EXPLORING THE EFFECTS OF EARLY CHILDHOOD ADVERSITY AND SUSTAINED ATTENTION ON READING OUTCOMES

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by
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ABSTRACT

Background: While researchers have identified childhood adversity as a risk factor for many poor reading outcomes and compromised attentional abilities, the mechanism that describe how childhood adversity affects the relationship between reading and attention remains unclear.

Objective: To examine the role of sustained attention in predicting early (five years old) and later (nine years old) reading outcomes within a context of childhood adversity.

Method: Three waves of data (ages 3, 5, and 9) from the Fragile Families and Child Wellbeing Study (FFCWS) was resourced for these analyses. Using a series of hierarchical regressions, three reading outcomes were examined among a longitudinal subsample of young children: 1. reading comprehension at age nine (i.e., Woodcock-Johnson Passage Comprehension), and 2. reading achievement at age five and 3. reading achievement at age nine, as measured using two constructed scales based on teachers’ evaluations of student performance. In the first block, child- and parent-level factors were inserted. In the second block, sustained attention was entered. In the final block total ACE scores and behavior scores were added.

Results: The results revealed: 1) sustained attention was a significant predictor of reading comprehension at age nine and reading achievement at age five and age nine above and over the effects of the any child- or parent-level factor, 2) male students performed worse on all reading outcomes than female students, 3) parent-level factors such as mother’s education, race/ethnicity, and income predicted reading comprehension scores 4) childhood adversity was not a unique predictor of any early or later reading outcomes.

Conclusion: In this study, sustained attention was identified as a unique component of all reading outcomes. This result emphasizes the need to implement practices that foster attentional development in schools and trauma-informed practices to improve reading outcomes.

Keywords: Sustained Attention, Childhood Adversity, Achievement, Reading Comprehension
# TABLE OF CONTENTS

LIST OF FIGURES .................................................................................................................... vi

LIST OF TABLES ........................................................................................................................ vii

ACKNOWLEDGEMENTS ............................................................................................................. viii

Chapter 1 Introduction .............................................................................................................. 1

Theoretical Framework: Reading as a Multicomponent Process ............................................. 2

Attention and Reading in the Context of Childhood Adversity ............................................. 5

Current study ............................................................................................................................. 8

Chapter 2 Methods .................................................................................................................... 10

Participants ............................................................................................................................... 10

Study Procedures ....................................................................................................................... 11

Dependent Variables ............................................................................................................... 11

    Reading Achievement at Ages Five and Nine ................................................................. 12

    Reading Comprehension at Age Nine ............................................................................. 13

Predictors ................................................................................................................................. 14

    Adverse Childhood Experiences (ACE) Score ............................................................. 14

    Child Behavior Checklist (CBCL) ............................................................................... 19

    Sustained Attention ........................................................................................................ 19

    Covariates ...................................................................................................................... 20

Analytical strategy ................................................................................................................... 21

Chapter 3 Results ..................................................................................................................... 23

Demographic Characteristics and Analyses ........................................................................... 23

Prevalence of ACE Exposure ................................................................................................. 25

ACE Exposure and Sustained Attention as Predictors of Reading Outcomes ...................... 27

    Reading Achievement at Age Five (Model 1) ............................................................. 27

    Reading Achievement at Age Nine (Model 2) ............................................................ 28

    Reading Comprehension at Age Nine (Model 3) ......................................................... 30

Chapter 4 Discussion ............................................................................................................... 33

The Unique Effect of Sustained Attention on Reading Outcomes ........................................ 33

Capturing Early Childhood Adversity: Multifinality and ACEs ........................................... 38

Parent-Level and Child-Level Influences on Reading Outcomes ....................................... 40

Implications for Practice ........................................................................................................ 41

Limitations and Future Directions ......................................................................................... 42

Conclusion ............................................................................................................................... 44

References ................................................................................................................................ 45
Appendix: Relationships with ACE Score: Reading Outcome and Sustained Attention....... 61

Appendix 1-1: Reading Comprehension and ACE Score.................................................. 61
Appendix 1-2: Reading Achievement at Age Five and ACE Score................................. 61
Appendix 1-3: Reading Achievement at Age Nine and ACE Score............................... 62
Appendix 1-4: Sustained Attention and ACE Score....................................................... 62
LIST OF FIGURES

Figure 1-1: Conceptual Model of Hierarchical Regression............................................. 22
**LIST OF TABLES**

Table 2-1: Adversity Type and Prevalence of Subsample. ........................................... 18

Table 3-1: Child-Level and Parent-Level Demographic Characteristics .................................. 24

Table 3-2: Correlations Between Main Variables ..................................................................... 27

Table 3-3: Regressing Reading Achievement on Childhood Adversity and Sustained Attention .................................................................................................................. 29

Table 3-4: Regressing Reading Comprehension on Childhood Adversity and Sustained Attention .................................................................................................................. 31
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Chapter 1

Introduction

In recent decades, exposure to childhood adversity (CA) has been consistently identified as a significant risk factor for difficulties with reading achievement as early as elementary school (Fantuzzo et al., 2011; Maclean et al., 2016; Rouse & Fantuzzo, 2009). Broadly, research has shown that introducing volatility to a child’s environment by way of adversity at the child (e.g., maltreatment, social difficulties), parent (e.g., domestic violence, substance abuse) and community (i.e., exposure to community violence) levels can lead to deviations from normative developmental and academic trajectories (Maclean et al., 2016; Maclean et al., 2020; Rouse & Fantuzzo, 2009; Slade & Wissow, 2007; Zeanah et al., 2018). Of particular importance is the effect CA can have on self-regulation (SR) — the ability to recruit control processes, such as sustained attention and effortful control, for goal-oriented action — on account of its role in managing dynamic cognitive, behavioral, and emotional fluctuations necessary for learning and proficient reading comprehension (i.e., a learned skill that coordinates cognitive, regulatory, linguistic, and text-specific processes) (Blair & Raver, 2015; Connor, 2016; Kweldju, 2015; Panlilio et al., 2019). Much of the literature has established that exposure to adverse environments in early childhood can negatively affect a child’s SR (Lavi et al., 2019; Lipscomb et al., 2021; Schatz et al., 2008), but as a broad and complex process, it may be beneficial to further characterize how CA disturbs specific sub-components of SR to understand the underlying mechanisms of how learning and development are impacted. Specifically, attention is one such sub-component of importance given its demonstrated vulnerability to CA (e.g., Pollak et al., 2005; Romens & Pollak, 2012). Defined as a set of mostly volitional processes that allow individuals to stay alert to incoming information, orient their focus to relevant stimuli, and to
detect and suppress attention to irrelevant information over time (Rothbart & Bates, 2007), attention is a key element of multiple processes crucial to learning and may be an important target for further research and intervention.

The potential ramifications of deviations across the attentional network (i.e., a set of cognitive, behavioral, and neural mechanisms that guide an individual’s awareness and orients their thoughts and feelings to context-specific situations) may be significant given evidence that attentional aberrations can lead to the development of psychopathologies (e.g., ADHD) and maladaptive behaviors (MacCoon et al., 2004; Posner & Rothbart, 2007). Such developmental consequences can then have subsequent negative impacts on students’ reading outcomes that includes reading achievement and reading comprehension (Commodari, 2012; Facoetti et al., 2009; LRRC, 2018). While the relationship between reading outcomes (i.e., reading achievement and reading comprehension) and SR are well documented, few studies have accounted for the complexity CA offers this relationship. Therefore, within a developmental framework of reading comprehension, the current study examined how CA and attentional processes play a role in predicting early and later reading outcomes in young children. This study on attentional processes within a SR framework has important implications for informing and reconceptualizing trauma-informed practices that aim to improve the academic achievement of children exposed to adversity.

Theoretical Framework: Reading as a Multicomponent Process

Reading is a highly complex ability that has only been a part of the human repertoire for approximately 5,000 years (Clayton, 2019). Simple word-reading, for instance, requires the integration of multiple parallel processes, such as the passive and active cognitive processing of visual input (i.e., orthographic structures, letter representation, textual features), motor tasks, and
activation of prior language knowledge (i.e., phonological lexicon, grammatical and syntactical properties) (Kim, 2020; McNorgan, 2021; Perfetti & Stafura, 2014). In addition to these processes, modern reading frameworks further propose the accounting of readers’ online regulatory functions and socio-emotional skills because reading can be a cognitively demanding activity that is dependent upon several factors that include individual differences, text features, and the purpose and goals for reading (Castles et al., 2018; Kim, 2020; Levinson et al., 2018; Perfetti & Stafura, 2014). These are especially important to consider once students begin to comprehend and learn from what they read, a much more complex process than simple word reading.

When reading to comprehend, other considerations must be made because of the increased demand for higher levels of cognitive and linguistic engagement as meaning is constructed from text. For example, in addition to activating propositional structures learned during the simple word reading stage, comprehension utilizes meaning activation, inference generating, and coherence monitoring processes (Castles et al., 2018). During reading comprehension, meaning is derived from a combined sequence of words and sentences evaluated against a reader’s prior knowledge (Kweldju, 2015; O’Brien & Cook, 2016). In turn, a reader’s word-reading skills and background knowledge (e.g., content and vocabulary) have a direct influence on how they build meaning from the text and monitor their coherence, which refers to a reader’s ability to validate incoming information for accuracy and congruency (O’Brien & Cook, 2016; van Moort et al., 2020). Therefore, proficient reading comprehension requires high-quality prior knowledge across a number of domains (e.g., linguistics, content), online processing of information, and skilled use of cognitive resources (Castles et al., 2018) reliant on regulatory processes like sustained attention.

To the most proficient readers, navigating the integration of these processes may seem to occur automatically; however, these activities are reliant on key attentional processes to
coordinate the simultaneous initiation and inhibition of these complex actions (MacCoon et al., 2004; MacDonald et al., 2021). Due to the multifaceted and interconnected nature of reading, attentional deficits may explain why some readers struggle academically. Since both reading skills and attention are developed through informal and formal instruction at home and at school, it is important to consider the developmental and environmental contexts in which the instruction occurs, particularly how highly stressful experiences and adverse environments affect children’s reading development through attention.

The lattice model of reading comprehension, as conceptualized by Connor (2016), provides a framework that incorporates several key reading components placed within environmental and developmental contexts. Specifically, the model integrates the social cognitive and regulatory processes, text and code-based processes, and linguistic processes outlined earlier. In the model, Connor (2016) acknowledges that reading comprehension is a transactional process that can be influenced by a child’s external environment, such as the type and quality of instruction they receive in school, and home and community influences that support a child’s learning over time. These processes and environmental factors are understood to be reciprocally interacting with one another to support a child’s ability to read with understanding. Because of the inclusion of environmental influences on the development of reading skills, the lattice model provides a mechanism by which to understand how multiple sources of vulnerability could negatively impact a child’s reading ability.

Although some of the variability seen across children’s reading outcomes may be attributed to individual differences, Connor’s lattice model (2016) suggests that exposure to volatile environments could explain some of the deficits seen in struggling readers. Typically, the family environment plays an important role in developing children’s emergent literacy skills, such as the promotion of language acquisition and other linguistic properties, while formal education harnesses these skills to facilitate reading development and later reading
comprehension (McNorgan, 2021). Failure to provide a rich environment that promotes reading in early childhood can be to the child’s detriment. In the context of maltreatment, prior research has shown that exposure to abuse or neglect during early childhood creates susceptibilities to developing later reading deficits and poor reading outcomes in middle school and high school (Fantuzzo et al., 2011; McClelland & Cameron, 2011; Slade & Wissow, 2007). Deficits in one skill due to isolated adverse experiences or prolonged exposure to adverse environments may have profound negative effects on reading development and achievement.

Therefore, in line with the lattice model, CA can be conceptualized as a developmental and environmental experience with the potential to affect children’s social cognitive, regulatory, or linguistic-based processes with cascading consequences on reading. Specific to self-regulation, CA could lead to the dysfunction of a reader’s attentional processing, which plays a critical role in the acquisition and development of emergent literacy skills (i.e., code-related, and oral language) critical to later reading outcomes (Geoffrey et al., 2016; Widom, 2014). As a principal construct to reading that first develops at birth and continues across the lifespan, influential factors to the early developmental trajectory of attention warrant further investigation (Lopez et al., 2005; McKay et al., 2010; Sarid & Breznitz, 1997).

Attention and Reading in the Context of Childhood Adversity

Among several learning theories (e.g., information processing theory, self-regulated learning), attention has been described as a function that precedes all cognitive and behavioral learning (Commodari, 2012; Munakata, 2006; Zimmerman, 2008). As a sub-component of self-regulation, attention is important in promoting the development of children’s reading abilities (Conners, 2009) through the directed and sustained focus towards important word features and the simultaneous disregard of superfluous information (van der Sande et al., 2013). Therefore,
deficits to specific attentional sub-processes may lead to increased distractibility that impairs a reader’s development (MacDonald et al., 2021).

Indeed, self-regulation and attentional focusing are explicitly identified as important components of learning (Zimmerman, 2008) that have implications for reading. Attentional focusing, otherwise recognized as sustained attention, is a limited internal psychological resource used to maintain vigilance on a stimulus over a given time (Betts et al., 2006; Colombo, 2001). From infancy to adulthood, sustained attention enables concentration and engagement with surrounding stimuli to facilitate learning. Some researchers have posited that the developmental trend of sustained attention follows changes in children’s brains related to maturation and experience, indicating the growth of children’s attentional capacities as they age (McDermott et al., 2012).

However, there is growing evidence of atypical development across different areas of the brain based on adverse events that imprint and change its structure and connectivity that may have direct consequences on a child’s developing cognitive processes. Areas such as the anterior cingulate cortex, dorsal lateral prefrontal cortex, and hippocampus have all been implicated as key brain regions in the attentional brain network that facilitate the top-down processing of information (Horowitz-Kraus et al., 2013; Moss et al., 2011). Notably, these brain regions, among others, have been observed to have altered brain volumes and functional connectivity following exposure to adversity-related stress (Teicher et al., 2019; Baker et al., 2013; McLaughlin et al., 2019). Because of this vulnerability, it is possible these brain regions are important to children exposed to adverse conditions as they learn to read.

As a limited cognitive resource, sustained attention is thought to be sensitive to a task’s duration, complexity, and rate of information (Betts et al., 2006; Colombo, 2001). When task demands and text features require a great amount of attentional resources, such as when reading to comprehend, performance can wane over time and can lead to mood shifts during or directly
following a task (Hancock & Warm, 2003). Given that sustained attention in early childhood is shown to impact academic performance more broadly (Betts et al., 2006; Laurie-Rose et al., 2006), less is known about how early sustained attention abilities relate to later sustained attention and reading more specifically. Studies using data from the Fragile Families & Child Well-Being Study (FFCWS), a nationally representative longitudinal study of predominantly low-income, non-marital births in the United States, observed that sustained attention at age five was predictive of later reading achievement at nine years old (Razza et al. 2012; Shelleby & Ogg, 2019). Razza et al. (2010) further identified that a component of sustained attention, focused attention, was a significant mediator that partially explained the relationship between maternal lack of hostility and receptive vocabulary. These results provide support for looking at the environmental context in which children are actively developing to explain its impact on attentional processes and their consequent impact on reading outcomes.

Furthermore, research into the association between CA and attention have revealed patterns that indicate children with adverse experiences exhibit attentional biases. In a sample of physically abused children, for instance, Pollak and Tolley-Schell (2003) exposed children to threatening stimuli during an attentional task and found that maltreated children preferentially gazed at the threatening stimuli more often and for longer than non-maltreated children. Other studies have shown similar patterns in attentional bias towards more threatening stimuli due to experiences of early adversity (Pollak et al., 2005; Romens & Pollak, 2012; Shackman et al., 2007). Additionally, it has been shown that such attentional problems are linked to an increased likelihood of developing externalizing and internalizing behaviors among this population (Garrido et al., 2011; Weinberg et al., 2011; Zielinski & Bradshaw, 2006).

Taken together, this body of research suggests that deviations in sustained attention affect reading outcomes through two possible trajectories following exposure to adverse experiences: 1. Limited sustained attention - if children’s ability to sustain their attention to a stimulus is
deficient, it could be difficult for them to meaningfully engage in a goal-oriented manner in an academic setting for prolonged periods, or 2. Biased sustained attention - if the presence of an attentional bias holds across different types of adversities (e.g., parent death, parent mental illness), then it is reasonable to suggest that some students may struggle to disengage from non-relevant cues to stimuli unassociated with academic tasks. In contrast with the first described trajectory, the strength of a child’s sustained attention is intact in the second; it is simply biased to non-academic tasks. Regardless of trajectory, however, a child’s attention is not held, nor oriented towards academic outcomes.

Therefore, as a salient elicitor of stress, CA exposure may threaten or constrain goal-oriented activity (Hancock & Warm, 2003; Pollak & Tolley-Schell, 2003). Although children have innate adaptive capabilities to manage low to moderate levels of stress, an accumulation of CA events can create highly stressful conditions (e.g., increased exposure time, chronicity, severity of stressor) that interfere with top-down regulatory processes, like sustained attention, necessary for supporting a learning state (Garrido et al., 2011; Geoffrey et al., 2015). Therefore, to better understand how children’s reading development proceeds in the context of CA, it is necessary to understand the complex relationship between sustained attention and different reading outcomes. As it stands, current research does not directly address the impact of CA on sustained attention and reading outcomes using standardized and teacher-based assessments.

**Current Study**

Although previous analyses have used the same dataset as this study (i.e., FFCWS) to examine questions about the family environment and the role of sustained attention as a mediator for academic markers of achievement, their results were not situated within a context of adversity nor used teacher-based reading outcomes (Razza et al., 2010; Razza et al., 2012).
knowledge, no study has yet to explore the relationships between CA, sustained attention, and reading outcomes in the same analysis using a longitudinal childhood sample. To address the gaps in the literature outlined above, the current study aimed to examine if sustained attention has unique effects on markers of reading achievement and comprehension in a subsample of children that have experienced adversity at the child (i.e., self), parent, and community-levels, and to replicate findings from previous studies regarding adversity’s negative effects on children’s reading achievement. Two main research questions were examined in this analysis: 1) To what extent does sustained attention uniquely effect three markers of reading achievement and reading comprehension in a subsample of children that have experienced adversity? 2) Does CA predict low early reading achievement and later comprehension? In line with prior research and the lattice model of reading comprehension (Connor, 2016), the unique effect of sustained attention was hypothesized to predict all three reading outcomes.
Chapter 2

Methods

Participants

Data for this study was drawn from the Fragile Families and Child Wellbeing Study (FFCWS), a nationally representative longitudinal study of nearly 5,000 children and their families. A stratified, random sample of 20 large (> 200,000 people) U.S. cities were used to collect data from predominantly low-income, unmarried parents and their children born between 1998 and 2000 soon after birth while still in the hospital (Reichman et al., 2001). They sampled from hospitals in: Austin, Oakland, Baltimore, Detroit, Newark, Philadelphia, Richmond, Corpus Cristi, Indianapolis, Milwaukee, New York City, San Jose, Nashville, Boston, Chicago, Jacksonville, Norfolk, Toledo, San Antonio, and Pittsburgh. Since this study’s inception in 1998, six follow-up interviews involving parents, children, other primary care givers, and teachers (only at ages five and nine) were collected when children were approximately 1, 3, 5, 9, 15, and 22 years old (Reichman et al., 2001). Access to the public-use version of this dataset was issued by Princeton University’s Office of Population Research. For this analysis, the datasets from the age three (2001-2003), five (2003-2006), and nine (2007-2010) at-home interviews and surveys were used.

Inclusion criteria for the current study sample include the following: 1) data must be available for subjects at age three, five, and nine on all independent, dependent, and control variables, and 2) children must have been reported to have attended preschool, school, or day care center at ages five and nine. The missingness patterns for items and responses on variables used in the analytical models were assessed using Little’s (1988) Missing Completely At Random
(MCAR) test using the total sample size, \( N = 4898 \). It was determined that the data for the analyzed variables (\( n = 14 \)) were not missing completely at random, \( \chi^2 (343) = 900.53, p < .001 \). Per the exclusionary criteria, for this analysis a sub-sample of complete cases (\( n = 257 \)) were used to investigate the effects of CA and sustained attention on measures of reading outcomes.

**Study Procedures**

Across the three timepoints of interest, parent interviews and most surveys were collected by telephone using computer-assisting technology and trained field interviewers (CRCW, 2018; CRCW, 2019a; CRCW, 2019b). Interviews and surveys that were not collected by phone were otherwise collected during in-home visits. Surveys and interviews included questions related to families’ demographic information, child well-being, parent education and employment, parent-child relationships, and other family characteristics. Beginning at age three, in-home visits were conducted by trained administrators who completed assessments (e.g., measures of cognitive ability) with children, and collected other samples and observations relevant to their study (CRCW, 2018, p. 15). At ages five and nine, researchers collected teacher surveys that asked questions regarding children’s behavior and social skills specific to the child to serve as indicators of student achievement (CRCW, 2019a, p. 14; CRCW, 2019b, p. 16).

**Dependent Variables**

Reading outcomes were defined as a child’s ability to read with comprehension and as a child’s reading achievement based on their teacher’s evaluation. The Woodcock-Johnson Passage Comprehension test (Schrank et al., 2001) was used in this study as a measure of reading comprehension at age nine. To assess reading achievement, teacher surveys collected at age five
and nine were used to create two separate scales representing children’s progress on measures of reading proficiency and literacy (“Public data documentation,” 2022). Both teacher surveys were completed at the end of the school year when the target child was in their classroom, indicating that students were exposed to some reading instruction (CRCW, 2019a; CRCW, 2019b). Details on the creation of these relevant dependent variables are outlined below. In total, three outcomes were evaluated: reading achievement at age five (RA5), reading achievement at age nine (RA9), and reading comprehension at age nine (RC).

**Reading Achievement at Ages Five and Nine**

Utilizing the age five kindergarten survey, a four-item reading achievement scale was constructed using responses that assessed four emerging literacy indicators: 1) understanding and interpreting a story or other text read to them, 2) easily and quickly naming all upper- and lowercase letters of the alphabet, 3) able to read simple books independently, and 4) able to demonstrate an understanding of some of the conventions of print (CRCW, 2019a). All four skills relate to either text-based processes and code-based processes, such as letter and word-level decoding, (Kim, 2020; Perfetti & Stafura, 2014). Teachers were able to respond to these items on a six-point scale that ranged from “not yet” (= 1) to “proficient” (= 5), with an option to indicate if an item “does not apply” (= 6). Sum scores were created using responses to these items, where a large value indicates a greater degree of reading achievement. The constructed scale had high reliability ($\alpha = .89$).

Using the age nine teacher survey, another reading achievement scale was constructed using select items to approximate students’ reading achievement following several years of formal reading instruction (CRCW, 2019b). Working within the boundaries of the teacher survey, the items used for this scale do not cleanly assess reading achievement or specific reading
indicators. Instead, items offer general assessments of students’ ability to 1) produce correct schoolwork in a language arts classroom, 2) spell, 3) read compared to peers and standards ("reading up to par"), and 4) demonstrate overall language and literacy skills. The first three skills mentioned were measured using a four-point scale (0 = never, 3 = very often). On the other hand, overall language and literacy skills when compared to other peers was assessed on a five-point scale (1 = far below average, 5 = far above average). A sum score was calculated for this analysis, where a large score indicates higher reading achievement. This scale had high reliability ($\alpha = .90$) among the sub-sample.

**Reading Comprehension at Age Nine**

As a measure of standardized reading comprehension, the Woodcock-Johnson Passage Comprehension subtest (WJPC; Schrank et al., 2001) was administered when children were approximately nine years old. This assessment uses a series of increasingly challenging items that reportedly assess a child’s ability to understand written text. The WJPC has three sets of stimuli that begin as a matching exercise where students match a picture symbol to another picture, then it has children match short phrases to pictorial stimuli, and finally has children provide a missing word to sentences and paragraphs (CRCW, 2019a, p. 46; Schrank et al., 2001). Standard sum scores on this assessment were used as an outcome variable for the regression analysis.
Predictors

Adverse Childhood Experiences (ACE) Score

A total adverse childhood experience (ACE) score was calculated based on the revised ACE measure outlined by Finkelhor et al. (2013), as well as the procedures outlined by Anyigbo et al. (2022), who specifically used the FFCWS dataset to calculate an ACE score for their sample. Using these papers, ten indicators of CA from the year three, wave three data were used: exposure to community violence, social difficulties (i.e., no good friends), parents always arguing, parent death, parent mental illness (i.e., depression), parent incarceration, and maltreatment based on experiences with physical abuse, emotional abuse, and neglect. All items were dichotomized and then summed, yielding a possible max ACE score of ten, indicating high levels of adversity. Among the sub-sample, ACE scores were normally distributed, with a single-subject max ACE score of seven and minimum score of zero, see Table 2-1.

Exposure to Community Violence

Based on Finkelhor et al.’s (2013) definition, this indicator is based on a child’s experience with community violence, which was identified to predict trauma symptoms in children ($\beta = 0.09, p < .001$); however, the Fragile Families datasets do not have items that assess a child’s specific exposure. For this analysis, the primary caregiver’s exposure to community violence was used as a proxy. The items included indicators of physical assault with or without a weapon, being shot at with a gun, or seeing someone be murdered. If parents reported they have seen or experienced either indicator of community violence at least once, a point was counted towards the child’s ACE score.
**Social Difficulties: No Good Friends**

As a proxy for not having any good friends, per Finkelhor et al. (2013), the Child Behavior Checklist (CBCL) subscale for social problems was used. The scale has 8-items that assess a child’s social skills, including items about a child getting teased, not being liked by other kids, and not getting along with other children. In their study, Finkelhor et al. (2013) found that not having any good friends was predictive of trauma symptoms for children ($\beta = 0.07, p < .001$). The scale had acceptable reliability ($\alpha = .40$). Items were recoded and then summed to represent more social difficulties as the number increases. This summed value was then dichotomized so a value of one would indicate evidence of having some social difficulty. If the score on the social difficulties scale was one, an additional point was added to a child’s total ACE score.

**Parents Always Arguing**

According to Finkelhor et al. (2013), parents always arguing was also identified as a viable ACE indicator of trauma symptoms as well ($\beta = 0.15, p < .001$). 16-items from the mother surveys that addressed the relationship quality between partners was used to construct this variable. Relationship topics assessed with these items include parents’ lack of communication, relationship power dynamics, and prior intimate partner violence. Items were recoded and summed such that a larger score would indicate having poorer relationship quality. The summed score was then dichotomized, where any number greater than one was recoded as one and added to a child’s ACE score.
**Parent Death**

Each parent was asked independently about their relationship with the child’s other parent. Among the response items, parents were able to indicate whether the other had passed away. Per Anyigbo et al. (2022), a point was added to the child’s ACE score if either parent indicated the other parent had passed.

**Parent Mental Illness – Depression**

Household mental illness has also been previously identified to predict trauma symptoms \( \beta = 0.04, p < .05 \); Finkelhor et al., 2013). In the Fragile Families data, the Composite International Diagnostic Interview-Short Form was used to assess parents’ mental health, which specifically assessed if parents had had major depressive episodes in the past year. Like Anyigbo et al. (2022), a point was added to the total ACE score if there was evidence of having experienced a major depressive episode.

**Parent Incarceration**

In their surveys, parents were asked if they or their partner had spent any time in jail in the past two years. If they confirmed that they or their partner had been to jail in the past two years, a point was counted towards the total ACE score.

**Parent Substance Abuse**

Referencing Anyigbo et al. (2022), parent substance abuse was assessed using a single item on the parent survey where parents were asked if drinking or a hangover interfered with their
work, school, job, or home in the past year. If either parent responded yes to the item, a point was added to the child’s total ACE score.

**Maltreatment**

As an indicator of childhood maltreatment, the Parent-Child Conflict Tactics Scale (CTSPC) as measured at age three was utilized for this analysis. The original CTSPC was modified to fit the research purposes of the FFCWS, resulting in a 19-item scale posed to parents during interviews (CRCW, 2018, p. 84). The scale is divided into four subscales that assess adverse parent-child interactions, including nonviolent discipline, psychological aggression, physical assault, and neglect (Straus et al., 1998). For each item, subjects were asked to indicate how many times in the past year an event has occurred using an 8-point response scale. Response options were described as an event having occurred: a) once, b) twice, c) 3-5 times, d) 6-10 times, e) 11-20 times, f) more than 20 times, g) not in the past year, but it happened before, or h) this has never happened. Though each subscale was measured concurrently and with the same response scheme, the nonviolent discipline subscale was not used for this analysis. This is because the nonviolent subscale contains questions that reflect actions that may be socially desirable conflict management strategies (e.g., explaining why something was wrong, put in time out or sent to room; CRCW, 2018, p. 85), which do not provide specific information of the CM experience. Considering the challenges around measuring a complex construct like CM and the constraints of the CTSPC, CM was conceptualized as an event or series of events where children are exposed to psychological aggression, physical assault, or neglect in this study.

A previous study that introduced the CTSPC reported the scale lacks internal consistency on the physical assault ($\alpha = .55$) and neglect ($\alpha = .22$) subscales (Straus et al., 1998). They argued, however, that because these subscales measure rare events, correlations between items
are affected, which consequently affect the scale’s internal consistency (Straus et al., 1998, p. 256). Other factors of the maltreatment environment, such as the severity of the event (e.g., hitting child with a belt, choking, stabbing), can also have an effect because they may apply to items differently, affecting subject responses. The CTSPC was reported to have stable construct and discriminant validity on seven of eight measures (e.g., age of parent, age of child, minority race/ethnic groups, parent gender), in addition to theoretically consistent partial correlations between psychological aggression and physical assault holding age of child, gender of child and parent, child race, parent level of education, and residence constant (Straus et al., 1998). To assure the stability of the psychometric properties of the CTSPC, the reliability was assessed within the context of this investigation for each subscale. Of note, the physical assault ($\alpha = .62$), psychological aggression ($\alpha = .58$), and neglect ($\alpha = .58$) subscales had substandard reliability based on the heuristic reliability cutoff value of 0.70. To address the research aims of this study, each subscale was dichotomized so that any self-reported occurrence of physical abuse, psychological aggression, and neglect were recoded as one. If the parent did not report any maltreatment, the scales were coded as zero.

Table 2-1: Adversity type and prevalence of subsample

<table>
<thead>
<tr>
<th>Adversity Type</th>
<th>Frequency $(n = 257)$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure to Community Violence</td>
<td>62</td>
<td>24.1</td>
</tr>
<tr>
<td>Social Difficulties</td>
<td>197</td>
<td>76.7</td>
</tr>
<tr>
<td>Parents Always Arguing</td>
<td>191</td>
<td>74.3</td>
</tr>
<tr>
<td>Parent Death</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Parent Mental Illness (Depression)</td>
<td>32</td>
<td>12.4</td>
</tr>
<tr>
<td>Parent Incarcerated</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Parent Substance Abuse</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Emotional Abuse</td>
<td>243</td>
<td>94.6</td>
</tr>
<tr>
<td>Physical Abuse</td>
<td>220</td>
<td>85.6</td>
</tr>
<tr>
<td>Neglect</td>
<td>13</td>
<td>5.1</td>
</tr>
</tbody>
</table>

ACE Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>12.1</td>
</tr>
</tbody>
</table>
Child Behavior Checklist (CBCL)

The total score of the Child Behavior Checklist (CBCL), as assessed by the focal child’s primary caregiver, was used to account for potential externalizing and internalizing behaviors. This measure was important to include because problematic externalizing and internalizing behaviors are often seen among children exposed to adversity (Shaw et al., 1998). This measure was administered during phone interviews and in-home sessions when the child was or nearing five years old. Large scores on the CBCL are indicative of behavior problems.

Sustained Attention

Researchers used the revised version of the Leiter International Performance Scale (Leiter-R) to assess a child’s ability to sustain their attention on targeted pictures over time (Michalec, 2011) during in-home sessions held during the age five visits (CRCW, 2019a, p. 57-59). On the Leiter-R task, children are shown a page with several stimuli and a target picture, then are tasked to mark all the stimuli that matches the target picture without marking dissimilar stimuli over an allotted time (CRCW, 2019a; Michalec, 2011). During the visit, four timed trials were held with each child. Using their scoring method, two sub-constructs of sustained attention can be calculated from children’s scores: focused attention and lack of impulsivity. The number of correct stimuli markings based on target pictures was defined as focused attention, while lack

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>66</td>
<td>25.6</td>
</tr>
<tr>
<td>4</td>
<td>96</td>
<td>37.3</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>19.5</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>3.5</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>0.4</td>
</tr>
</tbody>
</table>
of impulsivity was indicated by the number of incorrect markings (CRCW, 2019a, p. 57). Only the standardized scores of the Leiter-R task ($M = 10, SD = 3$) for focused attention was used in this analysis since Razza et al. (2010) found that focused attention, and not lack of impulsivity, was a significant predictor of receptive vocabulary (PPVT: $\beta = .32$, $p < .001$), an indicator of children’s emergent literacy skills. As reported by Razza et al. (2010), the Leiter-R task has high internal reliability ($\alpha = .83$) for children 4-5 years old and appropriate test-retest reliability ($r = .45$).

**Covariates**

A collection of child-level and parent-level covariate variables were used in the analyses to limit the confounding effect of central demographic characteristics on the dependent variables. For the analyses, the focal child’s sex and disability status (e.g., physical and mental disabilities) were included. These child-level factors were selected based on their reported influence on reading outcomes based on group assignment (Brown, 1991; Hemphill & Tivnan, 2008; Moser et al., 2012; Lynn & Mikk, 2009; Pan et al., 2005; Spencer & Cutting, 2021). Included among the parent-level covariates are household socioeconomic status (SES), mother’s race and ethnicity, maternal education, and maternal marital status. In previous research, each of these variables has been reported to have an influence on reading achievement and adversity. Also, several studies have identified that factors like household income (Brown, 1991; Dolean et al., 2019; So & Chan, 1982) and race and ethnicity (Brown-Jeffy, 2006) have a significant and independent impact on children’s reading achievement throughout development. Maternal education (Cottone, 2012; Zadeh et al., 2010) and marital status (i.e., family arrangements; Guetto & Panichella, 2019) have also been previously identified as significant predictors of early emergent readers.
As summarized by Zielinski et al. (2006), all the selected covariates can be described as direct or indirect ecological factors that add to the developmental contexts in which these children are being raised. Additionally, associations between adversity and the chosen variables have all been observed (e.g., Cicchetti et al., 2000; Freisthler et al., 2006; Zielinski et al., 2006). Group differences on each dependent variable based on both child-level and parent-level factors were assessed to clarify each variables’ potential influence in the analyses, see Table 3-1.

**Analytical Strategy**

To examine the unique effects of CA and sustained attention on three reading outcomes, a series of hierarchical regressions were used to predict each outcome variable: reading achievement at five years old (RA5), reading achievement at nine (RA9), and reading comprehension at nine (RC), see Figure 1. All data were prepared and analyzed using IBM SPSS Statistics version 28.0. To control for the effects of the selected covariates, each model included all child-level and parent-level demographic characteristics described in previous sections in the first block. The second block introduced the focused attention sub-score of the Leiter-R assessment of sustained attention to determine its unique effect on each reading outcome. In the last block, the CBCL and total ACE score were added to determine the distinctive influence of CA on reading holding all other variables constant.

Prior to the analyses, diagnostics were performed to assess adherence to each regression assumption. The residuals of each analysis were confirmed to be normally distributed and independent based on the calculated Durbin-Watson value (acceptable range: 1.751, 2.245). Plots of the standardized predicted and residual values with an overlayed Lowess curve for each model were used to confirm there were no issues meeting the assumptions of homoscedasticity and linearity. Additionally, no outliers on independent variables, dependent variables, and global
measures were detected using indicators for the Mahalonobis distance, externally studentized residuals, DfFits, and DFBETA, respectively.

Managing patterns of missingness is a key concern when working with longitudinal, extant data because of participant attrition and missing item responses across the dataset. To assess missingness appropriately, each regression variable was first constructed using the complete dataset. Listwise deletion was then used to ensure only cases that had values for each variable were complete across the three regression models. A final subsample of 257 cases were used for all analyses.

Figure 1-1: Conceptual model of hierarchical regression
Chapter 3

Results

Demographic Characteristics and Analyses

Child-level and parent-level characteristics of the subsample are presented in Table 3-1. Additional t-tests and analyses of variance were conducted to assess group differences among each demographic variable on all predicted reading outcomes. At the child-level, the subsample was mostly female (53.7%) and had no record of disability (87.9%). Significant group differences were observed on each reading outcome based on the focal child’s sex, where females outperformed male children (RA5: $t(233.49) = -2.34, p < .05$; RA9: $t(233.05) = -2.68, p < .01$; RC: $t(189.01) = -2.00, p < .05$). No significant differences were detected on reading outcomes between children that had been diagnosed with at least one disability and children with no recorded disabilities (RA5: $t(255) = .99, p = .33$; RA9: $t(255) = .76, p = .45$; RC: $t(255) = 1.12, p = .27$).

At the parent-level, the subsample of children can be largely described as having predominantly white mothers (42.4%), who are married to the focal child’s father (68.5%) and have at least some college experience (65.4%). Each parent-level variable had significant differences among its groups on reading outcomes: mother’s relationship with father (RA5: $t(255) = -2.28, p < .05$; RA9: $t(255) = -2.49, p < .05$; RC: $t(255) = -3.02, p < .01$), mother’s education (RA5: $t(153.41) = -3.84, p < .001$; RA9: $t(153.49) = -2.91, p < .01$; RC: $t(255) = -4.40, p < .001$), and mother’s race/ethnicity (RA5: $F(3, 251) = 3.93, p < .01$; RC: $F(3, 251) = 8.50, p < .001$). A Bonferroni post-hoc test was conducted to evaluate groups within the mother’s race/ethnicity variable and household income levels. This assessment revealed that when using the reading
achievement at age five scale, students with Black mothers ($M = 14.80, SD = 12.35$) scored higher than students with Hispanic mothers ($M = 12.35, SD = 5.02$), $p < .05$. Also, students with White mothers ($M = 100.70, SD = 10.47$) were found to have significantly higher RC scores than students with Black ($M = 94.22, SD = 15.83$) and Hispanic ($M = 92.22, SD = 9.97$) mothers at the .05 level. There were multiple differences based on income level on all reading outcomes as well (RA5: $F(4, 252) = 5.25, p < .001$; RA9: $F(4, 252) = 3.66, p < .01$; RC: $F(4, 252) = 10.33, p < .001$). To add, children from families with higher income levels (i.e., $60,000 – $99,999 and > $100,000) had higher reading achievement and reading comprehension scores than children from lower income levels (i.e., $10,000 – $29,999). Although mean achievement and comprehension scores were similar for families with $0 – $9,999 and $10,000 – $29,999, only 15 families with income levels between $0-$9,999 were found, which may have affected the assessments of group mean differences.

Group differences on sustained attention (not in table) were observed based on the child’s sex (male: $M = 12.68, SD = 3.00$; female: $M = 13.93, SD = 2.71$; $t(255) = -3.50, p < .001$). No other differences were observed for sustained attention based on other child- or parent-level characteristics.

Table 3-1: Child-level and parent-level demographic characteristics

<table>
<thead>
<tr>
<th></th>
<th>Frequency ($n = 257$)</th>
<th>%</th>
<th>RA5 $M (SD)$</th>
<th>RA9 $M (SD)$</th>
<th>RC $M (SD)$</th>
<th>ACEs $M (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child’s Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>119</td>
<td>46.3</td>
<td>13.39 (5.01)</td>
<td>10.34 (4.23)</td>
<td>95.50 (15.67)</td>
<td>3.70 (1.09)</td>
</tr>
<tr>
<td>Female (=1)</td>
<td>138</td>
<td>53.7</td>
<td>14.77 (4.29)</td>
<td>11.65 (3.56)</td>
<td>98.80 (9.52)</td>
<td>3.75 (1.11)</td>
</tr>
<tr>
<td>Child’s Disability Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No record of disability</td>
<td>226</td>
<td>87.9</td>
<td>14.24 (4.65)</td>
<td>11.12 (3.88)</td>
<td>97.60 (13.03)</td>
<td>3.72 (1.10)</td>
</tr>
<tr>
<td>Has at least one disability (=1)</td>
<td>31</td>
<td>12.1</td>
<td>13.35 (4.91)</td>
<td>10.55 (4.09)</td>
<td>94.87 (10.75)</td>
<td>3.81 (1.08)</td>
</tr>
</tbody>
</table>
The prevalence of adversity by type and by composite ACE score is found in Table 2. Ten types of adversity were assessed for their prevalence among the collected population. The table below summarizes the prevalence of each type:

<table>
<thead>
<tr>
<th>Mother’s Race/Ethnicity</th>
<th>Count</th>
<th>Prevalence</th>
<th>Reading Achievement at Five</th>
<th>Reading Achievement at Nine</th>
<th>ACEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, non-Hispanic</td>
<td>109</td>
<td>42.4</td>
<td>14.22 (4.49)</td>
<td>11.39 (3.73)</td>
<td>100.70 (10.47)</td>
</tr>
<tr>
<td>Black, non-Hispanic</td>
<td>75</td>
<td>29.2</td>
<td>14.80 (4.52)</td>
<td>10.76 (3.84)</td>
<td>94.22 (15.83)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>55</td>
<td>21.4</td>
<td>12.35 (5.02)</td>
<td>10.07 (4.40)</td>
<td>92.22 (9.97)</td>
</tr>
<tr>
<td>Other</td>
<td>18</td>
<td>7.0</td>
<td>15.56 (4.15)</td>
<td>12.63 (3.74)</td>
<td>103.31 (12.33)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother’s Relationship with Father</th>
<th>Count</th>
<th>Prevalence</th>
<th>Reading Achievement at Five</th>
<th>Reading Achievement at Nine</th>
<th>ACEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other arrangements</td>
<td>81</td>
<td>31.5</td>
<td>13.12 (5.08)</td>
<td>10.06 (4.26)</td>
<td>93.54 (10.95)</td>
</tr>
<tr>
<td>Married (=1)</td>
<td>176</td>
<td>68.5</td>
<td>14.58 (4.42)</td>
<td>11.45 (3.71)</td>
<td>98.88 (13.33)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother’s Education</th>
<th>Count</th>
<th>Prevalence</th>
<th>Reading Achievement at Five</th>
<th>Reading Achievement at Nine</th>
<th>ACEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some HS or HS diploma</td>
<td>89</td>
<td>34.6</td>
<td>12.55 (5.09)</td>
<td>10.03 (4.30)</td>
<td>92.62 (9.92)</td>
</tr>
<tr>
<td>Some College or College degree (=1)</td>
<td>168</td>
<td>65.4</td>
<td>14.94 (4.24)</td>
<td>11.53 (3.64)</td>
<td>99.59 (13.56)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household Income</th>
<th>Count</th>
<th>Prevalence</th>
<th>Reading Achievement at Five</th>
<th>Reading Achievement at Nine</th>
<th>ACEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 – $9,999</td>
<td>15</td>
<td>5.8</td>
<td>12.00 (5.54)</td>
<td>9.67 (4.48)</td>
<td>90.13 (10.28)</td>
</tr>
<tr>
<td>$10,000 – $29,999</td>
<td>53</td>
<td>20.6</td>
<td>12.11 (5.17)</td>
<td>9.72 (4.21)</td>
<td>90.45 (10.21)</td>
</tr>
<tr>
<td>$30,000 – $59,999</td>
<td>77</td>
<td>30.0</td>
<td>14.32 (4.81)</td>
<td>10.99 (3.91)</td>
<td>97.10 (15.49)</td>
</tr>
<tr>
<td>$60,000 – $99,999</td>
<td>71</td>
<td>27.6</td>
<td>15.06 (3.77)</td>
<td>11.68 (3.51)</td>
<td>99.82 (10.39)</td>
</tr>
<tr>
<td>&gt; $100,000</td>
<td>41</td>
<td>16.0</td>
<td>15.56 (3.90)</td>
<td>12.29 (3.40)</td>
<td>104.61 (9.07)</td>
</tr>
</tbody>
</table>

Note: RC = Woodcock-Johnson passage comprehension test (standard scores); RA5 = constructed reading achievement at age five scale; RA9 = constructed reading achievement at age nine scale; ACEs = constructed ACE measure

**Prevalence of ACE Exposure**

A summary of the prevalence of adversity by type and by composite ACE score is found in Table 2-1. Ten types of adversity were assessed for their prevalence among the collected population.
subsample. Notably, of the ten types, three types of adversity (i.e., parental death, parent incarceration, and parent substance abuse) were not detected in any of the included cases. Two measures of maltreatment, emotional abuse and physical abuse, were the most prevalent types of adversity with over 85% of the sample reporting that the focal child was exposed to abuse at least once. Conversely, only 13 (5.1%) families reported to have neglected their child at some point in the past. In the subsample, only one case (0.4%) reported to have no experiences with any of the adversity types assessed in this study. Using the composite ACE score, it is clear that many children in this sample have experienced some adverse event in early childhood. Although some cases had an ACE score of one (1.6%) or two (12.1%), most cases reported having experienced at least four types of adversity (37.3%) or more (23.3%).

Descriptive results of adversity prevalence by child- and parent-level characteristics are also presented in Table 3-1. There were group differences based on a mother’s relationship with the father, $t(255) = 2.48, p < .01$, where families that had married parents experienced less ACEs than families with other arrangements. Additional differences were observed based on a mother’s education, $t(255) = 1.83, p < .05$ where children that had mothers with some college experience or college degree had less ACEs than those that solely attended or completed high school. Post-hoc analyses of mother’s race and ethnicity, $F(3, 251) = 5.19, p < .01$, also revealed that families with Black mothers ($M = 4.08, SD = 1.06$) had more ACEs than families with White mothers ($M = 3.46, SD = 1.03$), $p < .001$. No other race and ethnicity group differences were observed. Lastly, as other researchers have seen (Halfon et al., 2017), the subgroup analysis showed that children from lower income families ($0 – $29,999) had higher ACE scores than children from higher income families ($30,000 +$) in this subsample as well, $F(4, 252) = 6.51, p < .001$. 
ACE Exposure and Sustained Attention as Predictors of Reading Outcomes

Relationships between each reading outcome and measures of children’s sustained attention, behavior (per CBCL), ACE total, and household income were assessed, see Table 3-2. Notably, the ACE total score ($r = -0.05, p = .40$) and household income ($r = 0.11, p = .08$) had weak, non-significant relationships with sustained attention. All other relationships were significant at the .05 level. Plots and correlations of the three reading outcomes and sustained attention on ACE scores also revealed a high degree of variability among the subsample, including across low and high ACE scores, see Appendix.

Table 3-2: Correlations between main variables.

<table>
<thead>
<tr>
<th></th>
<th>M (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. RC</td>
<td>97.27 (12.79)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. RA5</td>
<td>14.13 (4.68)</td>
<td>0.43***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. RA9</td>
<td>11.05 (3.90)</td>
<td>0.52***</td>
<td>0.48***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. SA</td>
<td>13.35 (2.91)</td>
<td>0.31***</td>
<td>0.34***</td>
<td>0.24***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. CBCL</td>
<td>16.99 (9.80)</td>
<td>-0.22***</td>
<td>-0.16**</td>
<td>-0.24***</td>
<td>-0.13*</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ACEs</td>
<td>3.73 (1.10)</td>
<td>-0.23***</td>
<td>-0.15*</td>
<td>-0.16*</td>
<td>-0.05</td>
<td>0.44***</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. Income$^a$</td>
<td>59.33 (46.28)</td>
<td>0.36***</td>
<td>0.22***</td>
<td>0.23***</td>
<td>0.11</td>
<td>-0.23***</td>
<td>-0.28***</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: RC = Woodcock-Johnson passage comprehension test (standard scores); RA5 = constructed reading achievement at age five scale; RA9 = constructed reading achievement at age nine scale; SA = Leiter-R sustained attention task (focused attention subscale); CBCL = Child Behavior Checklist; ACEs = constructed ACE measure

$^a$In thousands. * $p < .05$, ** $p < .01$, *** $p < .001$

Reading Achievement at Age Five (Model 1)

As seen in Table 3-3, the child-level and parent-level characteristics included in the first block of the model significantly predicted reading achievement at age five, $F(11, 245) = 3.92, p <$
In the first block, female students evidenced higher achievement than male students ($\beta = .15, p < .05$), children with Hispanic mothers had lower achievement than those with White mothers ($\beta = -.18, p < .01$), and parents with a household income between $10,000 - $29,999 had lower achievement than families earning $100,000+ (\beta = -.20, p < .05)$. The first block of the model accounted for 15% of the variance in reading achievement at age five.

In the second block, the addition of sustained attention resulted in a significant model, $F(12, 244) = 6.32, p < .001$. The model explained an additional 8.7% of variability after accounting for the effects of the child- and parent-level characteristics in block one. Overall, the model explained 24% of variance in reading achievement at age 5. As in the first block, children with Hispanic mothers had lower reading achievement scores than children with White mothers ($\beta = -.17, p < .01$). Additionally, sustained attention significantly predicted gains in reading achievement as the score on the Leiter-R focused attention task increased ($\beta = .31, p < .001$).

Inclusion of the ACE and CBCL total scores in block three continued to yield a significant model, $F(14, 242) = 5.57, p < .001$; however, the ACE and CBCL total scores did not significantly account for additional variance, 0.7%, above and over the effects of the variables in block one and block two. The difference in reading achievement scores was again observed between children with Hispanic mothers and White mothers as in the previous blocks at a similar magnitude ($\beta = -.17, p < .01$), and sustained attention predicted reading achievement ($\beta = .31, p < .001$). All other variables were non-significant predictors.

**Reading Achievement at Age Nine (Model 2)**

The first block of model two significantly predicted reading achievement at age nine, $F(11, 245) = 2.84, p < .01$, accounting for 11.3% of its variability. As observed in Table 3-3, child’s sex was identified as a significant predictor, where children identified as female had
higher scores on the reading achievement relative to male children ($\beta = .19, p < .01$). No other child- or parent-level characteristic predicted reading achievement.

Sustained attention, in block two of model two, uniquely predicted reading achievement at age nine ($\beta = .25, p < .01$) above and over the variables from block one, yielding a significant overall model, $F(12, 244) = 3.48, p < .001$. The addition of sustained attention to the model explained an additional 3.3% of variability in reading achievement. Children’s sex remained the sole characteristic significant from block one to block two ($\beta = .15, p < .05; F > M$). All other predictors were non-significant.

In block three, the overall model continued to predict reading achievement after adding ACE and CBCL scores, $F(14, 242) = 3.50, p < .001$. The adversity and behavior scores significantly accounted for an additional 2.2% above and over the effects of the variables in block one and two. Child’s sex ($\beta = .14, p < .05$) and sustained attention ($\beta = .18, p < .01$) remained the only significant variables from the previous blocks to significantly predict reading achievement at age nine. In block three, the CBCL score ($\beta = -.14, p < .05$) was identified as a significant predictor, where an increase in CBCL score predicted a decrease in achievement.

### Table 3-3: Regressing reading achievement on childhood adversity and sustained attention.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reading Achievement: 5</td>
<td>Reading Achievement: 9</td>
</tr>
<tr>
<td></td>
<td>$B$</td>
<td>$SE$</td>
</tr>
<tr>
<td><strong>Block 1: Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s sex</td>
<td>1.44*</td>
<td>.58</td>
</tr>
<tr>
<td>Disability status</td>
<td>-.53</td>
<td>.88</td>
</tr>
<tr>
<td>Mother’s race/ethnicity: Black$^a$</td>
<td>.48</td>
<td>.57</td>
</tr>
<tr>
<td>Mother’s race/ethnicity: Hispanic$^a$</td>
<td>-1.65**</td>
<td>.63</td>
</tr>
<tr>
<td>Mother’s race/ethnicity: Other$^a$</td>
<td>.48</td>
<td>.88</td>
</tr>
<tr>
<td>Relationship with father</td>
<td>.36</td>
<td>.71</td>
</tr>
<tr>
<td>Mother’s education</td>
<td>1.06</td>
<td>.69</td>
</tr>
<tr>
<td>Income $0 - $9,999$</td>
<td>-2.59</td>
<td>1.49</td>
</tr>
<tr>
<td>Income: $10,000 - $29,999$</td>
<td>-2.30*</td>
<td>1.06</td>
</tr>
<tr>
<td>Income: $30,000 - $59,999$</td>
<td>-.55</td>
<td>.93</td>
</tr>
<tr>
<td>Income: $60,000 - $99,999$</td>
<td>-.29</td>
<td>.88</td>
</tr>
</tbody>
</table>
\[ R^2 \begin{array}{ccc} 0.15^{***} & 0.11^{**} \\ F & 3.92 & 2.84 \end{array} \]

**Block 2: Sustained Attention**

Focused Attention

\[ R^2 \begin{array}{cccc} 0.50^{***} & 0.09 & 0.31 & 0.25^{**} & 0.08 & 0.19 \end{array} \]

\[ \Delta R^2 \begin{array}{c} 0.24^{***} \\ 0.15^{***} \end{array} \]

\[ \Delta F \begin{array}{c} 27.97 \\ 9.40 \end{array} \]

**Block 3: Childhood Adversity and Behavior**

<table>
<thead>
<tr>
<th></th>
<th>Adversity Total</th>
<th>CBCL Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.32</td>
<td>.28</td>
</tr>
<tr>
<td></td>
<td>-.01</td>
<td>.03</td>
</tr>
</tbody>
</table>

\[ R^2 \begin{array}{c} 0.24^{***} \\ \Delta R^2 \begin{array}{c} 0.01 \end{array} \\ \Delta F \begin{array}{c} 2.02 \\ 3.27 \end{array} \end{array} \]

*a* Mother’s race/ethnicity: White, non-Hispanic used as reference group; *b* Household income range: $100,000+ used as reference group; * p < .05, ** p < .01, *** p < .001

**Reading Comprehension at Nine (Model 3)**

In the third model, see Table 3-4, children’s reading comprehension ability at nine years old was predicted by several child- and parent-level characteristics in the first block, \( F(11, 245) = 8.48, p < .001 \), and explained 27.6% of the variance in reading comprehension. Like the previous models, child’s sex (\( \beta = .12, p < .05 \)) was a significant predictor of reading comprehension with females scoring higher than males. Additionally, children with White mothers performed better than children with Black (\( \beta = -.13, p < .05 \)) and Hispanic (\( \beta = -.20, p < .001 \)) mothers, but performed worse than children with mothers from the Other (\( \beta = .16, p < .001 \)) race/ethnicity category. Mother’s education (\( \beta = .16, p < .01 \)) also predicted children’s reading comprehension outcomes where children with mothers with at least some college (C) experience performed better than those with mothers with at most a high school (HS) degree. Income level differences were also observed. Children from families with a household income of $100,000+ performed better on
reading comprehension than children from families with household incomes of $0 - $9,999 ($\beta = -.21, p < .01$) and $10,000 - $29,999 ($\beta = -.35, p < .001$).

In block two, the inclusion of sustained attention continued to produce a significant model, $F(12, 244) = 9.35, p < .001$, and accounted for additional variance, 3.9%, in reading comprehension beyond the variance explained by the characteristics in the first block. As in the previous models, sustained attention predicted an increase in this reading outcome ($\beta = .21, p < .001$). Differences on children’s reading comprehension scores across mother’s race/ethnicity groups were observed again, where children from Hispanic mothers ($\beta = -.20, p < .001$) and the Other ($\beta = .16, p < .05$) category had similar beta magnitudes and directions as in block one compared to children from White mothers. Block two maintained the same differences at similar levels and directions identified in block one based on mother’s education (C > HS) and income levels ($100,000+ > $0 - $9,999 and $10,000 - $29,999$).

The model was again significant with the additions of the ACE and CBCL scores to the third block, $F(14, 242) = 8.43, p < .001$, but the ACE and CBCL scores did not explain additional variance in reading comprehension. Similar differences among mother’s race/ethnicity groups, mother’s education, and household income levels were observed as in the previous blocks. Sustained attention ($\beta = .20, p < .001$) remained a significant predictor of reading comprehension in block three.

Table 3-4: Regressing reading comprehension on childhood adversity and sustained attention.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 3</th>
<th>Reading Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$B$</td>
</tr>
<tr>
<td><strong>Block 1: Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s sex</td>
<td>2.64*</td>
<td>1.29</td>
</tr>
<tr>
<td>Disability status</td>
<td>-2.91</td>
<td>1.96</td>
</tr>
<tr>
<td>Mother’s race/ethnicity: Black$^a$</td>
<td>-2.69*</td>
<td>1.27</td>
</tr>
<tr>
<td>Mother’s race/ethnicity: Hispanic$^a$</td>
<td>-4.55***</td>
<td>1.40</td>
</tr>
<tr>
<td>Mother’s race/ethnicity: Other$^a$</td>
<td>4.98**</td>
<td>1.96</td>
</tr>
</tbody>
</table>
Relationship with father  .52  1.57  .02  
Mother’s education  3.84**  1.54  .16  
Income: $0 - $9,999  -9.86**  3.31  -.21  
Income: $10,000 - $29,999  -9.74***  2.35  -.35  
Income: $30,000 - $59,999  -3.27  2.06  -.13  
Income: $60,000 - $99,999  -3.35  1.96  -.13  

R²  .28***  
F  8.47  

Block 2: Sustained Attention  
Focused Attention  .80***  .21  .21  

R²  .32***  
ΔR²  .04***  
ΔF  14.02  

Block 3: Childhood Adversity and Behavior  
Adversity Total  -1.07  .63  -.10  
CBCL Total  -.04  .07  -.03  

R²  .33***  
ΔR²  .01  
ΔF  2.32  

*aMother’s race/ethnicity: White, non-Hispanic used as reference group.  
*p < .05, **p < .01, ***p < .001
Chapter 4

Discussion

Based on Connor’s lattice model (2016), children’s attentional and reading abilities are inextricably related and are shaped by a child’s environment, where negative home and community influences can lead to attention (Pollak et al., 2005; Romens & Pollak, 2012; Shackman et al., 2007) and reading deficits over time (Panlilio et al., 2019; Rouse & Fantuzzo, 2009; Slade & Wissow, 2007). However, the relationships between reading and attention have not been investigated together longitudinally in an early-childhood-adversity sample. Utilizing a sample of children that have experienced adversity by three years old, this study investigated the role of sustained attention in three reading outcomes measured at ages five and nine using a series of hierarchical regressions. Consistent with the lattice model and research hypotheses, sustained attention was identified as an important predictor of early reading achievement and later reading comprehension. Contrary to expectations, however, CA was not a significant predictor of poor reading outcomes as has been observed in previous literature. Differences in reading outcomes across children’s sex, mother’s education and race/ethnicity identity, and household income levels were also seen. These results suggest reading outcomes, though influenced by immediate external elements of the developmental environment (e.g., race/ethnicity, income level), rely on children’s attentional (i.e., regulatory) capacities despite their experience with adversity.

The Unique Effect of Sustained Attention on Reading Outcomes

This study contributes to the extant literature on sustained attention and its role in reading in several ways. First, the results show that young children’s ability to maintain a level of
sensitivity to stimuli for a given time is important early in their reading education. These results are consistent with previous literature that has established a positive relationship between young children’s early ability to sustain their attention and their reading achievement (e.g., Bohlmann & Downer, 2016, Razza et al., 2014). For many children, preschool and early elementary school is their first exposure to structured learning, which brings about many new expectations and tasks that require prolonged periods of engagement. In this context, this study is in line with prior work that show sustained attention predicts the achievement and acquisition of early foundational language and literacy skills through formal instruction in schools after one year of instruction (Lam & Beale, 1991; Matthews et al., 2009; Becker et al., 2014; Macdonald et al., 2021).

Additionally, as a marker of long-term developmental relevance, early sustained attention was also predictive of later reading achievement at age nine in the current study, providing further evidence that early self-regulatory abilities are important for distal reading outcomes (Macdonald et al., 2021).

Of note, many studies that make these connections used measures of vocabulary or other reading subskills as their proxy for reading achievement (e.g., Becker et al., 2014; Matthews et al., 2009). In contrast, this analysis was among the few studies found (e.g., Edley & Knopf, 1987; Rabiner et al., 2016) that used ecologically-relevant, teacher-based assessments of children’s reading achievement as an outcome to assess attention’s role in early reading achievement. Using these types of assessments, a similar medium size effect of sustained attention on reading beyond key demographic covariates was observed in this study as in the study by Davisson et al. (2021), who found a small-to-medium size effect of self-regulation on students’ reading achievement independent of larger contextual factors, such as household socioeconomic status and household chaos. Together, these results provide evidence for sustained attention’s role as a uniquely significant cognitive process related to children’s success on teacher-based assessments of early and later reading achievement.
Second, this study demonstrated that early sustained attention was an important predictor of later reading comprehension abilities. As in the case of reading achievement, others found similar significant relationships between reading comprehension and attention, and saw early attention predict later reading comprehension and reading skills (Bosse & Valdois, 2009; Macdonald et al., 2021; Rabiner et al., 2016; Stern & Shalev, 2013) such as this study, which captured reading comprehension four years after sustained attention was measured. These results lend further support to existing research that state reading with understanding, as conceptualized by Connor (2016), is developmentally dependent on a series of interactions between knowledge structures and cognitive processes, like sustained attention, acquired and refined over time. From this logic, differential developmental reading pathways could theoretically arise due to varying levels of attentional abilities early in life (Steele et al., 2012). In the literature, however, some studies contradict these conclusions. In two longitudinal samples, for instance, Gardner-Neblett et al. (2014) and Slattery et al. (2021) were unable to find sustained attention be predictive of reading comprehension at later time points, but Arrington et al.’s (2014) results were instead agreeable to the current study’s conclusions. These contradictory findings may be indicative of the difficulty in defining and capturing sustained attention and the complex, multi-dimensional nature of reading comprehension using behavioral and survey data. These findings could also serve as an indicator to further investigate the relationship between developmental timing and attention on reading. Nonetheless, possible evidence for attention’s role in reading comprehension has been observed in other fields.

From a broad neuropsychological perspective of the attentional network, the longitudinal relationship between early life sustained attention and reading outcomes are unsurprising as they map well with the continued maturation of the brain and children’s improving reading and attentional abilities (Blair & Raver, 2015). Some studies have shown pronounced changes in activation patterns throughout the brain associated with the transition between learning-to-read
and reading-to-learn, which begins for most children once they enter formal schooling (Chall, 1983). Specifically, these studies demonstrate early readers have broad activation across both left and right hemispheres of the brain, but as their proficiency and comprehension develop, their activation patterns begin to become increasingly lateralized to the left hemisphere (Berl et al., 2010; Horowitz-Kraus et al., 2013). Some of these reading-associated changes in the brain align with the brain development of the frontal and parietal cortices, cerebellum, and motor cortex, which are brain areas implicated in the activation of sustained attention (Fisher, 2019). It is possible that the co-development of the reading-related system and attentional system work in conjunction to enable reading comprehension, although this suggests an element of developmental timing may be at play and children whose early attentional development is not normative may struggle to read to comprehend. In support of this notion, Rabiner et al. (2016) saw evidence for differential academic achievement outcomes based on the timing of emerging attentional difficulties early in life, where children whose attention problems emerged in first grade fared worse on indicators of reading and math achievement in fifth grade than children whose attentional difficulties emerged in second grade.

Third, in addition to extending our understanding of sustained attention and its relationship with reading, the current study also explored this relationship within a context of CA. Investigating these relationships was important because though poor reading outcomes are related to a number of interactive and dynamic factors (i.e., text-based processes, code-based processes, and social and regulatory factors; Connor, 2016), research shows that CA can impact children’s academic abilities and school performance (Slade & Wissow, 2007). Many of these studies, however, have not investigated the specific developmental and learning mechanisms by which CA leads to poor reading outcomes. Considering this limitation, this study continued the unraveling of these mechanisms in investigating sustained attention as a predictor of reading achievement and comprehension given that prior research shows children with attentional
deficits, such as those that have experienced adversity, are at a disadvantage for learning complex reading skills in schools and for seeing poor proximal and distal success on reading outcomes (Blair & Raver, 2015; MacDonald et al., 2021; Spencer & Cutting, 2021; Stern & Shalev, 2013).

This is potentially problematic since a recent longitudinal study by Thomson and colleagues (2020) saw that children with attentional deficits remain one to three years behind children without any deficits on measures of attention into late childhood and early adolescence. As children’s cognitive loads are progressively taxed by growing academic demands (i.e., reading to comprehend), access to regulatory functions, like sustained attention, becomes increasingly important throughout their school careers (Connor, 2016; Lam & Beale, 1991; MacCoon et al., 2004; MacDonald et al., 2021; Sparapani et al., 2019). Problematic externalizing (e.g., hostility, defiance, lying) and internalizing (e.g., withdrawal, nervousness) behaviors may also manifest in children with deficits in sustained attention, which are often incompatible with classroom expectations and interactions, and can affect achievement across domains (Silver et al., 2005).

This observed relationship in the literature emphasizes the need to foster children’s attentional development through purposeful instruction in homes and at school to promote positive reading outcomes, especially in children exposed to adversity that are demonstrably vulnerable to changes in attention (Pollak et al., 2005; Romens & Pollak, 2012; Shackman et al., 2007).

However, incongruent with this study’s hypothesis and previous literature, the analyses revealed that adversity occurring at or before the child was three years old was not a unique predictor of any proximal and distal reading outcome after considering the explained variance of the demographic covariates and sustained attention. The lack of predictive influence for adversity in these models could depend on a variety of factors, such as the significant and, yet unclear, strength of sustained attention’s effect on reading outcomes or the unstable structure and conceptualization of the ACE measure used in this study. To the latter’s point, current research positions to the effects of CA suggest that exposure does not guarantee a negative consequence
Rather, exposure to CA is associated with a number of potentially consequential and even inconsequential outcomes, a concept referred to as *multifinality* — the principle that explains how children exposed to similar risk and/or protective factors have different developmental outcomes (McLaughlin, 2016, p. 10) — explored later. ACE measures, such as the one used in this study, take tally of the occurrence of each ACE category and weighs them equally, thus providing a simple, cumulative score which is unable to capture the multidimensional nature of CA (e.g., type, frequency, chronicity, severity; Lacey & Minnis, 2020) — a common limitation acknowledged by researchers (Kelly-Irving & Delpierre, 2019). It is probable that without parsing through the nuanced relationships between different dimensions of CA and reading-related constructs, it was difficult to determine if adversity influenced attention and reading in the current study.

It is important to note, however, that regardless of the absence of a relationship between adversity and reading in this study, sustained attention was still an important predictor of reading outcomes despite experiences with early CA, and therefore serves as a possible target for prevention and intervention reading efforts in this population. Perhaps by continuing to reconceptualize the relationship between adversity and reading by exploring the potentially causal role of theoretical and practical moderators or mediators like sustained attention, the impact of adversity on academic outcomes can be further elucidated.

**Capturing Early Childhood Adversity: Multifinality and ACEs**

Although some children in the subsample were exposed to similar types and a similar number of adverse experiences, adversity did not account for unique variability in any of the models. From a multifinality perspective (McLaughlin, 2016; Smith & Pollak, 2021), the lack of a discernable relationship between CA and reading outcomes or sustained attention lends
evidence for the differential impact of adversity on children’s attentional and reading development. This result is promising for children that were not negatively affected by early experiences with adversity and concerning for the children that were affected. Understanding the mechanisms and conditions that drive different trajectories of development following exposure to adversity is crucial for intervention and prevention efforts, including the use of a refined definition of CA that captures the construct efficaciously.

Smith and Pollak (2021) argued that definitions of CA need to move beyond describing and counting predefined adverse events and instead focus on how an adverse event was perceived by the person. Smith and Pollak (2021, p. 82) contend that a child must “process the [adverse] event and construe it as such” for it to become truly adverse. Only after an event is perceived as adverse can the event lead to possible trauma and other cognitive or biobehavioral consequences. This view of adversity is consistent with multifinality, where children that experience similar ACEs can have different attention and reading developmental consequences, and suggests the perception of the event was an important variable missed in the study. It is possible that among children in the subsample, some may have perceived their ACEs as truly adverse and were thus more vulnerable to negative consequences, while others may not have perceived their ACEs as adverse and were thus less vulnerable to consequence. Given that this study did not evaluate children’s perception of adverse events, findings cannot definitively say if any child was affected by adversity based on their argument. Though this conceptualization helps explain the null results observed in this study, future researchers are urged to substantiate the strength of this argument empirically because there is a need to specify the mechanisms and conditions by which adversity affects reading and attention since acquiring a cumulative count of ACEs is demonstrably insufficient.
Parent-Level and Child-Level Influences on Reading Outcomes

Like previous reading studies, (Brown-Jeffy, 2006; Cottone, 2012; Guetto & Panichella, 2019; Zadeh et al., 2010) some child-level and parent-level characteristics significantly predicted reading outcomes in the full models. At the child-level, sex was a significant predictor of reading achievement at age five and reading comprehension at age nine where female students outperformed their counterparts. This study replicated similar patterns of sexual differences on measures of reading achievement and self-regulation observed throughout the literature (e.g., Matthews et al., 2009). Though multiple child-level variables were evaluated, only child sex was predictive of a reading outcome in this study. At the parent-level, differences across subgroups also followed similar trends seen in previous work and provided additional evidence of an existing achievement gap based on identity and income. For instance, evidence of an achievement gap based on race and ethnicity grouping was seen, where children with White mothers scored higher on measures for reading achievement at age five and reading comprehension against Hispanic and Black subgroups (Brown-Jeffy, 2006). Also, evidence of an income achievement gap, where children from high household income families scored higher on a reading comprehension than low household income families, was observed too (Halfon et al., 2017). Together, these results highlight outcome homogeneity in the literature; showing that some factors are enough to predict children’s reading outcomes and trajectories by themselves.

However, since these factors exist within a much larger system (Connor, 2016), the interactions across risk (i.e., adversity), protective (e.g., mother’s education), and internal (e.g., sustained attention) factors need to be further explored to understand what combination of characteristics lead to poor or better reading outcomes. In the spirit of multifinality and an optimism rooted in reality, a child who has a mother who is of a racial and ethnic minority or come from a low-income household does not guarantee that they will have poor reading
outcomes. Instead, this result speaks to the mean differences on reading outcomes across subgroups compared to a privileged reference group, which suggest there may be large social issues to consider that are affecting the reading development of the average Hispanic or Black child and/or child who comes from a low-income household. Careful interpretation needs to be made of these results to not cause further harm to these populations.

**Implications for Practice**

To address issues stemming from exposure to adversity, some schools have adopted trauma-informed practices to promote their students’ social-emotional development. Schools who adopt this approach integrate what is known about trauma within their policies, procedures, and educational practices to enact school culture change to serve their students (Roseby & Gascoigne, 2021). However, recent evidence shows that efforts to implement and integrate trauma-informed practices into schools produce inconsistent results on children’s academic achievement (Roseby & Gascoigne, 2021). This may be partially due to the lack of instruction and training teachers receive related to addressing attention-related problems, such as externalizing and internalizing behaviors because of adversity exposure in their classrooms or the role that teachers’ bias and interpretation of such behaviors play in these classroom interactions (Loomis & Panlilio, 2022).

To address these inconsistencies on achievement, it may be fruitful to develop and implement practices that encourage the development of attention into the trauma-informed curriculum based on the results of this study. Despite the etiology and presentation of students’ attentional deficits, the impact of adversity on attention needs to be addressed. Integrating practices that promote attention, such as contemplative practices (e.g., meditation and yoga; Shapiro et al., 2015), teacher training and coaching on how to develop classroom management procedures to create predictable environments and reduce teacher stress levels, and self-
monitoring activities through collaborative play could support trauma-informed schools’ efforts to improve children’s social, emotional, and behavioral readiness as some researchers have seen (Ursache et al., 2012; Lipscomb et al., 2021; Mathis & Bierman, 2015).

Some studies have already observed positive relationships between attention-based practices and social-emotional learning (Whitcomb, 2009) and their direct association with later grade promotions (Bettencourt et al., 2018). Additionally, there is growing evidence that shows teaching strategies that facilitate attention during reading (i.e., rereading, paraphrasing, and self-explaining) can lead to increased learning gains and improved reading comprehension (Moss et al., 2011). Evidence also shows increased connectivity in the brain across the attentional network when reading interventions are used with dyslexic readers and those with ADHD (Greenwood et al., 2019; Horowitz-Kraus & Holland, 2015; Krafnick et al., 2011). To improve children’s social-emotional learning and achievement, research should investigate the validity and efficaciousness of integrating attention-based practices, such as those mentioned, with what schools are already doing with their trauma-informed curriculum.

**Limitations and Future Directions**

Due to a natural limitation associated with using extant data, some variables used to compute the ACE score were proxies rather than direct measures of children’s exposure to adverse experiences. Items related to children’s exposure to community violence, parents arguing, and parent substance abuse were based on their mother’s responses, which can only approximate, at best, children’s direct experience. This methodological challenge in particular changes this study’s interpretation of the constructed ACE measure in some ways because the ACE measure is reflective of a mother’s exposure to adverse experiences rather than the child’s. Future research should aim to use only child-specific measures of adversity instead of proximal indicators to
increase the measures’ validity. Also, to attain a more comprehensive look into adversity’s effects on children and their reading outcomes, researchers should collect additional information about an experience’s chronicity, severity, and frequency (Lacey & Minnis, 2020) since differences on language and reading outcomes have been observed based on these dimensions (Cicchetti & Rogosch, 1996; English et al., 2005). Researchers should also consider children’s trauma symptomology, a reflection of their perception of adverse events (Smith & Pollak, 2021), since previous work has found differences among children that have experienced adversity, and others that experienced adversity and had trauma symptoms on measures of academic outcomes (Ferrara & Panlilio, 2020) and engagement (Mullins & Panlilio, 2021).

Given the support these findings give to sustained attention as a key component to teacher assessments of early and later reading achievement, researchers should evaluate if attention is a potential mediator of children at-risk of poor reading outcomes within a context of adversity. Since previous studies have shown that adversity is related to attention and reading difficulties (e.g., Pollak et al., 2005; Rouse & Fantuzzo, 2009; Slade & Wissow, 2007), and attention problems can predict reading difficulties independently (Rabiner et al., 2000), adversity may be affecting children’s reading by influencing their ability to sustain attention to a stimulus. Conducting a mediation type analysis would be an effective first step towards establishing a potential mechanism that explains how adversity impacts academic outcomes. This type of information could provide important insight of the potential efficacy of implementing attention-based practices as part of trauma-informed curriculums.

Lastly, in creating the subsample for this analysis, it is important to note that there was considerable missingness that needed to be managed because of attrition, incomplete data, or having measures present in only one wave. After adhering to the exclusionary criteria, approximately 5% of the complete FFCWS dataset was used to create the subsample. Some covariate differences (i.e., household income, maternal relationship with father, and mother’s
education) were observed between the subsample and all other cases, which could have biased the analysis. Future research of longitudinal reading outcomes with this study may benefit from using more complex strategies than listwise deletion to handle missingness, such as multiple imputation.

**Conclusion**

The main purpose of this study was to investigate if sustained attention was a unique predictor of reading outcomes for children exposed to adverse experiences using a series of hierarchical regressions and a longitudinal sample. Overall, this study contributes to the extant literature in three main ways: 1. This study found additional evidence that children’s early sustained attention abilities are predictive of children’s early reading achievement, 2. The stability of early sustained attention is integral throughout children’s development since it predicted later reading achievement and reading comprehension four years after its initial measurement, and 3. Sustained attention is an important predictor of reading outcomes despite the influence of exposure to early adversity. Though CA was not identified as a significant predictor of any reading outcome, possible measurement or instrument errors could have influenced its effects. Moving forward, researchers should use tools capable of capturing children’s self-perceptions of the adverse event. This research study has important implications for schools that utilize trauma-informed practices because it highlights the need to focus on self-regulatory functions, like sustained attention, to promote children’s academic achievement and learning. Lastly, future research should continue to examine how adversity affects reading through sustained attention using mediation analyses to establish temporal, causal relationships.
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Appendix

Relationships with ACE Score: Reading Outcomes and Sustained Attention

Appendix 1-1: Reading Comprehension and ACE Score, $r = -.23$, $p < .001$

Appendix 1-2: Reading Achievement at Age Five and ACE Score, $r = -.15$, $p < .05$
Appendix 1-3: Reading Achievement at Age Nine and ACE Score, $r = -.16, p < .05$

Appendix 1-4: Sustained Attention and ACE Score, $r = -.05, p = .40$