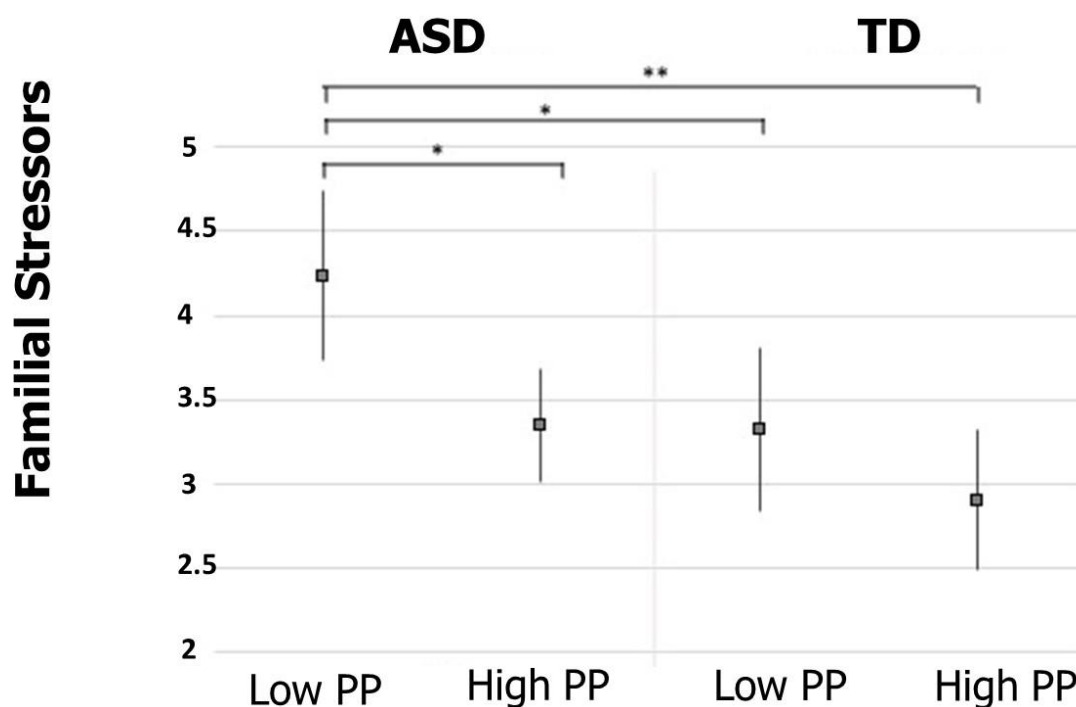
To examine whether children with ASD were more likely to experience either familial or environmental stressors, separate models were run for each type of adversity. In each model, primary diagnosis group was used as the predictor variable while controlling for age, sex and SES. A significant main effect for group ( $X^2 = 4.1$ ,  $p < .05$ ) and age was found ( $X^2 = 4.0$ ,  $p = .05$ ) whereby children with ASD ( $B = .5$ ,  $p = .04$ ) experienced an increased incidence of familial stressors compared to the TD group (Fig. 3).



**Figure 3: Number of familial stressors reported on the NLES-P in ASD and TD groups ( $B = .47$ ,  $p = .04$ ).  $*p < .05$**

### 2.2.3 Role of Parenting

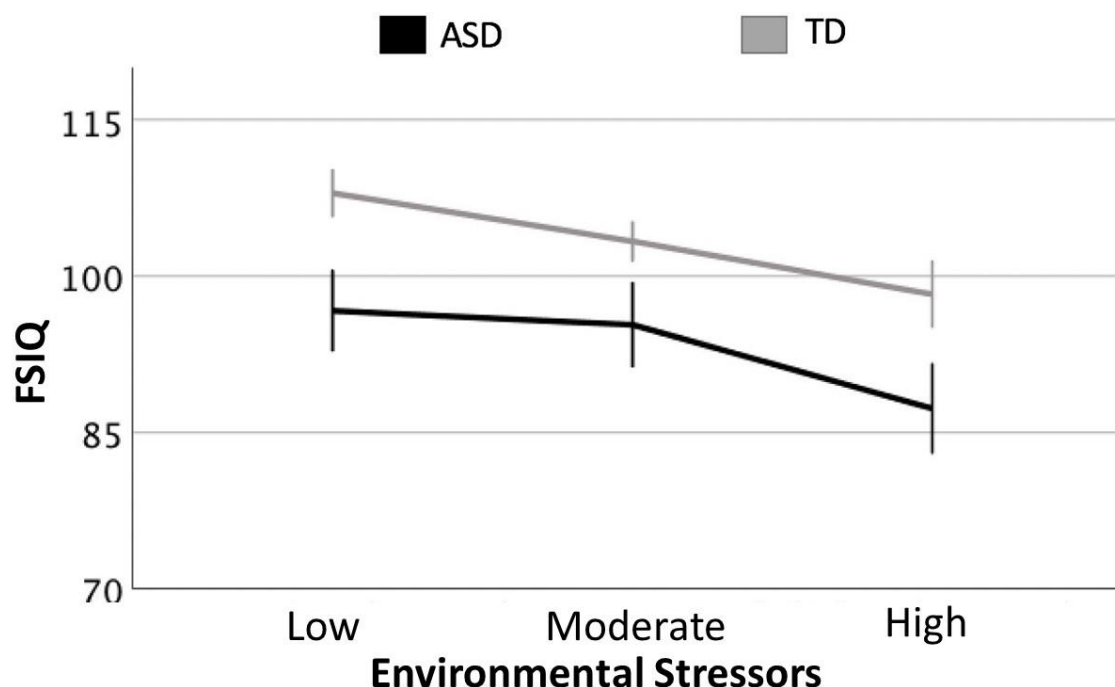
We subsequently examined negative life events in relation to the moderating effects of parenting practices from the APQ-P between groups. Environmental stressors were not significantly impacted by parenting practices. When analyzing the association between relational stressors and parenting, we found that Positive Parenting was the only composite significantly associated with any change in adversity. In an interaction analysis (parenting  $\times$  group), positive parenting was associated with a significant decrease in the number of familial early life stress events for both ASD ( $B = -.08$ ,  $p = .02$ ) and TD ( $B = -.1$ ,  $p = .003$ ) children. Children with ASD who were exposed to less positive parenting had a greater number of familial stressors compared to children with ASD who experienced more positive parenting, or typically developing children exposed to any level of positive parenting (Fig. 4).



**Figure 4: Number of familial stressors divided by diagnosis and parenting group.** Less exposure to positive parenting was associated with a significant increase in the number of familial stressors for children with ASD \*\* $p < 0.01$ , \*  $p < 0.05$

#### 2.2.4 Relationship between early life adversity and cognitive outcome

The relationship between adversity and cognitive outcomes was examined using the FSIQ from the WISC-V. In two separate models, the FSIQ scores were the dependent variables and either familial or environmental stressors as the independent variables, adjusting for age, sex and SES. In the environmental model, age ( $B = -0.9$ ,  $p = .006$ ) and diagnosis group ( $B = -8.8$ ,  $p < .0001$ , Fig 5) were significant predictors of FSIQ. Familial stressors were not a significant predictor of FSIQ.



**Figure 5: Environmental stressors were associated with lower IQ scores in young children (6-11 years) with ASD compared to their TD peers ( $B = -8.8$ ,  $p < .0001$ ).**

In a subsequent model, we assessed the effects of age and diagnosis on FSIQ. Results showed that only in young children (6-11 years) with ASD, lower FSIQ was predicted by environmental stressors ( $B = -10.4$ ,  $p = .02$ ). Figure 5 demonstrates the association between environmental stressors and FSIQ in children with ASD and TD children. No association with FSIQ and environmental stressors were seen in the TD population ( $B = -.558$ ,  $p = .460$ ). The FSIQ scores in TD and ASD adolescents (12-16 years) were not associated with environmental stress (both,  $p > .05$ ).

In young children (6-11 years), we subsequently examined each of the five indices of the WISC-V (Verbal Comprehension, Visual Spatial, Fluid Reasoning, Working Memory, Processing Speed) in relation to environmental and familial stressors. Increase in environmental stressors for children with ASD predicted lower scores on the Fluid Reasoning Index ( $B = -2.9$ ,  $p < .004$ ), Processing Speed Index ( $B = -3.67$ ,  $p < .001$ ) and Visual Spatial Index ( $B = -2.8$ ,  $p = .006$ ). No association was seen between environmental stressors and any WISC-V indices in the TD group or in older children, or with familial stressors in any group (all,  $p > .05$ ).



### 2.3 Discussion

In a moderate sample of children with ASD and TD children, we examined early life adverse events and their association with parenting styles and cognitive ability. Children with ASD were more likely to experience familial stressors than their TD peers, and the number of familial stressors increased for all children as age increased. However, when considering the role of parenting practices in protecting against familial adversity, we found that familial stressors decreased as positive parenting increased, for both ASD and TD children. Only younger children (6 – 11 years) with an ASD diagnosis who experienced a higher number of environmental stressors had significantly lower FSIQ scores than those who did not, and exhibited specific deficits in fluid reasoning, processing speed and visual spatial skills.

Our finding that children with ASD were more likely to experience certain types of adversity than their typically-developing peers aligns with previous findings<sup>27</sup>. In a large-scale survey study with children, Berg and colleagues<sup>27</sup> also demonstrated that children with ASD were more likely to experience both neighbourhood and family Adverse Childhood Events (ACEs). However, we found that significant increases in adversity for children with ASD could only be seen for familial stressors on the NLES, or events having mostly to do with loss or conflict of the child's interpersonal relationships. While the exact mechanisms behind the ASD-adversity relationship within our sample are unclear, it may be possible that the social deficits typically present in ASD symptomology contribute to increased familial stressors. Additionally, due to these marked social impairments, children and adolescents with ASD may struggle in social situations and are more likely to experience social adversity like bullying<sup>28,13</sup>. Research has also shown that lower executive functioning skills in children with ASD predict both lower social cognition skills and increased difficulty recognizing emotion in others, when compared to control groups<sup>29</sup>.

As expected, increased positive parenting practices predicted a lower number of familial stressors for both ASD and TD children. These findings support existing literature on the protective nature the child-parent relationship can have on both TD and neurodiverse children. Specifically, there is evidence that a nurturing child-parent relationship may

protect children against the cognitive, physical, and psychological consequences of negative early life events. For example, children who were born with a physical disability whose parents exhibited a more nurturing parenting style showed a significantly greater ability to process and adapt to stress than those with parents using a harsh parenting style<sup>30</sup>. Other recent research of a large, heterogeneous sample of children under the age of five found positive parenting practices protected against the social-emotional deficits otherwise correlated with adversity<sup>31</sup>. The impacts of parenting also appear to be long-lasting: when examining the prevalence of problem behaviours among children with intellectual disabilities, a longitudinal study showed closer parent-child relationships in early childhood predicted decreased behavioural problems in later childhood and adolescence<sup>32</sup>.

When examining the role of adversity in predicting cognitive outcomes, we found that environmental stressors were a significant predictor of cognitive impairments in ASD children, confirming our third hypothesis. However, while previous research has established evidence of adversity largely impacting executive functioning, the results of our analysis showed greater variation in the areas of cognition impacted. Although increased environmental stressors predicted lower processing speed, it was not a significant predictor for working memory abilities in ASD children. However, environmental stressors were also predictive of lower visual, spatial, and fluid reasoning skills for young children in this group. These findings are supported by previous research which reported an association between higher SES background in childhood with higher intelligence scores in adulthood<sup>33, 34</sup>. In our study, this pattern was only seen with ASD children. This suggests that the cognitive development of children with ASD may be more impacted by resource-deprived settings than those with typical development, aligning with previous findings<sup>35</sup>. However, our results also suggest that a lack of financial resources is not a sole predictor of cognitive outcomes in children with ASD: when adjusting for SES within our analysis using scores from the Barratt, environmental stressors were still a predictor of WISC-V scores. Instead, perhaps experiencing instability and disruption within the home environment could be playing a greater role than social status on the cognitive outcomes of these children. This finding suggests stability plays a more important role in the cognitive functioning of children with ASD

than TD children. This is in line with other research of children with ASD demonstrating an increased reliance on structure and routine for optimal functioning within the ASD population, and the positive impacts they have on the overall quality of life within the family<sup>36-38</sup>.

### **2.3.1 Limitations**

When examining associations between dynamic variables such as early adverse experiences, cognitive development, and parenting practices, it is difficult to establish any sort of concrete causation. Each of these factors have extremely complex interactions and can influence each other simultaneously. This is especially true when studying these associations within the ASD population, and trying to establish predictors of adversity and cognitive outcomes among children with varying levels of adaptive functioning and symptom severity. Additionally, the data used within the current study included only children with ASD who were able to complete the tasks required in the administration of the WISC-V, meaning that non-verbal children or those who have severe intellectual disabilities were not included. It is possible that children with ASD who have the highest communication deficits may suffer from more a more severe (or perhaps completely different) set of adverse events than those who were included in our study.

When considering the types of adversity, we found that environmental stressors were associated with decreases in cognitive outcomes in young children with ASD. When doing so, we controlled for SES differences based on the Barratt questionnaires filled out by parents. However, being part of a family with low SES scores could be considered a form of adversity. There may, therefore, be some overlap between items considered environmental stressors and low SES.

Finally, our measures of adversity and parenting practices were taken through parent-report surveys. This allowed for the inclusion of younger children who were not at the appropriate reading level to be included in the study. While this would no doubt give valuable insight into personal experiences within the family of an honest parent, there is also the possibility that parents may amplify their reports of positive parenting practices.

Future research, therefore, could use a combination of parent and self-reports to see any significant differences between parent/child perceptions, as well as parent observation.

### **2.3.2 Conclusions**

Children with ASD may experience a unique set of challenges throughout development which can impact children's cognitive outcomes. Positive parenting may offer protective cognitive benefits to children experiencing adverse events during childhood. Future studies should examine the long-term consequences of adversity in a longitudinal cohort, as well as the role of ASD symptomatology on the cognitive development of these children.

### **2.3.3 Acknowledgements**

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## Chapter 3

### 3 Study outcomes

Our study demonstrated an association between early adversity, parenting and cognitive outcomes, both for children with ASD and their TD peers. Children and adolescents with ASD experienced a significantly higher number of family-related stressors than their TD peers. However, nurturing and encouraging behaviours from parents seemed to moderate familial adversity experienced by both children with ASD and those who are typically developing. Our final result showed that for children with ASD under the age of twelve, increased environmental stressors were associated with cognitive deficits, specifically in areas of visual spatial, fluid reasoning and processing speed abilities. When controlling for SES within our analyses, our findings suggest that instability (rather than lack of financial resources) may have a meaningful impact on children with ASD, particularly in early childhood.

#### 3.1 Implications

Our first hypothesis that children and adolescents with ASD would experience a greater number of familial and interpersonal stress due to the social deficits caused by ASD symptomology was supported based on the results of our GLM and cluster analysis. The findings are in line with recent literature showing that children with ASD are more likely to experience negative life events and childhood trauma than TD children (Kerns et al., 2015; Berg et al., 2016). Furthermore, a current model of adversity in children with ASD suggests that children and youth with ASD experience more negative impacts on their mental health after experiencing adverse events because their social and communication deficits impair their access to social supports (Shochet et al., 2016). These social supports are thought to be instrumental in promoting resilience in the face of adversity.

Our finding that children with ASD were more likely to experience the familial type of adversity suggests that the challenges present for children with ASD could have impacts on the larger family system. Specifically, it seems that communication and social deficits may contribute to parent stress: parents of children with ASD report experiencing



significantly higher levels of stress than parents with TD children (Parsons et al., 2020; Hayes & Watson, 2013; Pastor-Cerezuela et al., 2016). When asked to state causes of stress, parents of children with ASD listed their child's communication deficits and social difficulties most commonly (Sim et al., 2018). It is important to note, however, that this relationship is likely bidirectional, and that parent stress can have negative impacts on child behaviour at the same time (Steijn et al., 2014; Karst & Van Hecke, 2012). The mutual influence of parenting stress levels and child behaviour seems to function similarly; however, when implementing parent-led intervention for children with ASD: parents who implemented research-based interventions reported that their stress levels decreased as the treatment progressed (Rovane et al., 2020; Mueller & Moskowitz, 2020; Schiltz et al., 2018).

In terms of the impact of parenting practices on adversity, we found that positive parenting had a significant effect in moderating the number of familial stressors experienced for both TD children and those with ASD. Previous literature has suggested that parenting plays a large role in protecting children against experiencing adversity and reducing the risk of developmental delays, social deficits, or behavioural problems in later childhood and adolescence, though much of this research has focused on TD children rather than those with neurodevelopmental disorders (Yamaoka & Bard, 2019; Jeon et al., 2016). This finding, therefore, gives further insight into the role parenting plays for children with ASD. By understanding the parenting behaviours that are most helpful for protecting children with ASD, clinicians and parents can work together to best support these children.

Our results indicate that certain types of adversity (environmental stressors) were a predictor for cognitive outcomes for young children with ASD, and is perhaps the most novel finding. We hypothesized that early adversity would predict cognitive deficits for children with ASD, specifically executive functions, due to prolonged periods of stress impacting development in the prefrontal cortex. This prediction was made based on similar findings showing lower executive functioning skills in TD children (Sheridan et al., 2017; Gajos & Beaver, 2016). Interestingly, when breaking down the specific areas of cognition most associated with changes in environmental stressors, we found that

composites of the WISC-V measuring executive functioning skills (Working Memory and Processing Speed Indices) were the only areas impacted. In fact, we found that environmental stressors were predictors of lower scores in the Fluid Reasoning, Visual Spatial and Processing Speed Indices in young children with ASD. This suggests that adversity may be associated with changes in broader areas of cognition for these children. A recent study showed some comparable findings in TD children who had spent time living in institutionalized settings: significant deficits were seen in visual spatial recognition, visual spatial working memory and attention shifting in children who had lived in institutions compared to children who had not (Bick et al., 2018). It is important to note that age played a role in this relationship, as we only saw this association between environmental stressors and IQ scores in children with ASD under the age of twelve. This result supports previous research suggesting there are sensitive periods in cognitive development during which childhood experiences are especially important in neurodevelopment (Byrne et al., 2017; Michael & Johnson, 2008; Knudsen, 2004). However, considering the complex nature and immense number of variables at play underlying the relationship between adversity, cognition and ASD symptomatology, it is difficult to state with certainty that this relationship is solely one-directional: it is equally possible that the cognitive deficits in children with ASD may contribute to increased adverse circumstances throughout their childhood, or that this relationship could be bidirectional. Despite this, our findings do provide evidence of an association between environmental stressors and cognitive outcomes which can be further built upon in future studies.

### **3.2 Future work**

One limitation of the current study was the use of the WISC-V as a cognitive measure. While the WISC-V is a well standardized, commonly used measure of intellectual ability for children, it requires children to have at least some level of verbal communication skills in order to complete the assessment (Weiss et al., 2015). This meant that for the purpose of this study, children who had severe intellectual disabilities ( $IQ < 66$ ) or communication difficulties were excluded. To gain a better understanding of how adversity and parenting play roles in cognitive outcomes of lower functioning or non-

verbal children with ASD, future studies should use intelligence tests with non-verbal measures such as the Stanford Binet, Fifth Edition or Raven's Progressive Matrices.

While the results of our study gave some insight into the underlying associations between the types of adversity experienced by children with ASD and various cognitive outcomes, there are still many factors which remain unexplored. As previously noted, children and youth with ASD experience a unique set of challenges throughout their socio-emotional development, and as a result they are much more likely to experience psychological disorders like depression and anxiety than their TD peers (Mackay et al., 2017; Mertens et al., 2017). Future research, therefore, should investigate the relationship between the increased early adversity experienced by children and youth with ASD and mental health outcomes. Additionally, understanding the role that parenting practices play in the mental health and psychological outcomes of children and youth with ASD could help this population improve the mental health supports provided to this population.

Finally, while we considered resilience to be demonstrated by a child's ability to progress normally in their cognitive development despite facing negative life events, future research should examine how parents and children with ASD succeed, grow, and thrive in the face of adversity. This can be done through standardized measures of resilience such as the Resilience Scale of Adolescence. Qualitative data gathered through interviews with parents and youth with ASD could also provide valuable insight into larger patterns in promoting resilience within the family. Additionally, exploring the role of adversity in relation to cognition using brain imaging technology could give further insight into how adversity alters development in key areas of the brain such as the hippocampus and PFC, and how these alterations impact specific areas of cognition in children with ASD and TD children.

### **3.3 Final conclusions**

The results of this study give valuable insight into the adverse environmental and familial events experienced by children and adolescents with ASD and how these unique challenges may impact on the cognitive development of these youth. Our findings also highlight the important role that encouraging and nurturing parenting behaviours can play

in offsetting the impacts of familial stress for all children, regardless of neurodevelopmental disorders. While these relationships are likely bidirectional, our study gave valuable insight into some of the potential mechanisms involved in the cognitive development of children with ASD. Future research should examine these variables more extensively to provide children with ASD and their families with practical support and interventions.

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## 4 Appendices

### 4.1 Appendix A: Negative Life Events Scale – Parent (NLES-P)

Have any of these things been a worry for your child in the last year? If the child was aware of these events, please indicate how upset they were:

0=Not at all upset, 1=A tiny bit upset, 2=A little upset, 3=Pretty upset, 4=Very upset

1a. The child's brother/sister was in serious trouble (such as trouble with the law, school, or drugs) Yes No

1b. If yes, the child was aware that his/her brother/sister was in serious trouble Yes No

1c. If yes, how upset was the child that his/her brother/sister was in serious trouble 0 1 2 3 4

2a. The child's close friend had serious troubles, problems, illness, or injury Yes No

2b. If yes, the child was aware that his/her close friend has serious troubles Yes No

2c. If yes, how upset was the child that his/her close friend had serious troubles 0 1 2 3 4

3a. The child suffered from a serious physical illness, injury, or extreme pain (something that required rest of one week in bed, hospitalization, or surgery). Yes No

3b. If yes, the child was aware he/she suffered from a serious illness or injury Yes No

3c. If yes, how upset was the child that he/she suffered from a serious illness or injury 0 1 2 3 4

4a. The child's brother or sister suffered from serious physical illness, injury, or extreme pain (something that required rest for one week in bed, hospitalization, or surgery). Yes No

4b. If yes, the child was aware his/her brother/sister suffered from a serious illness or injury Yes No

4c. If yes, how upset was the child that his/her brother/sister suffered from a serious illness or injury 0 1 2 3 4



5a. One of the child's brothers or sisters was very angry or upset.

Yes No

5b. If yes, the child was aware that his/her brother/sister was very angry or upset

Yes No

5c. If yes, how upset was the child that his/her brother/sister was very angry or upset

0 1 2 3 4

6a. People in the child's family (such as his/her parents, brothers or sisters) physically hit each other hard or hurt each other.

Yes No

6b. If yes, the child was aware that people in his/her family hurt each other

Yes No

6c. If yes, how upset was the child that people in his/her family hurt each other

0 1 2 3 4

7a. The child's parent suffered from serious illness, injury, or extreme pain, something that required rest for one week in bed, hospitalization, or surgery.

Yes No

7b. If yes, the child was aware that his/her parent suffered from serious or injury

Yes No

7c. If yes, how upset was the child that his/her parent suffered from serious illness or injury

0 1 2 3 4

8a. The child's mother or father talked about having serious money troubles (being worried about bills for ordinary things).

Yes No

8b. If yes, the child was aware that his/her mother or father talked about having serious money troubles

Yes No

8c. If yes, how upset was the child that his/her mother or father talked about having serious money troubles

0 1 2 3 4

9a. The child's relatives such as aunts, uncles, grandparents said bad things about his/her mother or father.

Yes No

9b. If yes, the child was aware that his/her relatives said bad things about his/her mother or father

Yes No

9c. If yes, how upset was the child that his/her relatives said bad things about his/her mother or father

0 1 2 3 4

10a. The child's mother or father fought or argued with his/her relatives such as aunts, uncles, grandparents Yes No

10b. The child's If yes, the child was aware that his/her mother or father fought or argued with his/her relatives

Yes No

10c. If yes, how upset was the child that his/her mother or father fought or argued with his/her relatives 0 1 2 3 4

11a. The child's mother or father acted badly in front of the child's friends (did things like yelled at them or criticized them).

Yes No

11b. If yes, the child was aware that his/her mother or father acted badly in front of the child's friends Yes No

11c. If yes, how upset was the child that his/her mother or father acted badly in front of the child's friends 0 1 2 3 4

12a. The child's mother or father was intoxicated in the child's presence

Yes No

12b. If yes, the child was aware his/her parents were intoxicated

Yes No

12c. If yes, how upset was the child that his/her parents were intoxicated 0 1 2 3 4

13a. The child's mother or father forgot to do important things for him/her that they promised they would do, such as take him/her on a trip, take him/her to nice places, or come to his/her school or athletic activities.

Yes No

13b. If yes, the child was aware his/her mother or father forgot to do important things for him/her Yes No

13c. If yes, how upset was the child that his/her mother or father forgot to do important things for him/her 0 1 2 3 4

14a. The child's mother or father was arrested or sent to jail.

Yes No

14b. If yes, the child was aware his/her mother or father was arrested or sent to jail Yes No

14c. If yes, how upset was the child that his/her mother or father was arrested or sent to jail 0 1 2 3 4

15a. The child's mother or father lost a job

Yes No

15b. If yes, the child was aware her/her mother or father lost a job

Yes No

## 4.2 Appendix B: Alabama Parenting Questionnaire – Parent (APQ-P)

### Parenting Questionnaire

#### Parent Form

ID#: \_\_\_\_\_ Parent completing form: \_\_\_\_\_

Instructions: The following are a number of statements about your family. Please rate each item as how often it TYPICALLY occurs in your home. The possible answers are: Never (1), Almost Never (2), Sometimes (3), Often (4), Always (5).

PLEASE ANSWER ALL ITEMS.

You have a friendly talk with your child.

1 2 3 4 5

You let your child know when he/she is doing a good job at something.

1 2 3 4 5

You threatened to discipline your child then do not actually discipline him/her.

1 2 3 4 5

You volunteer to help with special activities your child is involved in.

1 2 3 4 5

You ignore your child when he/she is misbehaving.

1 2 3 4 5

Your child talks you out of being disciplined after he/she has done something wrong.

1 2 3 4 5

You play games or do other fun things with your child.

1 2 3 4 5

You ask your child about his/her day at school.

1 2 3 4 5

You take away privileges or money from your child as discipline.

1 2 3 4 5

You help your child with his/her homework.

1 2 3 4 5

You feel like getting your child to obey you is more trouble than it's worth.

1 2 3 4 5

You ask your child what his/her plans are for the day.

1 2 3 4 5

You reward or give something extra to your child for obeying you or behaving well.

1 2 3 4 5

You send your child to his/her room as discipline.

1 2 3 4 5

You yell or scream at your child when he/she has done something wrong.

1 2 3 4 5

You compliment your child when he/she does something well.

1 2 3 4 5

You drive your child to a special activity.

1 2 3 4 5

Your child is not disciplined when he/she has done something wrong.

1 2 3 4 5

You calmly explain to your child why the behaviour is wrong when he/she misbehaves.

1 2 3 4 5

You talk to your child about his/her friends.

1 2 3 4 5

You use time out (make him/her sit or stand in a corner) as discipline.

1 2 3 4 5

Your child helps plan family activities.

1 2 3 4 5

The type of discipline you give your child depends on your mood.

1 2 3 4 5

You praise your child if he/she behaves well.

1 2 3 4 5

You attend PTA meetings, parent/teacher conferences, or other meetings at your child's school.

1 2 3 4 5

You give your child extra chores as discipline.

1 2 3 4 5

You tell your child you like it when he/she helps around the house.

1 2 3 4 5

### 4.3 Appendix C: Supplementary Tables

#### 2 : Supplementary Table 1

##### Positive Parenting scale items on the APQ

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- 2. You let your child know when he/she is doing a good job with something
- 5. You reward or give something extra to your child for obeying you or behaving well.
- 13. You compliment your child when he/she has done something well.
- 16. You praise your child for behaving well.
- 18. You hug or kiss your child when he/she has done something well.
- 27. You tell your child that you like it when he/she helps out around the house.

#### 3 : Supplementary Table 2

##### Adversity Clusters from the NLES-P

---

##### Cluster 1: Relational Stressors

- 19a. The child's father acted very worried, upset, or sad, not because of something the child did.
- 20a. The child's mother acted very worried, upset, or sad, not because of something the child did.
- 7a. The child's parent suffered from serious illness, injury, or extreme pain, something that required rest for one week in bed, hospitalization, or surgery.
- 18a. A close friend of the child moved away
- 4a. The child's brother or sister suffered from serious physical illness, injury, or extreme pain (something that required rest for one week in bed, hospitalization, or surgery).
- 17a. A close friend of the child died
- 1a. The child's brother/sister was in serious trouble (such as trouble with the law, school, or drugs)
- 5a. One of the child's brothers or sisters was very angry or upset.
- 2a. The child's close friend had serious troubles, problems, illness, or injury
- 16a. A close family member to the child died such as a parent, close uncle, grandparent, or some other relative.
- 3a. The child suffered from a serious physical illness, injury, or extreme pain (something that required rest of one week in bed, hospitalization, or surgery).

**Cluster 2: Environmental Stressors**

- 9a. The child's relatives such as aunts, uncles, grandparents said bad things about his/her mother or father.
- 10a. The child's mother or father fought or argued with his/her relatives such as aunts, uncles, grandparents
- 6a. People in the child's family (such as his/her parents, brothers or sisters) physically hit each other hard or hurt each other.
- 13a. The child's mother or father forgot to do important things for him/her that they promised they would do, such as take him/her on a trip, take him/her to nice places, or come to his/her school or athletic activities.
- 14a. The child's mother or father was arrested or sent to jail.
- 8a. The child's mother or father talked about having serious money troubles (being worried about bills for ordinary things).
- 12a. The child's mother or father was intoxicated in the child's presence
- 11a. The child's mother or father acted badly in front of the child's friends (did things like yelled at them or criticized them).
- 21a. The child changed schools.

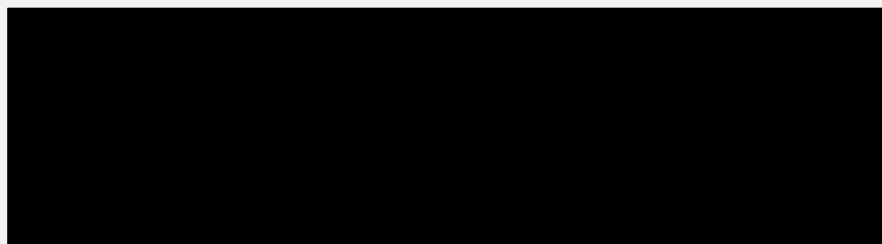
## 4.4 Appendix D: Ethics Approval

Template Approved April 2019

### CHILD MIND INSTITUTE BIOBANK

#### RECIPIENT INFORMATION AND CERTIFICATIONS

First Name: Emma Last Name: Duerden



Research Project (title): Early adversity and the association with hippocampal development and cognitive ability

Data Requested (check all that apply): ☒ HBN ☒

Standard Scope of Work:

"To determine if early adversity predicts altered hippocampal development. The early adversity data will be examined in relation to hippocampal volumes segmented using an automatic segmentation pipeline. Hippocampal volumes will be assessed in relation to cognitive outcome measures. It is predicted that children exposed to early adverse events will have decreased volumes of the hippocampi and adverse cognitive outcomes."

\* To request any additions to the Standard Scope of Work, please attach a page(s) to this application with detailed information regarding your request. By signing and dating this DUA as part of requesting access to Biobank Data, Recipient Institution's authorized institutional official and I certify that Recipient will abide by the DUA and the principles, policies and procedures for the use of the Biobank Data. Recipient Principal Investigator further certifies that he/she has shared this document and the relevant Biobank Data policies and procedures with any research staff who will access the Biobank Data. Recipient Institution's authorized institutional official further certifies that he/she has shared this document and the relevant Biobank Data policies and procedures with appropriate institutional entities and individuals.

Recipient Principal Investigator

Recipient Institution (by authorized  
institutional official)

Signature:

Name:

Title:

Institution:



Date: 17-May-2019

Date: MAY 21, 2019



## Curriculum Vitae

<b>Name:</b>	Elizabeth Kuenzel
<b>Post-secondary Education and Degrees:</b>	<p>Concordia University of Edmonton Edmonton, Alberta, Canada 2014-2018 B.A. (Psychology)</p> <p>The University of Western Ontario London, Ontario, Canada 2019-2021 M.A. (School and Applied Child Psychology, <i>In Progress</i>)</p>
<b>Honours and Awards:</b>	<p>Concordia University Psychology Academic Award 2018</p> <p>Western University Entrance Scholarship 2019-2021</p>
<b>Related Work Experience</b>	<p>Research Assistant The University of Western Ontario 2019-2021</p> <p>Residential Counselor Salvation Army Lawson Ministries Hamilton 2018 – 2021</p> <p>ABA Junior Facilitator Behaviour Innovations 2018-2019</p>
<b>Publications:</b>	<p>Seguin, D., Kuenzel, E., Morton, J. B., Duerden, E.G. School's out: parenting stress and screen time use in school-age children during the COVID-19 pandemic. <i>J Affective Disorders. Submitted.</i></p> <p>Kuenzel, E., Seguin, D., Nicholson, R. &amp; Duerden, E. G. Early adversity and positive parenting: association with cognitive outcomes in children with ASD. <i>Autism. Submitted.</i></p>
<b>Conference Presentations:</b>	<p>Kuenzel, E., Seguin, D., Nicholson, R. &amp; Duerden, E. G. Early adversity, positive parenting and resilience: Predicting cognitive outcomes in children with ASD. <i>Accepted</i></p>

for presentation at the Society for Research in Child Development Conference, 2021. [Poster].

Kuenzel, E., Seguin, D.; Nicholson, R. & Duerden, E. G. Early adversity, positive parenting and resilience: Predicting cognitive outcomes in children with ASD. Presented at Child Health Research Day Conference, 2020. [Poster].

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