Childhood Adversity and Functional Impairment in Emerging Adulthood: The Role of

Executive Function

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Abstract

Emerging adulthood (EA; ages 18-29) is a unique developmental period when individuals transition from their teenage years into adulthood, experiencing increased demands associated with independence. For some, there are increased levels of uncertainty and mental health difficulties, but, for those who adapt to such transitions, there are positive implications in later life. Adverse childhood experiences (ACEs) may potentiate transitional difficulties in EA. ACEs are known to disrupt neurodevelopment and executive function (EF), a key set of mental skills that include emotion regulation and planning. As such, emerging adults who experience ACEs may be at an increased risk for impairment during these important transitional years. This study examines whether ACEs are related to decreases in EF and functional impairment in emerging adults. Specifically, Hayes' PROCESS macro is used to test whether the relationship between ACEs and functional impairment was moderated by EF. A total of 162 emerging adults completed an online self-report questionnaire package assessing ACEs, EF, and functional impairment. As expected, regression analyses highlighted that number of endorsed ACEs significantly predict self-reported EF scores in emerging adults. Similarly, ACEs predict self-reported functional impairment in the domains of school, family, life skills, risky behaviours, self-concept and social relationships. However, EF did not significantly moderate the relationship between ACEs and functional impairment, contrary to expectation. Upon further investigation, exploratory mediational analyses demonstrated that EF significantly mediates the relationship between ACEs and functional impairment such that EF partially explains the relationship between ACEs and functional impairment in emerging adults. The present results demonstrate the need to consider EF as a target to reduce functional impairment in emerging adults.

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Emerging Adulthood (EA), characterized as the developmental period between the ages of 18-29, is a stage when individuals transition out of adolescence into adulthood and navigate a range of novel societal structures (Arnett, 2015). Traditionally, developmental research was largely concerned with outcomes occurring before the age of 18, with stages of development often separated into childhood, adolescence, and adulthood. This classification was likely due to societal patterns seen in individuals between the ages of 18 and 20 when most young adults had quickly married, started careers, and had children (Douglass, 2005). However, there was a swift change in marital and education trends seen in the early 1970s, expanding the window between adolescence and adulthood. Highlighting this, Canadian census data shows that the average age at first marriage increased from 24.5 to 32.7 years of age between 1971 and 2017 (Eichler, 2018), a similar trend observed in American census data (U.S Census Bureau, 2019). Around the same time, individuals began seeking post-secondary education at a 235% increase (Statistics Canada, 2020) while women, on average, started having children 5.5 years later (Driscoll & Ely, 2020). These trends, coupled with changing economic demands, have prompted the need for consideration of a separate developmental window between adolescence and adulthood thus, EA came to be conceptualized (Arnett, 2015).

Although trajectories of emerging adults may differ, 20-year data conceptualizing EA highlights five key challenges of emerging adults. These challenges include:

1. Identity exploration: answering the question, "who am I?" while exploring different life options in love and work;

2. General instability (in relationships, work, place of residence);

3. Self-focus (obligation to others is low);

4. Feeling "in-between" (in transition, neither adolescent or adult); and

5. Developmental possibilities (unlimited opportunity; Arnett, 2015).

Although emerging adults report more positive than negative emotional feelings, researchers note that EA is the time when mental health difficulties such as depression tend to peak – with those navigating the transition between high school and post-secondary school possibly experiencing the most difficulty (Arnett, 2015; Humensky et al., 2010; Kessler et al., 2005; Kuwabara et al., 2007). A longitudinal study involving 9282 individuals show that mental health difficulties tend to peak in late adolescence and early adulthood when compared to other life stages (Kessler et al., 2005). Specifically, mood disorders (major depressive disorder, dysthymia, bipolar I and II disorders) and substance use disorders have a median age of onset between 25-32 years of age and between 18-27 years, respectively. Similar statistics can be seen from Canadian census data which highlight that among 2.8 million Canadians, those between 15 – 24 years of age are more likely to experience depression and substance use disorder than any other age group (Pearson et al., 2013).

Having higher rates of mental health difficulties in the context of increased levels of uncertainty makes EA a complex time that puts one at risk for maladaptation when facing the various challenges noted by Arnett (2015). Responding adaptively to such developmental challenges is likely to, in large part, influence outcomes such as living independently, navigating romantic relationships, educational and vocational achievement. Other than infancy, some posit that there is no other stage in life that presents with such dynamic and complex changes in neuroanatomical, social, emotional, and developmental changes (Fischer et al., 2003; Wood et al., 2017). For example, emerging adults are often faced with increased independence as they experience changes in their living situation, decreased familial and institutional support, engage in marital relationships, and experience unique financial

constraints (Clark, 2014). Challenges in EA may exist due to increased educational and social role requirements. However, this period of development has the potential to be a very positive stage with decisions made during this time having lifelong implications (Wood et al., 2017).

Why study emerging adults enrolled in post-secondary education?

Beyond gaining employment, researchers note that participating in post-secondary education offers further value. For example, longitudinal research demonstrates that Canadians with post-secondary diplomas out-earn their non-graduate counterparts and are more likely to engage in civil duties such as volunteering and voting (Doyle & Skinner, 2017; Zhao et al., 2017). Further, recent research of post-secondary education characterizes post-secondary education as a health investment (Lutz & Kebede, 2018). Using longitudinal data across 174 countries, Lutz and colleagues show that, regardless of eventual income, education predicts longevity (i.e., those who undergo more schooling benefit from longer lifespan; Lutz & Kebede, 2018). Earlier work produced similar results wherein the positive effect of education on longevity increases with increasing years of formal learning (with no difference between sex or ethnicities; Cutler & Lleras-Muney, 2006). This relationship not only affected the individual who completed education, but also their infant children; infants of mothers with more than 12 years of education demonstrate rates of mortality at less than half of the infants whose mothers had less education (Cutler & Lleras-Muney, 2006).

Notwithstanding the many benefits of post-secondary education, there are inherent challenges for an EA in pursing advanced schooling. For example, post-secondary education may lead to heightened stress and emotional distress compared to non-enrolled emerging adults. A 2015 study consisting of 34,039 Canadian undergraduates noted that 57.6% of students report experiencing "more than average stress" in the past 12 months, with 14.8% reporting "tremendous stress" (Versaevel, 2014). In addition, research examining prevalence rates of depression and anxiety in university students indicate that they experience increased

rates of emotional distress when compared to the general population across multiple post-secondary settings (Ibrahim et al., 2013; January et al., 2018; Mayer et al., 2016). Given that post-secondary achievement leads to positive lifelong outcomes, this time in development is important to study.

For emerging adults entering post-secondary schooling, the result of increased stress and emotional distress may lead to functional impairment. Unlike clinical outcomes which describe symptom functioning, functional impairment represents real-life consequences of a particular disorder that affects an individual's functioning in various domains such as vocation, risk taking, self-care, and social functioning (Weiss et al., 2018). The most frequently impaired functional domains, as endorsed by university students, are academic, financial, and sleep difficulties (Versaevel, 2014). However, work examining functional impairment in university students has not examined the role of early adversity on outcomes in EA. For emerging adults who experience trauma in their younger years, functional impairments may be exacerbated.

EA and the brain.

Neurodevelopmental researchers theorize that brain development, especially that of the prefrontal cortex, extends well into young adulthood (Luciana et al., 2005). As the prefrontal cortex is thought to be responsible for executive functions such as planning, problem solving and decision making, disturbed maturation of this brain region may hinder an emerging adult's ability to use such skills at the highest capacity (Nelson et al., 2012; Siddiqui, 2008). As emerging adults undergo prefrontal maturation, they are better equipped to regulate their emotions, filter unnecessary input, and delay satisfaction (Wood et al., 2017). Taken together, these abilities enable the emerging adult to develop more meaningful relationships, think critically, engage in tactful decision making, interact optimally, and manage their personal health appropriately (Nelson et al., 2012). Potential disruptions in

neurodevelopment were not measured in these studies. When neurodevelopment is disrupted, it may be more taxing for the emerging adult to navigate such a challenging time. For example, young adults exposed to trauma in early development demonstrate neurodevelopmental disruption (Lund et al., 2020). In fact, emerging adults who have underdeveloped executive functions engage in maladaptive coping when faced with navigating novel societal environments and increased levels of emotional distress (Mahmoud et al., 2012). Maladaptive coping is expressed in various ways. Some maladaptive behaviours reported in EA include substance use, avoidance strategies, and engagement in risky behaviours (Jenzer et al., 2018). Such behaviour may predispose the emerging adult to various negative outcomes. For individuals who are exposed to trauma in earlier years, this difficulty may be exacerbated.

Adverse Childhood Experiences

Adverse Childhood Experiences and EA

Historically, adverse childhood experiences (ACEs) have been increasingly recognized as contributors to a variety of detrimental outcomes later in life (Felitti et al., 1998; Petruccelli et al., 2019). The original Adverse Childhood Experiences study, a collaborative effort by The Center for Disease Control (CDC) and Prevention and Kaiser Permanente, aimed to identify how adversity in childhood was associated with negative outcomes seen in adulthood (Felitti et al., 1998). Felitti and colleagues used data from the CDC-Kaiser study to establish that cumulative exposure to ACEs is associated with a variety of health difficulties later in life. Since the initial findings, a range of health outcomes have been associated with ACEs. Some of them include: heart disease (Felitti et al., 1998; Gilbert et al., 2010); cancer (Brown et al., 2009); mental distress (Gilbert et al., 2010); suicide attempt (Dube et al., 2001); depression (Chapman et al., 2004); sexually transmitted infections (Felitti et al., 1998); alcohol and substance abuse (Dube et al., 2002; Dube et al.,

2003); chronic inflammation (Houtepen et al., 2020); risky behaviours (Felitti et al., 1998; Ford et al., 2001; Hillis et al., 2001); as well as an increased risk for premature mortality (Brown et al., 2009). With recent numbers showing that nearly 66% of individuals experience at least one ACE in their lifetime and one in six experience four or more, it is crucial to understand ACEs, the underpinnings of their trajectory, as well as how ACEs affect individuals in EA (Iniguez & Stankowski, 2016).

The definition of ACEs tends to vary. Adversities most studied include: abuse (emotional, physical, sexual), neglect (emotional and physical), and household dysfunction (violence toward mother, substance use disorder within the home, a mental health disorder within the home, or incarceration of a member within the home) (Felitti et al., 1998; Gilbert et al., 2010). Such adversity goes beyond normative developmental challenges that are expected to occur but rather, are developmentally inappropriate (e.g., trauma, neglect) and grossly overwhelm a child's capacity for coping. ACEs are thought to disrupt social, emotional, and cognitive development (Felitti et al., 1998; Pechtel & Pizzagalli, 2011; Tost et al., 2015). Specifically, exposure to abuse, neglect, and household dysfunctions are strongly associated with disruptions in normative brain development and subsequent negative mental, physical, and functional (i.e., educational, vocational, relational) outcomes in adulthood (Anda et al., 2006; Coulter, 2013; Hardcastle et al., 2018).

Beyond this, researchers discovered that there is a dose-response relationship between ACEs and poor health outcomes. Specifically, for adults who experienced four or more ACEs, seventeen-year longitudinal work of almost ten thousand children demonstrated that there was a 12-fold increased risk for negative outcomes related to depression, alcoholism, suicide, and substance misuse during development compared to those who experienced less than four ACEs (Houtepen et al., 2020). In addition, the mean number of negative outcomes increases as the number of reported ACEs increase, in a graded fashion (Anda et al., 2006;

Merrick et al., 2017). Specifically, with each increase in ACEs endorsed, the risk for experiencing negative comorbid difficulties significantly increases, nearly tripling between the experience of 0 and 7ACEs (Anda et al., 2006). Such difficulties include: perceived stress, anxiety, depression, anger, panic, sleep disturbance, severe obesity, hallucinations, substance abuse, smoking, early intercourse, and trauma spectrum disorder (Anda et al., 2006). Even exposure to a single ACE has been demonstrated to significantly increases the risk of drug use, alcohol abuse, depressed affect, and a suicide attempt, compared to adults who experiences no ACEs (Merrick et al., 2017). Also, individuals who are exposed to at least one ACE are more likely to use unhealthy coping behaviours such as drug use, alcohol consumption, and to attempt suicide than those who are not exposed to ACEs (Merrick et al., 2017). Beyond the originally studied ACEs, recent work highlights additional ACEs that may affect individuals in similar ways to traditional ACEs (Afifi et al., 2020; National Scientific Council on the Developing Child, 2020).

Missing from this focus on deficit-based outcomes related to ACEs are the adaption-based outcomes in children who experience ACEs. For example, Ellis and colleagues (2017) discovered that, in 25 children who were exposed to stressors such as peer and school violence and parental neglect and abuse, they benefitted from "stress-adaptive advantages". Specifically, ACE-exposed children demonstrated increased empathetic accuracy and the ability to better detect angry faces (Ellis et al., 2017). However, these "advantages" often occur in the face of stressors, as per the sensitization hypothesis wherein, those who experience ACEs become hypervigilant during times of stress which allows for such abilities to appear in stressful contexts or when these abilities would provide the most fitness-relevant advantages (Ellis et al., 2017).

Expanding the Conceptualization of ACEs

Since the original ACE study (Felitti et al., 1998), researchers have explored how adversities in childhood such as bullying, racism, community violence, peer victimization, household gambling problems, foster care placement, poverty, and neighbourhood safety may also correspond with negative outcomes in adulthood (Afifi et al., 2020). Afifi's work examining 1002 Canadian adolescents demonstrated that, independent of the original ACEs, peer victimization, foster care placement, parental problematic gambling, poverty and neighbourhood safety are all significantly associated with increased odds of substance use (cigarette smoking, cannabis use, and binge drinking). Such results demonstrate how broader forms of adversity and community-level stressors contribute to negative outcomes in later life. Such adversities may warrant additional focus in future research.

ACEs and Educational Achievement.

One of the limitations to the original ACE study was that it did not disentangle pathways between ACEs and negative life outcomes, which Clark et al. (2010) described as a "major methodological limitation" (p.386). Today, it is hypothesized that one potential pathway might be through the disruption in attachment-mediated prefrontal cortical development. Such disruption is thought to affect emotion regulation, and metacognition through disruptions in executive functions (Lund et al., 2020). The role of prefrontal disruption and subsequent outcomes may have negative effects on post-secondary educational attainment through impaired cognitive function (i.e., memory and concentration; Richards & Wadsworth, 2004). Using birth cohort data, Richards and colleagues (2004) determined that early adverse experiences were associated with lower cognitive ability and lower cognitive growth as detected on measures of memory, educational attainment, and concentration in midlife, while controlling for social background, in their sample of 1339 adults. The authors of this work concluded that negative effects of ACEs on cognitive function tracked across the lifespan and at least as far as middle age (Richards et al., 2004).

Researchers hypothesize that the negative effects of ACEs on lifetime educational attainment is a result of poorer educational outcomes throughout development, that is not fully explained by familial and socioeconomic factors (Hardcastle et al., 2018; Houtepen et al., 2020; Slade & Wissow, 2007; Wodarski et al., 1990). Recent work notes that the exposure to four or more ACEs more than doubles the risk of having no post-secondary education or formal qualifications in later adulthood, after assessing for the potential effects of child socioeconomic status or other important demographic confounders (Hardcastle et al., 2018). This finding is thought to be attributed to the experience of chronic stress in the home and difficulties meeting educational goals across elementary grades (Hardcastle et al., 2018). Further, children who experience ACEs show poorer cognitive abilities, school connectedness, and school attendance, amplifying the risk for not obtaining educational milestones during development (Basch, 2011). As well, outcome data have demonstrated that children with more ACEs report significantly lower grade point averages and have difficulty with homework completion (Slade et al., 2007). In work examining general long-term negative outcomes associated with ACEs, some have attempted to explain the mechanisms by which these relationships exist (Slade et al., 2007). One hypothesized pathway between ACEs and educational performance that Slade and colleagues proposed was that of reduced cognitive abilities such as impaired attention (2007). Some researchers have called for the consideration of neurological mechanisms due to ACEs and, whether an inquiry into these mechanisms explain the relationship between ACEs and negative associated outcomes (Morris et al., 2019).

Executive Function

Neurological Mechanisms and the Role of Executive Function

One hypothesized pathway between ACEs and psychopathology is through dysregulation within systems responsible for one's stress response (Heim et al., 2008). For

example, ACEs are linked to dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis which is thought to be due to the chronic cortisol (stress) response experienced by those who experience ACEs (Kalmakis et al., 2015). Dysregulation of the HPA axis is associated with alterations in how the brain responds to stressful life events in the form of an over-active stress response (Morris et al., 2019). Such alterations to the HPA axis are thought to contribute to various types of psychopathology. For example, cognitive outcomes related to ACEs have been associated with developmental burdens on the prefrontal cortex. The prefrontal cortex is collectively responsible for cognitive executive control, top-down processing, emotional control, conflict detection, performance monitoring, and response-selection, among other functions (Alexander & Brown, 2010; Botvinick et al., 2001; Carter et al., 1998; Miller & Desposito, 2005; Stuss & Levine, 2002; Ridderinkhof et al., 2004; Voytek & Knight, 2010). ACEs are associated with significant differences in the physical structure of the brain. For example, research has demonstrated that children who experience ACEs have marked differences in gray matter volume of the prefrontal cortical region (as seen in total gray matter and middle frontal gyrus gray matter volumes) when compared to those without ACEs (Sheffield et al., 2013).

Because the prefrontal cortex is responsible for cognitive executive control, it is thought that such deficits of the brain may lead to impaired executive functions.

Executive functions represent the higher-order cognitive control processes required for initiation and implementation of goal-directed behaviours (Diamond, 2013). Researchers agree that executive function (EF) collectively encompasses: attention, working memory, organization, impulse control, planning, self-monitoring, cognitive flexibility and emotion regulation (Naglieri & Goldstein, 2014). When a child is exposed to ACEs, they demonstrate poorer than average EF performance as measured by non-verbal inhibitory control, directed attention, planning, and problem solving, compared to those who do not experience ACEs

(Kirke-Smith et al., 2016; Lund et al., 2020; Nolin & Ethier, 2007). Work examining the experience of childhood institutionalization suggests that compounded ACEs (i.e., experiencing both physical and emotional neglect) result in significant EF impairment as seen on tasks of working memory, attention, and inhibitory control compared to those who had experienced emotional neglect alone (Merz et al., 2013). This is true of adult samples in both clinical and non-clinical settings.

For example, in their research of 165 adults diagnosed with major depressive disorder, Saleh et al. (2017) discovered that there was increased difficulty seen on measures of working memory and processing speed for those who experienced ACEs. As well, individuals experiencing first episode psychosis, who reported childhood abuse, performed worse on broad measures of EF compared to those who reported psychosis without abuse (Sideli et al., 2014). Further, university students who reported experiencing ACEs demonstrate more difficulty on specific measures of EF (i.e., metacognition, inhibition, switching, set-shifting, emotional control and self-monitoring; Daly et al., 2007; Schroeder & Kelly, 2008) compared to peers without ACEs. This relationship may be related to the dose-response relationship previously discovered, but this dose-response relationship has yet to be evaluated.

Since EFs are a set of processes that facilitate organization and self-control, those with EF difficulties as a result of ACEs may be disadvantaged when navigating tasks that require EF skills. One way to explore this relationship may be through the consideration of functional impairment.

Functional Impairment

Disruption in EFs may result in repercussions throughout the lifespan across functional domains. Functional domains that may be of importance to study in EA include: academics, work, relationships, life skills, risky behaviours, and self-concept.

Relating to ACEs and functional impairment in EA, Boden and colleagues (2007) used birth cohort data to examine the relationship between exposure to childhood sexual and physical abuse and later educational achievements in young adulthood. Results from over one thousand children demonstrated that those who had experienced childhood abuse were less likely to complete secondary schooling or post-secondary schooling (Boden et al., 2007). However, adjustment for confounders including social, parental, and individual factors explained most of the associations in this study (Boden et al., 2007).

Further, longitudinal research on high school students demonstrate that those who experience more ACEs have higher rates of high school drop-out, lower grades, more difficulties in learning, higher levels of stress, decreased attendance, and lower rates of homework completion (Houtepen et al., 2020; Slade & Wissow, 2007). In research on adolescents and educational attainment, Slade and Wissow showed that cognitive deficits (i.e., impaired attention) associated with maltreatment significantly moderated the relationship between ACEs and academic performance (as measured by GPA and homework completion), noting significant educational impairment associated with ACEs through cognitive impairment (2007). Although this relationship has been established in adolescents, this relationship in emerging adults has yet to be studied.

ACEs have also been associated with increased likelihood for social disparities such as welfare dependency, criminal activity, poverty at age 55, as well as disproportional wage, while controlling for important associated factors in childhood (Currie et al., 2006; Schurer et al., 2019). Further, cross-sectional data demonstrate that, in adults who experience more than four ACEs, individuals are 1.6 times more likely to be living in poverty and 2.3 times more likely to be unemployed (Metzler et al., 2017). Currie and Widom's (2013) prospective cohort study also reported that adults with documented histories of ACEs have lower rates of education, employment, earnings and fewer assets compared to their matched cohort group.

Such outcomes could be thought to lead to significant economic burdens for individuals who experience ACEs. These burdens could potentiate lifelong hindrances seen for people who experienced ACEs.

Overall, there is an emerging consensus that a range of negative consequences associated with ACEs exist in EA. However, research has yet to disentangle the complex pathway between ACEs and these eventual negative outcomes.

The Present Study

Negative outcomes as a result of ACEs have prompted a need for research that explores the pathways associated with such trajectories (Lund et al., 2020). There is considerable work done demonstrating how early adverse experiences upset normative developmental trajectories across a range of domains and, subsequently, lead to poor outcomes in adulthood. As well, it is thought that EFs contribute to one's ability to appropriately control cognitive processes necessary for behaviour. As EA is a time that is associated with the navigation of novel societal structures and responsibilities, well-developed EFs are likely important for easing this transition. This developmental time deserves attention due to the importance of decisions made during EA, and their bearing on long-term financial stability, health and overall wellbeing.

While some research has highlighted ACE outcomes in later adulthood, this work has failed to determine details regarding pathways between ACEs and outcomes in EA. Further, no research has examined how the relationship between ACEs and negative outcomes may be influenced by EF. Given the literature to date, the relationship between ACEs and functional impairment in EA may vary as a function of EF.

The present study attempts to disentangle specific pathways between ACEs and emerging adults' functional outcomes. Specifically, this study examines how ACEs affect one's functional impairment during EA while examining if this relationship is moderated by

EF. It is believed that this is the first study to examine EF as moderating the relationship between ACEs and functional outcomes in EA. Completing a moderation analysis will allow for a better understanding of how the relationship between ACEs and functional outcomes varies as a function of EF, as well as the strength to which this occurs. EFs provide individuals with the ability to appropriately manage novel demands that may be important in EA. As such, it is important to understand how EF affects the relationship between ACEs and potential functioning during this time. For example, if higher EF is found to lessen the burden of ACEs on functioning in EA, opportunity for interventions aimed at strengthening EFs may be available, which will surely have lifelong implications.

Objectives and Hypotheses

The first objective was to examine the relationship between ACEs and functional impairment in emerging adults. It was hypothesized that ACEs would predict functional impairment, seen across many domains, for emerging adults (i.e., a positive relationship between ACEs and functional impairment). Second, it was hypothesized that a similar relationship would be seen between EF and functional outcomes whereby, those who experience lower EF skills would show higher functional impairment. Such research questions expand on previous work and, supports the societal importance of understanding how early childhood outcomes and EFs affect various outcomes in later life (Lund et al., 2020).

The final objective was to determine whether EF moderates the relationship between ACEs and functional outcomes in EA. This research question will address when the relationship between ACEs and functional impairment is changing and the degree or strength of this relationship. It was hypothesized that the relationship between ACEs and self-reported functional impairment would change as scores on measures of self-reported EF change. Specifically, examining if individuals who report experiencing lower EF also report greater

functional impairment after experiences ACEs. For those who reported higher scores on measures of EF, it was hypothesized that there would be lesser functional impairment demonstrated, even after experience ACEs.

Method

Participants

Planned analyses required a minimum of 120 participants to satisfy power and sample size calculation according to Stata's Power and Sample-Size Reference manual for multiple regression analyses (StataCorp, 2013). It was noted that the required one hundred and twenty participants would yield an approximate power of .80 and an effect size of $F^2 = .16$.

To account for participant attrition and data error, one hundred and eighty-three participants were recruited and 162 remained after data cleaning (i.e., 21 cases were removed due to missing data or an incomplete questionnaire). The majority of the final sample were Caucasian (74.4%), female (93%), with an average age of 22.01 ($SD = 6.38$). The remaining participants reported Indigenous (6%), Asian (3.7%), African (3.1%), South Asian (2.5%), and other ethnic descent (14.2%). All participants were enrolled in undergraduate studies with 25.9% in first, 25.9% in second, 25.31% in third, 19.12% in fourth and 3.13% in their fifth year. Psychology was the most frequently declared major (43.71%).

After completing independent samples t-tests to compare descriptive statistics of the variables of interest between males and females, it was decided to include men in the analysis as the scores did not significantly differ between participant groups (See Appendix K).

Procedure

Due to restrictions placed on in-person research during the COVID-19 pandemic, emerging adults were recruited electronically through Sona Experiment Management System and poster circulation via email to undergraduates' classes. The informed consent process took place in accordance with the Tri-Council Policy Statement: Ethical Conduct for

Research Involving Humans (TCPS 2; Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council of Canada, 2014) and Lakehead University's Research Ethics Board. Once informed consent was obtained (Appendix B), participants completed an online questionnaire package which gathered data on ACEs, EF, and impairments in functional impairment (Appendices C-G). Participants completed the electronic questionnaire within 30 minutes, on average. Following completion of the questionnaire, participants were debriefed and provided with resources in the event that they required mental health support (Appendix H). Participants were offered 0.5 bonus points to go toward an eligible psychology course or the option to be entered into a draw for a $50 Visa gift card.

Measures

Demographics

A demographic questionnaire was included to obtain information regarding age, sex, gender, ethnicity, physical and mental health characteristics, and information regarding occupation, income, and academics (Appendix I).

Covid-19 Experience Questionnaire

Participants were asked to rate the degree to which Covid-19 impaired various aspects of their life (i.e., family, employment, health, relationships, travel, hobbies, and goals) as well as the degree of distress Covid-19 caused in these areas of functioning (Appendix I).

ACEs

Participants' exposure to 10 different categories of abuse, neglect and household dysfunction experienced before the age of 18 were assessed using the Adverse Childhood Experiences Questionnaire (Felitti et al., 1998). Items included questions such as 'Did a parent or other adult in the household often or very often swear at, insult, or put you down?' and 'Did a parent or other adult in the household often or very often push, grab, shove, or slap you?'.

Participants were also asked to indicate the frequency with which they had experienced each event before the age of 18. Each question has three possible answers including: "Never", "At least once" and "Many times". For the present study, an answer of "At least once" and "Many times" was given a score of 1, indicating a presence of such category. An answer of "Never" was given a score of 0. This measure has demonstrated acceptable internal consistency, concurrent and convergent validity, and test re-test reliability over intervals ranging from six to twenty months in post-secondary students (internal consistency of $r = .84$; test re-test reliability of $r = .79$; Zanotti et al., 2010). In line with Afifi's work urging researchers to study ACEs beyond the traditionally studied variables, questions assessing for the experience of bullying, racism, community violence, spanking, peer victimization, household gambling problems, foster care placement, poverty, and neighbourhood safety in childhood were created and included in the data collection (Afifi et al., 2020; Appendix C). To obtain a total ACE score in the present study, the sum of the original ACE questionnaire was added to the sum of the additional ACE questions informed by Afifi's work. In the present study, the internal consistency of the full scale was acceptable ($r = .84$).

Executive Functions

To evaluate EFs in emerging adults, participants completed the self-report version of the Comprehensive Executive Function Inventory-Adult (CEFI-Adult; Naglieri & Goldstein, 2014; Appendix D).

The CEFI-A contains 80 items across 9 scales dedicated to evaluating various EF strengths and difficulties. The nine scales include: attention, planning, self-monitoring, initiation, working memory, emotional regulation, and inhibitory control (Naglieri et al., 2014). Participants in the present study answered questions using a six-point Likert-type scale ranging from 0-5, reflecting the frequency with which the individual performs on the

measured behaviour (i.e., never, rarely, sometimes, often, very often, and always). Participant total scores were obtained by summing scores of the 80 items.

CEFI-A total scores produce a standard mean score of 100 and a standard deviation of 15. For emerging adults aged 23 – 29, raw scores that fall between 196-255 are considered "average", while scores of 167-195 are considered "low average", and scores between 130-166 are considered "below average". Any total score below 70 is considered well below average (Naglieri et al., 2013). Full scale reliability of the CEFI-A has been established in adults of normative and clinical samples (test re-test reliability of r = .74 – 91 after a four-week interval; internal reliability of α = .97; Naglieri et al., 2013).

Emotion Regulation

To assess emotion regulation, the Difficulties in Emotion Regulation-18 (DERS-18) was used (Kaufman et al., 2016). The DERS-18 was derived from the original 36-item DERS scale (Gratz & Roemer, 2004). This 18-item, self-report scale assesses difficulties with emotion regulation, including various dimensions by which these difficulties occur during times of stress. As research has noted that the ability to regulate emotions is strongly supported by several core EFs (Jiang et al., 2016), this measure was used in conjunction with the CEFI-A to go beyond measuring participant EF.

Participants rated the extent to which a statement applied to them (i.e., when I am upset, I acknowledge my feelings) on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always). The DERS-18 subscales include: Non-acceptance of emotional responses (nonacceptance), difficulties engaging in goal directed behaviour (goals), impulse control difficulties (impulse), lack of emotional awareness (awareness), limited access to emotion regulation strategies (strategies), and lack of emotional clarity (clarity). The measure also yields a total score, which is a sum of all the questions, after reversing positively worded questions such as, "I am clear about my feelings", as well as six sub-scale scores. The DERS-

18 has good psychometric properties as demonstrated by strong internal consistency and test re-test reliability in samples of emerging adults (Cronbach's α = 0.91for total scale and, α = 0.77-0.90 for subscale scores; Victor & Klonsky, 2016).

Functional Impairment

The Barkley Functional Impairment Scale (BFIS) was used to measure the perceived degree of functional impairment experienced in 15 major domains of psychosocial functioning (Barkley, 2011). Participants responded to each of the 15 domains based on a scale ranging from 0 (no impairment) to 9 (severe impairment). Scores from the BFIS intend to produce a mean functional impairment score. The nine domains include: home life with immediate family, life skills (i.e., finishing chores at home; managing household; management of money; bills, and debts; driving a motor vehicle and history of citations and accidents; organization and management of daily responsibilities; taking care of and raising children), work or occupation, social interactions with friends, activities in the community, educational activities, marital, co-living, or dating relationships, sexual activities and sex relations with others, caring for oneself daily, maintaining one's health. The total scale score is produced by summing the score of all nine domains. Taken together, the total score creates an overarching construct score for functional impairment. The BFIS has high internal reliability (α = .97) and good test-retest reliability through all nine domains (.47 to .72; Barkley, 2011).

The Weiss Functional Impairment Rating Scale – Self Report (WFRIS-S; See Appendix G) is a widely used self-report measure, originally developed to assess functional impairment in adults with ADHD, a condition often associated with EF dysfunction. Since, the WFRIS-S has been validated as a measure of functional impairment in non-ADHD and normal populations (Weiss et al., 2018). Participants completed the 69-item self-report measure which addresses various questions in the domains of: Family (8 items), Work (11

items), School (10 items), Life Skills (12 items), Self-Concept (5 items), Social relationships

(9 items), and Risky behaviours (14 items). Participants answered each question on a 4-point

scale ranging from Never (0) to Very often (3). The school subscale attempts to capture the

participant's level of school impairment while the family, social relationships, work, life

skills, self-concept and risky behaviour subscales attempt to capture impairment in their

respective domains.

Subscale scores derived from each category capture domain-specific impairment

while a total score provides an overall functional impairment score. This measure has been

psychometrically validated with strong internal consistency seen for all of the subscales as

well as for the scale as a whole within adult post-secondary samples, adult ADHD samples

and adult non-psychiatric samples (>.80; Weiss, 2018). Taken together, the BFIS and

WFRIS-S will allow for a thorough examination into various domains of functional

impairment.

Data Analysis

Data Cleaning

Data cleaning procedures assessed for accuracy of data, missing data, outliers,

homoscedasticity and homogeneity of variance, as well as normality of the variables. To

check for missingness in the dataset, frequency statistics were completed to visually check for

missing values. Once missing values were identified, the Little's MCAR test was used to

determine if these values were considered missing at random. Then, expectation

maximization estimation was completed to generate estimated values for missing data using

expectation and maximization algorithms (Osborne, 2013). Expectation maximization is

recognized as superior to listwise, pairwise, and mean substitution methods and is assumed to

produce unbiased parameter estimates for data missing completely at random (Musil et al.,

2002). This analysis yielded 10 total missing items which came from the CEFI and WFIRS-S.

Results of Little's MCAR test showed a lack of significance ($p = .268$ and $p = .485$,

respectively) meaning that no pattern is observed thus, the data is missing completely at

random (Little, 1988).

To identify out-of-range values, variable frequencies were examined, and all variables

were found to be within the appropriate range. All outliers for continuous variables (z scores

≥ 3.3) in the data set were examined. The number of outliers for each variable was as follows:

ACE item 3 ($n = 9$), ACE item 5 ($n = 10$), ACE item 7 ($n = 5$), ACE item 8 ($n = 5$), ACE item

11 ($n = 4$ items), ACE 16 ($n = 8$), and ACE 17 ($n = 8$). Upon examination, it was discovered

that the forty-nine outliers from the ACE scale were considered outliers in the output when

individuals simply endorsed the variable and, were not due to mistakes in entry or incorrect

data. Therefore, there is no identifiable condition that caused them to be invalid and thus, are

being included in the analysis. Further, while some cases may vary from the rest of the

sample, it reflects the potential uncertainty that is inherent in a post-secondary sample. It

would be poor statistical practice to remove legitimate data just to produce a better fitting

model (Babyak, 2004). The outliers in the data reflect legitimate cases of the population

being studied and therefore including them in the data set is justified (i.e., those who

experience more adversity in childhood; Tabachnick & Fidell, 2001).

Determining normality of variables included assessments of kurtosis and skewness

(Kline, 2011). Skewness values between -2 and +2 and kurtosis values between 7- and +7 are

indicative of a normal distribution (Bryne, 2010; Hair et al., 2010). The results of the analysis

yielded no issues of skewed or leptokurtic distribution.

Analysis Processes

All analyses were conducted using SPSS statistical software (Version 26). As

correlations are used to understand relationships between predictor and outcome variables

before conducting a moderation analysis (Hayes, 2015), bivariate correlations were computed

to examine the relationship between ACEs and functional outcomes on all available domains (i.e., home life with immediate family, life skills [as defined in previous section], social interactions with friends, activities in the community, educational activities, marital, co-living, or dating relationships, sexual activities and sex relations with others, caring for oneself daily, maintaining one's health). Because such a small percentage of the participants endorsed being employed (17%), the questions asking about employment on the functional impairment scale were omitted from the final functional impairment scale scores.

To analyze hypothesis 1, total ACE score was entered into the predictor variable (X) box, and the total score of the WFIRS-S scale was entered into the outcome variable (Y) box. For the next analysis, total ACE score was entered into the predictor variable (X) box and total score of the BFIS was entered in the outcome variable (Y) box. A histogram and scatter plot were also examined for each analysis to obtain graphical interpretation of significant relationships.

Moderation

Next, to investigate if EF moderated the relationship between ACEs and functional impairment (hypothesis 3), Hayes' PROCESS macro (version 3.1) model 1was utilized. The total ACE score was entered into the predictor variable box (X), total functional impairment score (WFIRS) was entered into the outcome variable box (Y), and total EF score (CEFI) was entered into the moderator variable box (W; Hayes, 2015). Moderation analysis was done to determine the degree or strength to which EF affects the relationship between ACEs and functional outcomes in EA. Theoretically speaking, a moderator is a variable that is hypothesized to alter the strength of a causal relationship between two other variables (Wu & Zumbo, 2008). Relevant to the present study, this analysis was used to test the proposed hypothesis that individuals who experienced ACEs will demonstrate more or less difficulty across functional domains as their score of executive function changes.

The proposed predictor of this relationship includes scores from the ACE scale with the outcome indicated by scores on the measures of functional impairment. All interactions as a result of the moderated analyses were examined with Simple Slope Analysis which allows for visual interpretation of the strength of interaction between ACEs and functional impairment through EF (Cohen et al., 2003; Frazier et al., 2004).

Lastly, PROCESS was used to conduct an exploratory mediation (model 4). PROCESS estimates the coefficients of a model using maximum likelihood logistic regression for dichotomous outcomes or ordinary least squares regression for continuous outcomes. PROCESS also uses bootstrapping, a nonparametric approach to effect size estimation that uses resampling wherein subsamples are derived from the original sample and the effect within each subsample is computed (Hayes, 2015). This process is repeated thousands of times to estimate a sampling distribution for the effect of interest. From this distribution, upper and lower estimates of the effect can be identified, and a confidence interval can be computed.

Results

Descriptive Statistics

Means, standard deviations, and alpha reliabilities for the study measures are summarized in Table 1. Prevalence rates of ACEs, when examining the original ten ACEs, were higher than expected whereby, 80.2% of participants reported at least one ACE, compared to 55.8% documented in a larger scale sample of Canadian adults (Carsley & Oei, 2020), and 59.3% reported in a similar American sample (Metzler et al., 2017).

When examining prevalence rates of ACEs with the additional seven ACE items, the prevalence rate increased to 89.5%, with participants endorsing 2.49 items more, on average (Table 1). Further, 35.8% of participants endorsed four or more of the original ACEs, with 54.9% endorsing four or more of total ACE items (See Appendix L).

Taken together, participants on average endorsed 6.63 ACE items of the potential 17 examined. Percent of individual items endorsed, and cumulative percentage of ACEs endorsed can be seen in Appendix J.

Similarly, mean rates of difficulties in emotion regulation were elevated when compared to published research using a similar sample; $M = 51.25$ compared to $M = 42.91$ reported by MacIsaac et al., 2021. EF scores as measured by the CEFI fell in the average range when compared to published norms of similar samples $M = 213.20$ (out of a potential 360; $SD = 46.39$; Naglieri & Goldstein, 2014).

Table 1

Means, Standard Deviations, and Cronbach Alpha Values for Study Variables (N = 162)

Scale	*M*	*SD*	Cronbach's Alpha
ACEs (Original)	4.14	4.14	.83
Additional ACEs	2.49	2.43	.66
ACEs (Original + Additional)	6.63	5.60	.85
EF (CEFI)	213.20	46.39	.96
DERS	51.25	5.72	.92
FI (WFIRS)	0.754	0.4124	.97
FI (BFIS)	39.26	21.44	.91

Note. FI = Self-Reported Functional Impairment; ACEs (Original) = Adverse Childhood Experiences as measured by the Adverse Childhood Experiences Questionnaire; ACEs (Original + Additional) = Total number of adverse childhood experiences as measured by the Adverse Childhood Experiences Questionnaire with the additional ACE questions; EF = Self-

Reported Executive Function; CEFI = Comprehensive Executive Function Inventory; DERS = Difficulties in Emotion Regulation Scale; WFIRS = WEISS Functional Impairment Rating Scale; BFIS = Barkley Functional Impairment Scale; FI = Self-Reported Functional Impairment.

Bivariate Correlations

Bivariate correlations were computed between ACEs, executive function, difficulties in emotion regulation, and functional outcomes (see Table 2). Contrary to expectation, ACEs experienced by participants did not correlate with executive function, indicating that a higher ACE score was not associated with increased EF scores. ACEs were however positively correlated with difficulties in emotion regulation in all but one area of difficulty, suggesting that ACEs are related to difficulties in emotion regulation in 5 domains (i.e., awareness, clarity, impulse control, nonacceptance, and strategy; See Table 3). ACEs were also positively correlated with functional impairment, such that an increase in ACE score is associated with an increase in total impairment as well as impairment in all but one area of functioning (i.e., impairment in all subscales except work; Table 4). ACEs not correlating with functional impairment in the domain *work* is not surprising given that the majority of the sample reported being unemployed or working casually. Difficulties in emotion regulation and EF were also negatively correlated with functional outcomes, indicating that lower EF is associated with more impairment in functioning; which was the case across all areas of functioning (i.e., family, work, school, life skills, risk behaviours, self-concept, and social impairment; Table 5).

Table 2

Bivariate Correlations of the Study Variables (N = 162)

Variable	1	2	3	4	5
1. ACEs	---	-.09	.21**	.34**	.27**
2. EF (CEFI)		---	-.56**	-.53**	-.55**
3. DERS			---	.52**	.65**
4. FI (WFIRS)				---	.67**
5. FI (BFIS)					---

Note. FI = Self-Reported Functional Impairment; ACEs = Adverse Childhood Experiences; EF = Self-Reported Executive Function; CEFI = Comprehensive Executive Function Inventory; DERS = Self-Reported Difficulties in Emotion Regulation Scale; WFIRS = WEISS Functional Impairment Rating Scale; BFIS = Barkley Functional Impairment Scale. **$p < .01$.

Linear Regressions

In order to analyze hypotheses 1 and 2, linear regressions were performed to examine 1: The predictive relationship between ACEs and functional impairment, and 2: The predictive relationship between EF and functional impairment. Results of the regressions confirmed hypothesis 1, that ACEs significantly predict functional impairment on all scales of impairment as measured by the WFIRS-S, $R^2 = .15$, $F(1, 160) = 27.13$, $p = .000$ and BFIS, $R^2 = .07$, $F(1, 160) = 12.56$, $p = .001$; Table 6. This analysis suggests that ACEs, in part, predict functional impairment, accounting for 7-14% of the variance reported in this sample (See R^2; Table 6).

Next, results of the second regression are consistent with the hypothesis (hypothesis 2) that EF, as measured by the CEFI, significantly predicted level of functional impairment. This was the case when predicting emotion dysregulation whereby, ACEs also significantly predicted scores on the DERS-SF. In fact, this was true across all variables of interest (i.e.,

EF, emotion regulation and functional impairment; $p = .000$; Table 7). Taken together, the results of this analysis demonstrate that EF accounts for 19-32% of the variance in functional impairment for this sample of emerging adults.

Table 3

Bivariate Correlations of ACEs and Difficulties in Emotion Regulation Subscales (N = 162)

Variable	1	2	3	4	5	6	7	8	9
1. ACE10	---	.62**	.95**	.19*	.13	.10	.11	.13	.14
2. ACE7		---	.84**	.11	.18*	.17	.22**	.21**	.18*
3. ACET			---	.19*	.16*	.13	.16*	.18*	.17*
4. AWARE				---	.26**	.22**	.22**	.20*	.17*
5. CLARITY					---	.52**	.57**	.54**	.54**
6. GOALS						---	.81**	.83**	.79**
7. IMPULSE							---	.82**	.84**
8. NONACCEPT								---	.81**
9. STRATEGY									---

Note. ACE10 = Original ACE Scale; ACE7 = Additional ACEs as informed by Afifi et al (2020); ACET = Sum of ACE10 and ACE7; AWARE = Self-awareness subscale of the DERS-SF; CLARITY = Clarity subscale of the DERS-SF; GOALS = Goals subscale of the DERS-SF; IMPULSE = Impulsivity subscale of the DERS-SF; NONACCEPT = Non-acceptance subscale of the DERS-SF; STRATEGY = Strategy subscale of the DERS-SF.

*$p < .05$; **$p < .01$.

Table 4

Bivariate Correlations of ACEs and Functional Impairment Subscales (N = 162)

Variable	1	2	3	4	5	6	7	8	9	10
1. ACE10	---	.62**	.95**	.20**	.28**	.32**	.20*	.33**	.20*	.14
2. ACE7		---	.84**	.30**	.33**	.37**	.22**	.31**	.20**	.04
3. ACET			---	.27**	.33**	.37**	.23**	.36**	.22**	.11
4. FAMILY				---	.43**	.51**	.35**	.39**	.53**	.38**
5. SCHOOL					---	.64**	.33**	.44**	.38**	.42**
6. LIFE SKILLS						---	.38**	.63**	.53**	.47**
7. RISK							---	.20*	.48**	.56**
8. SELF								---	.51**	.18*
9. SOCIAL									---	.55**
10. WORK										---

Note. ACE10 = Original ACE Scale; ACE7 = Additional ACEs as informed by Afifi et al (2020); ACET = Sum of ACE10 and ACE7; FAMILY = Family impairment subscale of the WFIRS; SCHOOL = School impairment subscale of the WFIRS; LIFE SKILLS = Impairment in life skills subscale of the WFIRS; RISK = Risk taking subscale of the WFIRS; SELF = Impairment in self-concept subscale of the WFIRS; SOCIAL = Social impairment subscale of the WFIRS; WORK = Work impairment subscale of the WFIRS.

*p < .05; **p < .01.

Table 5

Bivariate Correlations of Executive Functions, Emotion Regulation, and WFIRS Functional Impairment Subscales (N = 162)

Variable	1	2	3	4	5	6	7	8	9
1. CEFI	---	-.56**	-.35**	-.46**	-.47**	-.27**	-.42**	-.41**	-.30**
2. DERS		---	.42**	.36**	.45**	.24**	.56**	.41**	.17

3. FAMILY	---	.43**	.51**	.35**	.39**	.53**	.38**
4. SCHOOL		---	.64**	.33**	.46**	.38**	.42**
5. LIFE SKILLS			---	.38**	.63**	.53**	.47**
6. RISK				---	.20*	.48**	.56**
7. SELF					---	.51**	.18*
8. SOCIAL						---	.55**
9. WORK							---

Note. CEFI = Comprehensive Executive Function Inventory; DERS = Difficulties in Emotion Regulation Scale; FAMILY = Family impairment subscale of the WFIRS; SCHOOL = School impairment subscale of the WFIRS; LIFE SKILLS = Impairment in life skills subscale of the WFIRS; RISK = Risk taking subscale of the WFIRS; SELF = Impairment in self-concept subscale of the WFIRS; SOCIAL = Social impairment subscale of the WFIRS; WORK = Work impairment subscale of the WFIRS.

*p < .05; **p < .01.

Table 6

Regression Analysis Summary: ACEs Predicting Functional Impairment in Emerging Adults (N = 162)

	Model	Regression Coefficient B	95% CI	R^2	b	t	p
	(Constant)	32.82	[28.00, 37.64]			13.46	.000
BFIS	ACEs	.971	[.43, 1.53]	0.07	0.27	3.54	.001
	(Constant)	33.71	[28.18, 39.25]			12.03	.000

WFIRS	ACEs	1.64	[1.02, 2.27]	0.14	0.32	5.21	.000

Note: CI = Confidence Interval for B; ACEs = Adverse Childhood Experiences; BFIS = Barkley Functional Impairment Scale; WFIRS = WEISS Functional Impairment Rating Scale.

Table 7

Regression Analysis Summary: Self-Reported Executive Functions Predicting Functional Impairment in Emerging Adults (N = 162)

	Model	Regression Coefficient B	95% CI	R^2	b	t	p
	(Constant)	6.66	[80.25, 106.57]			14.02	.000
BFIS	CEFI	-0.25	[-.31, -.19]	.30	-.55	-8.32	.000
	(Constant)	106.75	[90.73, 122.76]			12.03	.000
WFIRS	CEFI	-0.29	[-.37, -.22]	.28	-.53	-7.84	.000
	(Constant)	-8.59	[-19.89, 2.69]			-1.51	.134
BFIS	DERS-SF	.934	[.72,1.15]	.32	.56	8.65	.000
	(Constant)	.294	[-14.40, 14.99]			0.04	.969
WFIRS	DERS-SF	.864	[.59, 1.14]	.19	.44	6.14	.000

Note: CI = Confidence Interval for B; Functional Impairment; ACEs = Adverse Childhood Experiences; EF = Self-Reported Executive Function; CEFI = Comprehensive Executive Function Inventory; DERS = Difficulties in Emotion Regulation Scale; WFIRS = WEISS Functional Impairment Rating Scale; BFIS = Barkley Functional Impairment Scale.

Simple Moderation Analysis

Simple moderation analysis was used to test the final hypothesis of the present study. EF was examined as a moderator of the relationship between ACEs and functional impairment. It was hypothesized that EF would moderate the relationship between ACEs and functional impairment in emerging adults. Results of the moderation analysis demonstrated that the interaction term was not statistically significant (b = -0.002, SE = 0.005, p = 0.616; Table 5). Next, another moderation analysis was completed using the alternate measure of functional impairment (BFIS) and the result of that interaction was also nonsignificant (b = 0.123, SE = 0.187, p = 0.513; Table 5). Lastly, when examining emotion dysregulation (DERS-SF) as the moderator (W) variable, the results of the interaction were nonsignificant as well (b = 0.006, SE = 0.02, p = 0.731). Taken together, the moderation analyses demonstrate that, in this model, EF and emotion regulation were not significant moderators of the relationship between ACEs and functional impairment for emerging adults.

Table 5

Hierarchical Multiple Regression Analyses Testing the Moderating Effect of Executive Functions on the Relationship Between Adverse Childhood Experiences and Functional Impairments in Emerging Adults (N = 162)

Predictors	R^2	Adj. R^2	B	ΔR^2	ΔF	df
Model 1						
WFIRS (O)	.59	.354		.001	22.27	1, 158
ACE (X)			.023***			
CEFI (Y)			-.203***			
ACE x CEFI			**-.002**			
(int)						

Model 1						
BFIS (O)	.57	.321		.002	24.87	1, 158
ACE (X)			.789***			
CEFI (W)			-10.320***			
ACE x CEFI (int)			**.123**			

*Note: Nonsignificant interactions are **bolded.**;* FI = Self-Reported Functional Impairment; ACEs = Adverse Childhood Experiences; EF = Self-Reported Executive Function; CEFI = Comprehensive Executive Function Inventory; DERS = Difficulties in Emotion Regulation Scale; WFIRS = WEISS Functional Impairment Rating Scale; BFIS = Barkley Functional Impairment Scale.

**$p < .001$

Exploratory Analyses

Given that there is literature to suggest that ACEs contribute to biological changes within brain structures (i.e., the prefrontal cortex; Lund et al., 2020) and, that the prefrontal cortex is responsible for cognitive behaviours required for appropriately navigating EA (such as EFs; Diamond, 2013), it is hypothesized that EF may help to explain the relationship between ACEs and functional impairment in emerging adults. Therefore, it was decided to explore the potential mediating role of EF and emotion dysregulation on the relationship between ACEs and functional impairment through exploratory mediation analyses.

In order to calculate the direct and indirect effect of such mediating relationships, Model 4 of the PROCESS macro of Hayes (2015) was used. The first analysis examined what is known by Hayes (2015) as the direct effect or *c'* path. This step confirmed that the path

between ACEs and functional impairment is positive and significant ($B = .5129$, $SE = .2188$,

$p = .020$). Meaning that, as an individual experiences more ACEs, they are likely to endorse

increased functional impairment (as measured by the WFIRS; path c'; Figure 1).

In step two, what is known as the a path or, the direct effect of ACEs on emotion

dysregulation (DERS-SF), is positive and significant ($B = .4970$, $SE = .1865$, $p = .008$)

demonstrating that those who experience increased ACEs report increased difficulty with

emotion regulation (path a; Figure 1). The direct effect of ACEs on the broad measure of EF

(CEFI) was not significant ($p = .513$).

As ACE scores did not significantly predict scores on the CEFI, using the CEFI score

as a mediation variable was not explored. However, the results did support the inclusion of

the DERS-SF score as a mediator as ACEs significantly predicted scores on the DERS-SF.

As such, difficulties in emotion regulation was the only mediating variable explored.

Figure 1 shows that the direct effect of emotion regulation on functional impairment

is positive and significant ($B = .9222$, $SE = .0907$, $p = .0000$) meaning, those who

experienced increased difficulties with emotion regulation also endorsed higher functional

impairment (path b). Finally, the effect of X on Y is still significant when adding the mediator

variable (DERS-SF) into the relationship. Therefore, it can be concluded that there is a partial

meditation effect demonstrated whereby, difficulties in emotion regulation partially mediates

or explains the relationship between ACEs and functional impairment in this sample

(Preacher et al., 2007).

Indirect Effect. The indirect (a.k.a mediation) effect was tested using parametric

bootstrapping in Hayes PROCESS model 4. This analysis allows one to determine the

amount of mediation occurring through the mediator variable (i.e., DERS-SF; Preacher &

Hayes, 2007). To determine whether there is a significant indirect effect in the mediation

model, the 95% bias-corrected confidence intervals (CIs) must not include zero (Preacher et

al., 2007). If 0 falls outside of the lower and upper bounds, it can be determined that the

indirect effect is significant and, mediation is significant. In the present study, the indirect

effect was statistically significant (IE = .4583, CI = .0974, .8562) demonstrating that there is

a positive predictive relationship between ACEs and functional impairment, as mediated by

difficulties in emotion regulation.

Figure 1

Mediation Pathway: Assessing the Mediating Effect of Emotion Dysregulation on the

Relationship Between Adverse Childhood Experiences and Functional impairment
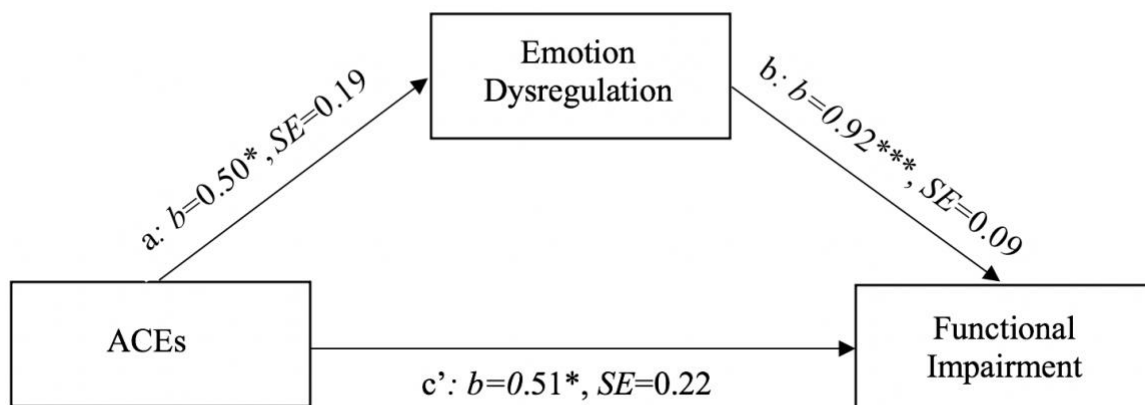
$*p < .05; **p < .01; ***p < .001$

Discussion

Summarized Findings

The present study revealed several notable findings. First, since earlier research has

primarily focused on negative *health* (mental and physical) outcomes associated with ACEs,

this study provides new insight by exploring how ACEs affect *functional* outcomes. ACEs,

generally, are linked with later mental, physical, and behavioural health problems (Bellis et

al., 2019). Adding to the literature, the present study shows that ACEs are associated with

self-reported functional impairments. This result indicates that ACEs pose a risk to more

palpable indicators of daily functioning, above and beyond indicators of health. Therefore, not only do ACEs cause disruption in health-related outcomes such as increased mental health difficulties and decreased physical wellness, but ACEs also disrupt later adaptive functioning as seen through difficulties in effective functioning at home, in social relationships, risk-taking behaviours, life skills, family, school, and self-concept.

As well, previous work has primarily focused on non-community-based samples to explore negative health outcomes associated with ACEs (Lund et al., 2020). The present study demonstrates that presumably high functioning community samples experience functional impairment associated with ACEs. Namely, 89.5% of this post-secondary sample endorsed experiencing at least one ACE with 35.8% reporting four or more ACEs. This finding suggests that the prevalence of ACEs is common in emerging adults. Therefore, post-secondary samples may be an important group to study in the context of ACE outcomes.

Hypothesized results

The present study sought to determine whether EF moderates the relationship between ACEs and functional impairment in emerging adults. Three hypotheses were examined. Hypothesis 1 (proposing that ACEs would significantly predict functional impairment) was supported, as results demonstrated that ACE scores significantly predicted more functional impairment in EA. In addition, the hypothesis (hypothesis 2) that EF would predict functional impairment in EA was partially supported, whereby difficulties in emotion regulation (a process supported by EF) significantly predicted functional impairment. However, scores on the self-reported measure of EF (CEFI) did not predict functional impairment. Lastly, the hypothesis (hypothesis 3) that EF would moderate the relationship between ACEs and functional impairment was not supported. Models testing the number of ACEs by EF interactions revealed no significant effects for functional impairment.

Executive functions as a mediator. In exploring the potential mediating role of EF on the relationship between ACEs and functional impairment, results demonstrate that difficulties in emotion regulation mediate the relationship between ACEs and functional impairment. In other words, increased difficulties in emotion regulation partially accounted for the relationship between ACEs and functional impairments seen in EA.

Fit with Prior Research

Hypothesis 1. Regarding the first hypothesis, the significant association between ACEs and functional impairment in emerging adults is consistent with earlier work and expands on what is known about the effect of early trauma on functional outcomes in adulthood. Increased ACE exposure has been previously associated with various negative life outcomes such as lower rates of unemployment (Liu et al., 2013), higher rates of health risk behaviours (Garrido et al., 2017), difficulties in social relationships (Clark et al., 2010), as well as global functional impairment (Duron et al., 2021). However, the present findings are unique in that previous work examining these relationships was predominately examined in children, adolescents, or non-community settings (e.g., psychiatric or correctional settings). The present study highlights how ACEs affect functional impairment in EA, an important time in development that is sure to have lifelong implications. Knowing this, assessing for ACEs in emerging adults who are presenting with difficulties in functioning may be of importance. Further, understanding the pathways by which these outcomes occur is an important consideration for intervention efforts (see Mediation Model).

Hypothesis 2. Concerning the second hypothesis, the lack of association between the broader measure of EF and functional impairment adds to the existing mixed literature on this relationship. I found that ACEs are not associated with scores on broader measures of EF in this sample but are associated with difficulties in emotion regulation. This finding may be unique to post-secondary samples as recent work exploring a similar relationship in college

students highlights that ACEs do not predict broader EFs but are associated with negative coping (Kalpidou, Volungis, & Bates, 2021). Specifically, Kalpidou and colleagues discovered that emerging adults who experienced ACEs are more likely to endorse negative coping strategies such as self-blame and denial which partially explains the role of ACEs on post-secondary adaptation, symptoms of psychopathology, and substance use (2021). Further, though previous work demonstrates that ACEs are associated with impaired abilities in working memory (Philip et al., 2015) and diminished inhibition in children (Mittal et al., 2015) not all work examining this relationship shows that ACEs are associated with EF deficits (Lund et al., 2020). For example, Carrion and colleagues did not find significant differences on measures of inhibitory control between children who had post-traumatic stress syndrome compared to healthy controls (2008). Similarly, measures of visual attention did not differ in ACE-exposed children with and without PTSD in De Bellis et al.'s (2009) study. However, while ACEs are not associated with broader EF scores in the present sample, the significant predictive relationship between ACEs and difficulties in emotion regulation is consistent with prior research (Cameron, Hamilton, & Carroll, 2018; Kalia & Knauft, 2020).

Hypothesis 3. With respect to the third hypothesis, the lack of EF moderation on the relationship between ACEs and functional outcomes adds to the limited literature on the causal pathways between ACEs and negative outcomes in adulthood. While no study has examined this relationship specifically, Poole and colleagues (2017) discovered that positive forms of coping predicted symptoms of depression and that positive coping moderated the relationship between ACEs and symptoms of psychopathology. Specifically, positive coping skills such as tolerance of negative affect, having an action-oriented approach to problem solving, and the ability to focus under pressure significantly lessened the impact of ACEs on negative psychopathology in their adult sample (Poole et al., 2017). As coping and emotion regulation are similar constructs by definition and measure (Compas et al., 2014), it is

surprising that this model was not significant in the present study. However, outcome variables of the present study focused on functional impairment and not psychopathology. Therefore, this relationship may not remain true when considering functional outcomes. Further, recent work has indicated that this relationship may be better explored through mediation.

Mediation model.

The significant exploratory findings of the present study coincide with new research showing that young adults exposed to ACEs demonstrate increased mental health difficulties and health risk behaviours in adulthood, as mediated by executive dysfunction (Trossman et al., 2020). Although Trossman and colleagues did not explore functional impairment as the outcome variable, their study supports the significance of the mediation model in the present study as do others who highlight that emotion regulation mediates the relationship between ACEs and adult symptoms of psychopathology such as PTSD and depression (Barlow et al., 2017; Chang et al., 2017). Similarly, Cloitre et al (2019) discovered that emotion regulation mediates the relationship between ACEs and three negative health outcomes (i.e., symptoms of PTSD, depression, and poor physical health), further supporting the inclusion of a mediation model in the present study. What makes the current work especially unique is that prior research has only examined this relationship in adults with severe mental health disorder (Mansuetto et al., 2019) and is quite limited (Lund et al., 2020). Taken together, the findings expand on research and theory within the field of developmental neuropsychology which highlights how ACEs hinder one's ability to effectively regulate emotions in adulthood (Poole et al., 2017). Just as important, the results indicate that there are significant differences in EF for individuals who experience ACEs which account for functional impairment seen thereafter. Beyond negative health outcomes, the present findings demonstrate how ACEs affect functioning, as mediated by emotional regulation for emerging adults.

Implications for EA

Previous work has highlighted how EA is a particularly challenging time and, emerging adults who transition into post-secondary school are at increased risk for psychological distress (Arnett, 2015; Humensky et al., 2010; Kessler et al., 2005; Kuwabara et al., 2007). Having higher rates of mental health difficulties in the context of increased levels of uncertainty make EA a complex time that puts emerging adults at risk for maladaptation when facing the various challenges noted by Arnett (2015). Of further importance, emerging adults who are exposed to ACEs may be at increased risk for such difficulties as it is hypothesized that individuals who experience ACEs experience disruption in attachment-mediated prefrontal cortical development. Such disruption is thought to then lead to difficulties in areas of coping and emotion regulation (Lund et al., 2020). The present study supports this theory in that, emerging adults who report higher ACE scores demonstrate increased difficulties in emotion regulation and thus, worsened functioning.

Though post-secondary education is a time of increased psychological distress and instability, this developmental period offers many important future benefits including increased financial stability, decreased risk of unemployment, and longer longevity across the lifespan (Lutz & Kebede, 2018). Little is currently known about the direct effects of ACEs on educational outcomes, however the present study suggests that ACEs may affect educational outcomes in those attending post-secondary schooling. Specifically, there are increased difficulties for emotion regulation, a variable known to affect educational outcomes in this population (Bytamar et al., 2020).

The Role of Emotion Regulation

Although previous work indicates that EF is affected by ACEs, it may be that specific facets of EF are affected by ACEs differently. For example, researchers have indicated that, depending on the intensity and chronicity of ACEs, EF may be affected differently (Young-

Southward et al., 2020). Further, as EFs are typically classified in a taxonomy, it might be possible that subcategories of EF are affected differently as EF develops, depending on the type of ACEs (Boelema et al., 2014). For example, Miyake and colleagues proposed three fundamental EFs including mental set shifting, cognitive inhibition, and working memory (2000). Recent work by Diamond indicated that, beyond the fundamental EFs, are higher-order EFs that include cognitive tasks such as emotional reasoning, planning and problem-solving (2013). Therefore, although EFs broadly do not significantly explain the relationship between ACEs and functional impairment in the present sample, a higher-order component of EF does significantly explain this relationship. Namely, emotion regulation.

As such, emotion regulation may act as a specific target for assessment and intervention against functional impairment in emerging adults who have experienced ACEs. Emotion regulation is described as a process by which individuals adapt their emotions in the context of managing emotional response, timing of emotions, and expression of emotions (Gross, 2015). Research suggests that the regulation of emotions can change the duration, speed, and dynamics of the experienced emotion thus, controlling the consequence of the emotion. Further, theory of cognitive development indicates that emotion regulation is heavily supported by EFs including attentional shifting, decision making, and cognitive inhibition (Tottenham et al., 2011). This allows one to regulate the strength of their emotional experience (positive and negative) depending on the needs or goals of the individual (Aldao, 2013). The findings of the present study suggest that emerging adults who experience ACEs are more vulnerable to increased rates of functional impairment and, it is possible that such impairment could affect future outcomes associated with such burdens (e.g., increased financial difficulties). Therefore, emerging adults high in ACEs with difficulties in emotion regulation may benefit from opportunities that promote emotion regulation.

A recent meta-analysis by Moltrecht and colleagues (2021) shows promising evidence for early intervention strategies targeted at increasing emotion regulation and decreasing emotion dysregulation within youth samples (2021). However, further work is needed to understand which specific components of the current intervention protocols effectively result in this benefit (Moltrecht et al., 2021). Namely, it is known that interventions that incorporate emotion regulation in their protocol show improvement in emotion dysregulation and increased emotion regulation (e.g., dialectical behaviour therapy [DBT]) however, it is unclear what components of DBT result in this change, specifically (Moltrecht et al., 2021). Such therapeutic interventions show promise for maintaining improved emotion regulation at three-, six-, and twelve-months post-treatment (Sloan et al., 2017).

Within post-secondary settings, some institutions show success in providing interventions for emotion regulation in students, seen through improvements in academic outcomes; and decreases in frustration, depression and anxiety (Engelmann & Bannert, 2019; Finkelstein-Fox et al., 2018). Results herein suggest that targeting emotion regulation may be a useful addition to university programs, helping students in various functional domains as they navigate post-secondary education. Finkelstein-Fox and colleagues (2018) suggest that emotion regulation in post-secondary students may be best promoted through fostering adaptive mindfulness abilities. Further, brief mindfulness-based intervention is particularly effective for trauma-exposed post-secondary students for reducing academic and perceived stress (Cherry, 2019). Regardless of the presence of trauma, emotion regulation skills play a key role in transdiagnostic models of preventive interventions and treatments for a range of psychological difficulties (Mennin, Ellard, Fresco, & Gross, 2013). Therefore, it may be beneficial for post-secondary institutions to create or adapt programs to include strategies that facilitate skills targeted at emotion regulation to prevent functional impairment. Such

interventions may then possibly mitigate long-term negative outcomes such as program drop out, academic performance, and mental health difficulties in their students.

Assessing Emotion Regulation. Findings from the present study add to the limited literature on explanatory models of factors that may contribute to functional impairment in EA. The results suggest that emerging adults with higher ACE scores are more vulnerable during post-secondary schooling and may endorse increased difficulties in emotion regulation, higher risk-taking, difficulties in managing academic demands, interpersonal challenges, and other functional impairments. Therefore, it is important to consider assessing for difficulties in emotion regulation in these individuals, especially given the prevalence of ACEs in the current post-secondary sample.

The present sample did not demonstrate a significant association between ACEs and scores on the broad measure of self-reported EF (i.e., CEFI). Previous literature has hypothesized that, changes in EF come as a result of marked brain differences in the prefrontal cortex for those who experience trauma during development. And, while previous research has noted that certain negative outcomes are associated with ACEs generally, the onset of adversity in childhood is an important consideration. Recent work demonstrates that the onset, chronicity, and recency of trauma in childhood may be associated with the differences seen on outcomes of neurodevelopment (Young-Southward et al., 2020). Therefore, the present sample may show differences between groups who experienced ACEs more frequently in development or, when adversity occurred during critical periods in development. As the sample was derived from a post-secondary sample, it could also be assumed that these individuals demonstrated enough EF required to achieve post-secondary admission and thus, there may be a bias in the sampling seen on the broad measure of EF if contrasted to a community sample.

Accordingly, it may be helpful for school counsellors to assess difficulties in emotion regulation among students seeking help within post-secondary settings. Assessing difficulties in emotion regulation may provide counsellors with a clearer understanding of what may be contributing to current challenges in the student's life. For example, if a student were assessed and identified with a high DERS-SF score, emotion regulation may be a potential target for intervention. Specifically, cognitive behavioural and mindfulness strategies can be used to enhance emotion regulation in both trauma exposed and non-trauma exposed individuals (Hofmann et al., 2012; Konanur et al., 2015)

Limitations and Future Directions

The present study is not without limitations. The study was limited by a homogenous (i.e., predominantly Caucasian and female) sample, recruited from a medium sized university in Northwestern Ontario. Therefore, it is not clear whether the current findings would generalize to all emerging adults or capture emerging adults who experienced alternative trajectories. In addition, diversity among the population of first-year post-secondary students needs to be considered. Racial minorities in Canada (i.e., Black, Hispanic, and Indigenous peoples) have previously reported experiencing higher exposure to ACEs than Caucasian Canadians (Giano et al., 2020; Maguire-Jack et al., 2020; Richards et al., 2020). As the present study does not adequately represent ethnic minority groups, future research should consider examining larger samples of ethnically diverse individuals for better generalizability of the study findings. As well, the present study had a sample that was predominately female. Therefore, while this work helps to identify how ACEs contribute to later difficulties with functioning through difficulties in emotion regulation, future work should explore this relationship with more male participants. With that, including independent measures of functional impairment rather than relying on self-reported functioning would provide further value to the current study.

Due to the covid-19 pandemic, the study method relied on online, self-report measures which may be subject to responder bias (Rosenman et al., 2011). Future studies may wish to include a measure of social desirability or response-bias if relying on predominately self-report measures in this way in the future. When appropriate to do so, researchers should consider other forms of collecting information that may provide a broader picture of functioning. For example, including performance-based measures of executive function rather than or in combination with self-report measures may be beneficial. Especially given that each type of measure appears to capture different levels of cognitive abilities (Toplak et al., 2012). For instance, self-report measures of EF tend to provide an indication of individual goal pursuit whereas performance-based measures tend to capture an indication of processing efficiency or, the reflective and algorithmic mind, respectively (Toplak et al., 2012). The findings from the present study may not apply to measures of EF on performance-based tasks. As well, due to the nature of self-report measures, retrospective reporting of adversity in childhood was required of the participants. A limitation to this type of assessment is that the measure may not have been sensitive enough to capture the amount or chronicity of ACEs with complete accuracy. Including a more sensitive measure of the frequency of ACEs in future work may be important.

Given that a convenience sample was derived from a post-secondary research pool, without random assignment or experimental manipulation, causality cannot be inferred for the present study. The use of randomized controlled study designs could be used to test intervention strategies for difficulties in emotion regulation in order to determine whether improvements in emotion regulation causes decreased functional impairments in post-secondary students who reported ACEs.

A retrospective self-report measure was used to capture the occurrence of ACEs before the age of 18. This scale is helpful in capturing a snapshot of the number of

adversities, beyond normative developmental adversities, that one experiences during development. However, a limitation to this scale is that it does not capture when the adversity occurred and for how long such adversities transpired. Further, criticisms of retrospective self-report measures exist in the literature (Tofthagen, 2012). Therefore, longitudinal research needs to be done to better understand the longer-term impact of early adversity.

Future research would benefit from duplicating this study in a non-post-secondary sample or in a different post-secondary setting in order to compare how these results look in outside samples. Of further interest would be to investigate how interventions targeted at emotion regulation affect functional impairment in this relationship. Specifically, work examining interventions targeted at emotion regulation in an attempt to decrease functional impairment in emerging adults who have experienced ACEs would provide further value.

Taken together, addressing the limitations of the present study would expand on the internal and external validity of this study.

Concluding Remarks

Canadian post-secondary undergraduates experience a high prevalence of ACEs which increase functional impairment as mediated through difficulties in emotion regulation. Although the initial study hypothesis (that EF may moderate the relationship between ACEs and functional impairment) resulted in null findings, the results of the exploratory mediation analysis offered welcomed insight. The present study suggests that emotion regulation, at least partially, *explains* the relationship between ACEs and functional impairment in emerging adults. As emerging adults enter post-secondary schooling with a high number of ACEs and increased difficulties in emotion regulation, an opportunity exists to intervene to reduce the negative impairments associated with these difficulties. Services at all levels of the postsecondary education system can be strengthened through screening for ACEs, difficulties in emotion regulation, and/or assessing impaired functioning in students seeking help.

Currently, screening for ACEs is not uncommon but has yet to be implemented broadly across post-secondary settings (Ford et al., 2019). The current results can be used to support the adaption of interventions on post-secondary students by raising awareness of how to manage emotions and the increased risk for various functional impairments. As the present study suggests that ACEs through emotion regulation predict 47% of the variance in functional impairment, identifying students with a history of ACEs may be imperative in appropriately supporting students in post-secondary settings.

This is the first study to highlight the potential effects of ACEs on functional impairment in emerging adults. As there is evidence that emotional distress may be increasing in post-secondary samples (ACHA, 2018), the findings of the present study highlight that ACEs relate to difficulties in emotion regulation and increase functional impairment. Specifically, emotion dysregulation mediates the effects that ACEs have on functioning in EA, pinpointing a potential area for intervention in post-secondary students who have experienced ACEs while inviting the exploration of further potential mediators of such relationships.

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Appendix A

Information Letter

Childhood Adversity, Executive Function, and Functional Impairment: Testing a

Moderation Model Among Emerging Adults

Dear Potential Participant:

You are invited to participate in our research study titled: ***Childhood Adversity, Executive Function, and Functional Impairment: Testing a Moderation Model Among Emerging Adults.*** Your participation in this study is entirely voluntary, and whether you choose to participate or not will not impact your academic standing at Lakehead University. Before you decide whether or not you would like to take part, please read this letter carefully to understand what is involved. After you have read the letter, please email any questions you may have.

PURPOSE

The purpose of this research is to examine the relationships between childhood adversity, executive function, and functional impairment in young adults. Executive functions are higher-order cognitive processes required for implementing goal-directed behaviours. Experiencing adversity in childhood is known to have lasting impacts across the lifespan. This project will explore the impact of these early adverse experiences on functional outcomes in undergraduate students.

The Principal Investigator of the research is Dr. Aislin Mushquash, Assistant Professor, Department of Psychology, Lakehead University. Dr. Christopher Mushquash, Associate Professor, Department of Psychology, Lakehead University, is the Co-Investigator. Kara Boles is a graduate student researcher in the Department of Psychology, Lakehead University, supervised by Dr. A. Mushquash and Dr. C. Mushquash. Elizabeth Grassia is a research assistant under the supervision of Dr. A. Mushquash.

WHAT IS REQUESTED OF ME AS A PARTICIPANT? As a participant, you will be asked to complete a self-report questionnaire via SurveyMonkey. This should take up to 20 minutes to complete.

WHAT INFORMATION WILL BE COLLECTED? The study will ask questions about adverse childhood experiences, executive function, and functional impairment in various aspects of your life, along with your experience during the COVID-19 pandemic. Some of the questions may be difficult for some people to think about or may cause some temporary distress. You are not required to answer all questions and can feel free to skip questions that you are not comfortable answering.

WHAT ARE MY RIGHTS AS A PARTICIPANT? As a participant, you are under no obligation to participate and you have the right to withdraw your data up until you submit the questionnaire. Your data is completely anonymous and there will be no way to connect you to your data. Your decision to participate will not affect your academic status.

WHAT ARE THE RISKS AND BENEFITS? There are no known harms associated with participating in the study. However, as mentioned above, some questionnaires will ask about difficult experiences you may have had in your life. Some of these questions may be hard for some people to think about. You are not required to answer all questions and can feel free to skip questions that you are not comfortable answering. Should you feel upset during or after the study, we encourage you to contact any of the following support services:

Lakehead University Student Counselling (807) 343-8361; Thunder Bay Counselling Centre Walk-In Counselling (807) 684-1880; Good2Talk 24 hour Student Helpline `1-866-925-5454; Student Helpline Crisis Response (807) 346-8282

The information that you provide will not be shared with anyone outside of the research team. Your name will not be included on the questionnaires as it is entirely anonymous. All information will be stored on a password protected hard drive. The primary benefits of the proposed study are for society and for the advancement of knowledge. Specifically, this study will provide information on the impact of adverse childhood experiences on functional outcomes in young adults and whether this relationship is moderated by executive function. For participating in the study via SONA, you will receive 0.5 bonus points to go towards an eligible psychology course. If you do not require or want the bonus points, you have the option to be entered into a draw for a $50 Visa gift card. If you wish to be entered into the draw, please email the research team at coping.research@lakeheadu.ca instead of using SONA. The draw will occur when the study is complete.

HOW WILL MY CONFIDENTIALITY BE MAINTAINED?

Confidentiality will be maintained throughout the study. All data will be completely anonymous with no links between you and your data. Please note that the online survey tool used in the study, (SurveyMonkey), is hosted by a server located in the USA. The US Patriot Act permits U.S. law enforcement officials, for the purpose of antiterrorism investigation, to seek a court order that allows access to the personal records of any person without the person's knowledge. In view of this we cannot absolutely guarantee the full confidentiality and anonymity of your data. With your consent to participate in this study, you acknowledge this.

WHERE WILL MY DATA BE STORED?

Data will be stored on a password-protected hard drive at Lakehead University, Department of Psychology. In accordance with Lakehead University's policy, data will be retained for at least 5 years following the completion of the research.

HOW CAN I RECEIVE A COPY OF THE RESEARCH RESULTS?

All findings will be presented in summary. If you would like to receive a summary of the findings following the completion of the study, follow the link at the end of the study and enter your email address. Your email address will not be associated with your study data.

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RESEARCH ETHICS BOARD REVIEW AND APPROVAL:

This research study has been reviewed and approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team, please contact Sue Wright at the Research Ethics Board at (807) 343-8283 or research@lakeheadu.ca.

Appendix B

Consent Form

Childhood Adversity, Executive Function, and Functional Impairment: Testing a Moderation Model Among Emerging Adults

MY CONSENT:
I agree to the following:

✓ I have read and understand the information contained in the Information Letter

✓ I agree to participate

✓ I understand the risks and benefits to the study

✓ That I am a volunteer and can withdraw from the study up until I submit the questionnaire, and may choose not to answer any question

✓ That the data will be securely stored on a password protected hard drive for a minimum period of 5 years following completion of the research project

✓ I understand that the research findings will be made available to me upon request

✓ That my name will not be included on my questionnaire and that it is entirely anonymous ✓ All of my questions have been answered and I can contact the Principal Investigator with further questions

By consenting to participate, I have not waived any rights to legal recourse in the event of research-related harm.

Please note that the online survey tool used in the study, (SurveyMonkey), is hosted by a server located in the USA. The US Patriot Act permits U.S. law enforcement officials, for the purpose of anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without the person's knowledge. In view of this we cannot absolutely guarantee the full confidentiality and anonymity of your data. With your consent to participate in this study, you acknowledge this.

My consent has been given by clicking "CONSENT" below and continuing on to the questionnaire.

Appendix C

Adverse Childhood Experiences Questionnaire (Felitti, et al., 1998; With the addition

of 6 questions as per Afifi et al., 2020)

Adverse Childhood Experiences (Felitti et al., 1998; Frewen et al., 2019)

While you were growing up, during your first 18 years of life…

	Never	At least once	Many times
1. Did a parent or other adult in the household often or very often… Swear at you, insult you, put you down, or humiliate you? OR Act in a way that made you afraid that you might be physically hurt?			
2. Did a parent or other adult in the household often or very often… Push, grab, slap, or throw something at you? OR Ever hit you so hard that you had marks or were injured?			
3. Did an adult or person at least 5 years older than you ever… Touch or fondle you or have you touched their body in a sexual way? OR Attempt or actually have oral, anal, or vaginal intercourse with you?			
4. Did you often or very often feel that… No one in your family loved you or thought you were important or special? OR Your family didn't look out for each other, feel close to each other, or support each other?			
5. Did you often or very often feel that … You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? OR Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?			
6. Were your parents ever separated or divorced?			

7. Was your mother or stepmother: Often or very often pushed, grabbed, slapped, or had something thrown at her? OR Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? OR Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?			
8. Was your father or stepfather: Often or very often pushed, grabbed, slapped, or had something thrown at him? OR Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? OR Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?			
9. Did you live with anyone who was a problem drinker or alcoholic OR who used street drugs?			
10. Was a household member depressed or mentally ill, or did a household member attempt suicide?			
11. Did a household member go to prison?			

Adverse Childhood Experiences Additional Questions

While you were growing up, during your first 18 years of life…

	Never	At least once	Many times
12. Did peers, friends, or other children outside your household often or very often… Bully you (in person or online), swear at you, insult you, put you down, or humiliate you? OR Act in a way that made you afraid that you might be physically hurt?			
13. Did you often or very often experience being treated poorly because of your race, sexual orientation, place of birth, disability, or religious values?			

14. Did an adult or caretaker at least 5 years older than you often or very often spank you for misbehaving, not following household rules or for other reasons?			
15. Did you often or very often see or hear violence outside of the home in your neighbourhood or school neighbourhood?			
16. Did you often or very often feel that … Someone in your household spent more money than they could afford to on gambling? OR Ever gambled so often that bills were not able to be paid or household needs were strained?			
17. Were you ever placed into foster care or alternative care?			

Appendix D

Comprehensive Executive Function Inventory-Adult (CEFI-Adult; Naglieri & Goldstein, 2014)

Read each statement that follows the phrase, "*During the past four weeks, how often did you…*," then choose the option that tells you how often it happened. Read each question carefully, then choose how often it happened in the **past four weeks**.

During the past four weeks, how often did you…	Never	Rarely	Sometimes	Often	Very Often	Always
1. show self-control?						
2. have trouble finding things?						
3. maintain self-control?						
4. plan ahead?						
5. remember many things at one time?						
6. know when a task was completed?						
7. come up with different ways to solve problems?						
8. pay attention for a long time?						
9. have trouble solving problems?						
10. start tasks easily?						

11. get upset?					
12. get things done correctly?					
13. think of the consequences before acting?					
14. pay attention during a boring task?					
15. forget to do things?					
16. know what to do first?					
17. stay calm when handling small problems?					
18. like everyone you met?					
19. accept a different way of doing things?					
20. need others to tell you how to get started on things?					
21. work neatly?					
22. have trouble listening to instructions?					
23. keep all your commitments?					

24. remember instructions with many steps?						
25. keep track of time?						
26. prepare for upcoming events?						
27. find it hard to control your emotions?						
28. get things done on time?						
29. respond thoughtfully?						
30. fail to put plans into action?						
31. work well in a noisy environment?						
32. hold several ideas in memory?						
33. have trouble judging how long it takes to do something?						
34. react with the right level of emotion?						
35. start something without being asked?						
36. pay attention to details?						

37. have good thoughts about everyone?						
38. notice your mistakes?						
39. think through your decisions?						
40. manage frustration?						
41. change your behaviour as needed?						
42. need others to tell you to do things?						
43. manage time effectively?						
44. have trouble waiting your turn?						
45. concentrate while reading?						
46. get bothered by something?						
47. follow instructions well?						
48. learn from past mistakes?						
49. solve problems creatively?						
50. become upset in new situations?						

51. compromise when needed?						
52. appear motivated?						
53. organize your thoughts well?						
54. have trouble waiting to get what you wanted?						
55. notice how your actions affected others?						
56. make a mistake?						
57. remember important things?						
58. response calmly to delays?						
59. consider other points of view?						
60. get distracted?						
61. organize tasks well?						
62. have a bad day?						
63. ask for help when needed?						
64. resist change?						
65. think before acting?						

66. stay on topic when talking?						
67. keep goals in mind when making decisions?						
68. make careless errors?						
69. come up with a new way to reach a goal?						
70. get upset when plans were changed?						
71. start a task without help?						
72. appear disorganized?						
73. think before speaking?						
74. tell a fib?						
75. fix your mistake?						
76. forget where you put things?						
77. make good decisions?						
78. control emotions when under stress?						
79. react well to new demands?						

80. take initiative?						

Appendix E

Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004)

Please indicate how often the following 36 statements applied to you over the last 2 weeks by choosing the appropriate number from the scale below (1 – 5).

	Almost Never (0-10%)	Sometimes (11-35%)	About half of the time (36-65%)	Most of the time (66-90%)	Almost Always (91-100%)
1. I paid attention to how I feel.	1	2	3	4	5
2. I had no idea how I was feeling.	1	2	3	4	5
3. I had difficulty making sense out of my feelings.	1	2	3	4	5
4. I cared about what I was feeling.	1	2	3	4	5
5. I was confused about how I felt.	1	2	3	4	5
6. When I was upset, I acknowledged my emotions.	1	2	3	4	5
7. When I was upset, I became embarrassed for feeling that way.	1	2	3	4	5
8. When I was upset, I had difficulty getting work done.	1	2	3	4	5
9. When I was upset, I became out of control.	1	2	3	4	5
10. When I was upset, I believed that I would end up feeling very depressed.	1	2	3	4	5
11. When I was upset, I had difficulty focusing on other things.	1	2	3	4	5

12. When I was upset, I felt guilty for feeling that way.	1	2	3	4	5
13. When I was upset, I had difficulty concentrating.	1	2	3	4	5
14. When I was upset, I had difficulty controlling my behavior.	1	2	3	4	5
15. When I was upset, I believed that there was nothing I could have done to make myself feel better.	1	2	3	4	5
16. When I was upset, I became irritated with myself for feeling that way.	1	2	3	4	5
17. When I was upset, I lost control over my behaviours.	1	2	3	4	5
18. When I was upset, it took me a long time to feel better.	1	2	3	4	5

Appendix F

Barkley Functional Impairment Scale (BFIS; Barkley, 2011)

(Copyrighted Measure)

Appendix G

Weiss Functional Impairment Rating Scale – Self Report (WFRIS-S; Weiss et al., 2018)

Choose the number for the rating that best describes how your emotional or behavioural

problems have affected each item in the last month.

		Never or not at all	Sometimes or somewhat	Often or much	Very often or very much	N/A
A	**FAMILY**					
1	Having problems with family					
2	Having problems with spouse/partner					
3	Relying on others to do things for you					
4	Causing fighting in the family					
5	Makes it hard for the family to have fun together					
6	Problems taking care of your family					
7	Problems balancing your need against those of your family					
8	Problems losing control with family					
B	**WORK**					

1	Problems performing required duties					
2	Problems with getting your work done efficiently					
3	Problems with your supervisor					
4	Problems keeping a job					
5	Getting fired from work					
6	Problems working in a team					
7	Problems with your attendance					
8	Problems with being late					
9	Problems taking on new tasks					
10	Problems working to your potential					
11	Poor performance evaluations					
C	**SCHOOL**					
1	Problems taking notes					
2	Problems completing assignments					
3	Problems getting your work done efficiently					
4	Problems with teachers					

5	Problems with school administrators					
6	Problems meeting minimum requirements to stay in school					
7	Problems with attendance					
8	Problems being late					
9	Problems with working to your potential					
10	Problems with inconsistent grades					
D	**LIFE SKILLS**					
1	Excessive or inappropriate use of internet, video games or TV					
2	Problems keeping an acceptable appearance					
3	Problems getting ready to leave the house					
4	Problems getting to bed					
5	Problems with nutrition					
6	Problems with sex					
7	Problems with sleeping					
8	Getting hurt or injured					
9	Avoiding exercise					

10	Problems keeping regular appointments with doctor/dentist					
11	Problems keeping up with household chores					
12	Problems managing money					
E	**SELF-CONCEPT**					
1	Feeling bad about yourself					
2	Feeling frustrated with yourself					
3	Feeling discouraged					
4	Not feeling happy with your life					
5	Feeling incompetent					
F	**SOCIAL**					
1	Getting into arguments					
2	Trouble cooperating					
3	Trouble getting along with people					
4	Problems having fun with other people					
5	Problems participating in hobbies					
6	Problems making friends					

7	Problems keeping friends					
8	Saying inappropriate things					
9	Complaints from neighbours					
G	**RISK**					
1	Aggressive driving					
2	Doing other things while driving					
3	Road rage					
4	Breaking or damaging things					
5	Doing things that are illegal					
6	Being involved with the police					
7	Smoking cigarettes					
8	Smoking marijuana					
9	Drinking alcohol					
10	Taking "street" drugs					
11	Sex without protection (birth control, condom)					
12	Sexually inappropriate behaviour					
13	Being physically aggressive					

| 14 | Being verbally aggressive | | | | | |

Appendix H

End of Study Thanks

Thank you for participating in our study on adverse childhood experiences, executive function, and functional impairment.

In compensation for your time, you will be given **0.5 bonus points** towards an eligible psychology course.

If you provided your email at the beginning of the questionnaire, once the study is complete, you will receive the summarized results. The email you gave will not be connected to your questionnaire responses.

If you have any questions or concerns following your participation, please do not hesitate to let us know.

We can be contacted at:

coping.research@lakeheadu.ca (Research Team)

aislin.mushquash@lakeheadu.ca (Dr. Aislin Mushquash, Principal Investigator)

kboles@lakeheadu.ca (Kara Boles, Graduate Student Researcher)

If you are feeling concerned or upset following this questionnaire, here are some resources to help:

Lakehead University Student Counselling (807) 343-8361; Thunder Bay Counselling Centre Walk-In Counselling (807) 684-1880; Good2Talk 24 hour Student Helpline `1-866-925-5454; Student Helpline Crisis Response (807) 346-8282

Appendix I

Demographic Questionnaire

1. Your age: _____ years

2. Your biological sex: _____

3. Your gender_____

4. Your sexual orientation (choose one):
   a. Exclusively heterosexual
   b. Predominantly heterosexual, only incidentally homosexual
   c. Predominantly heterosexual, but more than incidentally homosexual
   d. Equally heterosexual and homosexual
   e. Predominantly homosexual, but more than incidentally heterosexual
   f. Predominantly homosexual, but only incidentally heterosexual
   g. Exclusively homosexual
   h. Prefer not to say

5. Your ethnicity: _____

6. Your biological mother's ethnicity: _____

7. Your biological father's ethnicity: _____

8. Your country of birth: _____

9. How long have you lived in Canada? _____ years

10. Your year of study in university (e.g. 1st): _____

11. Your major in university: _____
    (note: "undecided" or "undeclared" may be listed as a Major)

12. Prior to starting university, where did you live:
    a. Thunder Bay
    b. In Northwestern Ontario but outside Thunder Bay
    c. In Ontario but outside of Northwestern Ontario
    d. In Canada but outside of Ontario
    e. Outside of Canada

13. Where do you live during the school year?
    a. With family
    b. In my own apartment by myself
    c. In an apartment or house with housemates
    d. In residence

14. Check the option that best describes your current employment situation:
    a. I work full-time

       b. I work part-time
       c. I am unemployed
       d. Other (please specify): _____

15.   Check the option that best describes your current educational situation:
       a. I am a part-time student
       b. I am a full-time student
       c. Other (please specify): _____

16.   This question does not ask about your annual personal income. Instead, it asks about your annual family income. In other words, indicate how much money was earned last year in the household where you were raised. Check the option that best describes your annual family income in Canadian dollars (before taxes, deductions, etc.):
       a. $0.00 - $19 999
       b. $20 000 - $39 999
       c. $40 000 - $59 999
       d. $60 000 - $79 999
       e. $80 000 - $99 999
       f. $100 000 - $119 999
       g. $120 000 - $139 999
       h. $140 000 - $159 999
       i. $160 000 - $179 999
       j. $180 000 - $199 999
       k. Greater than $200 000

17.   How many people are supported by your total annual family income (listed in question 16)? _____

18.   Your current romantic relationship status (check all that apply):
       a. Single
       b. Dating one person
       c. Dating multiple people
       d. Separated
       e. Married
       f. Divorced
       g. Cohabiting (i.e., living with your partner)
       h. Widowed
       i. Other (please specify): _____

19.   Are you currently receiving treatment from a mental health professional (e.g., social worker, psychologist, counsellor)?
       a. Yes
             i. If yes, for how long: _____
       b. No

20.   How has the COVID-19 pandemic impacted your employment situation?
a.   I remained employed but am working from home
b.   My place of employment was temporarily closed
c.   I have been laid off or had work hours reduced

d.   I had quit my job
e.   My employment situation has not been impacted
f.   Other: _____

21.   Were you unable to travel home when you would have liked due to travel bans and flight restrictions related to the COVID-19 pandemic?
a.   Yes
b.   No
c.   Does not apply

22.   Please describe your social distancing/self-isolation practices during the COVID-19 pandemic:

23.   Have you become ill during the COVID-19 pandemic?
a.   Yes, and tested positive for COVID-19
b.   Yes, and tested negative for COVID-19
c.   Yes, but was not tested for COVID-19
d.   No

24.   Did someone you know (e.g., family or close friend) become ill during the COVID-19 pandemic?
a.   Yes, and tested positive for COVID-19
b.   Yes, and tested negative for COVID-19
c.   Yes, but was not tested for COVID-19
d.   No

25.   What has been your general experience during the COVID-19 pandemic? Feel free to provide as much information as you would like.

26.   Please indicate the extent to which each area of your life has been impacted by the COVID-19 pandemic:

	Positively affected			Not affected	Negatively affected		
	Very	Moderately	Slightly		Slightly	Moderately	Very
1. Physical health	1	2	3	4	5	6	7
2. Fitness/physical activity	1	2	3	4	5	6	7
3. Emotional/mental health	1	2	3	4	5	6	7
4. Academics/School work	1	2	3	4	5	6	7
5. Employment	1	2	3	4	5	6	7
6. Finances	1	2	3	4	5	6	7
7. Home life	1	2	3	4	5	6	7
8. Eating/diet	1	2	3	4	5	6	7
9. Housing	1	2	3	4	5	6	7
10. Safety	1	2	3	4	5	6	7
11. Romantic relationships	1	2	3	4	5	6	7

12. Friendships	1	2	3	4	5	6	7
13. Travel	1	2	3	4	5	6	7
14. Hobbies/leisure activities	1	2	3	4	5	6	7
15. Goals/future plans	1	2	3	4	5	6	7
16. Health and/or safety of family/loved one's	1	2	3	4	5	6	7

27.	Please indicate the extent to which you have been worried/distressed/concerned about each area below in response to the COVID-19 pandemic:

	Not at all	Slightly	Moderately	Very	Extremely
1. Physical health	1	2	3	4	5
2. Fitness/physical activity	1	2	3	4	5
3. Emotional/mental health	1	2	3	4	5
4. Academics/School work	1	2	3	4	5
5. Employment	1	2	3	4	5
6. Finances	1	2	3	4	5
7. Home life	1	2	3	4	5
8. Eating/diet	1	2	3	4	5
9. Housing	1	2	3	4	5
10. Safety	1	2	3	4	5
11. Romantic relationships	1	2	3	4	5
12. Friendships	1	2	3	4	5
13. Travel	1	2	3	4	5
14. Hobbies/leisure activities	1	2	3	4	5
15. Goals/future plans	1	2	3	4	5
16. Health and/or safety of family/loved one's	1	2	3	4	5
17. Society/others in general	1	2	3	4	5

Appendix J

Percentage of Cases: Endorsed ACE Items (N = 162)

ACE Item	Never	At Least Once	Many Times
1. ACE1	43.2%	27.2%	29.6%
2. ACE2	63.6%	23.5%	13%
3. ACE3	84.6%	9.9%	5.6%
4. ACE4	55.6%	25.9%	18.5%
5. ACE5	88.3%	5.6%	6.2%
6. ACE6	70.4%	18.5%	11.1%
7. ACE7	87.7%	9.3%	3.1%
8. ACE8	91.4%	4.3%	4.3%
9. ACE9	72.8%	12.3%	14.8%
10. ACE10	55.6%	23.5%	21%
11. ACE11	94.4%	3.1%	2.5%
12. ACE12	43.8%	34%	22.2%
13. ACE13	71.6%	19.1%	9.3%
14. ACE14	56.8%	24.1%	19.1%
15. ACE15	69.1%	19.8%	11.1%
16. ACE16	90.7%	4.3%	4.9%
17. ACE17	95.1%	3.7%	1.2%

Percentage of Cases: Cumulative ACE Scores (N = 162)

	Cumulative Percent	Endorsed At Least Once
No ACEs	10.5%	10.5%
One ACE	22.2%	11.7%
Two ACEs	33.3%	11.1%
Three ACEs	45.1%	11.7%
Four ACEs	54.9%	9.9%
Five ACEs	64.2%	9.3%
Six ACEs	71.0%	6.8%
Seven ACEs	77.8%	6.8%
Eight ACEs	85.8%	8.0%
Nine ACEs	90.1%	4.3%
Ten ACEs	92.6%	2.5%
Eleven ACEs	93.2%	0.6%
Twelve ACEs	96.3%	3.1%
Thirteen ACEs	99.4%	3.1%
Fourteen ACEs	---	0%
Fifteen ACEs	---	0%
Sixteen ACEs	---	0%
Seventeen ACEs	100%	0.6%

Appendix K

Independent Samples Tests: Comparing Self-Reported ACEs Between Female and Male participants

Sex	n	M	SD	p
Female	154	4.58	3.61	0.82
Male	7	6.43	3.60	

Note. ACEs = Adverse Childhood Experiences; n = Number of Participants; *M* = Mean

Score; *SD* = Standard Deviation; *p* = Significance.

Independent Samples Tests: Comparing Self-Reported CEFI Scores Between Female and Male participants

Sex	n	M	SD	p
Female	154	213.40	46.32	0.97
Male	7	213.71	54.92	

Note. CEFI = Comprehensive Executive Function Inventory; n = Number of Participants; *M*

= Mean Score; *SD* = Standard Deviation; *p* = Significance.

Independent Samples Tests: Comparing Self-Reported DERS Scores Between Female and Male participants

Sex	n	M	SD	p
Female	154	48.67	14.49	0.44
Male	7	47.00	12.78	

Note. DERS = Difficulties in Emotion Regulation Scale; n = Number of Participants; *M* =

Mean Score; *SD* = Standard Deviation; *p* = Significance.

Independent Samples Tests: Comparing WFIRS Scores Between Female and Male participants

Sex	n	M	SD	p
Female	154	43.85	24.05	0.08
Male	7	64.00	48.71	

Note. WFIRS = WEISS Functional Impairment Rating Scale; n = Number of Participants; *M* = Mean Score; *SD* = Standard Deviation; *p* = Significance.

Independent Samples Tests: Comparing BFIS Scores Between Female and Male participants

Sex	n	M	SD	p
Female	154	21.93	1.72	0.47
Male	7	27.53	10.40	

Note. BFIS = Barkley Functional Impairment Scale; n = Number of Participants; *M* = Mean Score; *SD* = Standard Deviation; *p* = Significance.

Appendix L

Number of Participants Endorsing Adverse Childhood Experiences (N = 162)

	n	Cumulative Percent	Endorsed At Least Once
No ACEs	17	10.5%	---
One ACE	19	22.2%	11.7%
Two ACEs	18	33.3%	11.1%
Three ACEs	19	45.1%	11.7%
Four ACEs	16	54.9%	9.9%
Five ACEs	15	64.2%	9.3%
Six ACEs	11	71.0%	6.8%
Seven ACEs	11	77.8%	6.8%
Eight ACEs	13	85.8%	8.0%
Nine ACEs	7	90.1%	4.3%
Ten ACEs	4	92.6%	2.5%
Eleven ACEs	1	93.2%	0.6%
Twelve ACEs	5	96.3%	3.1%
Thirteen ACEs	5	99.4%	3.1%
Fourteen ACEs	0	---	0%
Fifteen ACEs	0	---	0%
Sixteen ACEs	0	---	0%

Seventeen ACEs	1	100%	0.6%