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Parental Involvement as a Mediator of ACE Scores and Intelligence Among Children

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LOMA LINDA UNIVERSITY
School of Behavioral Health
in conjunction with the
Department of Psychology

Parental Involvement as a Mediator of ACE Scores and Intelligence Among Children

by

Shirin Mostofi

A Project submitted in partial satisfaction of
the requirements for the degree
Doctor of Psychology

September 2020

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Each person whose signature appears below certifies that this project in his/her opinion is adequate, in scope and quality, as a project for the degree Doctor of Psychology.



_____, Chairperson

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ABBREVIATIONS

ACE	Adverse Childhood Experiences
IQ	Intelligence Quotient
PRQ	Parenting Relationship Questionnaire
EEG	Electroen-Cephalogram
MRI	Magnetic Resonance Imaging
KBIT-II	Kaufman-Brief Intelligence Test, Second Edition
PHQ	Patient Health Questionnaire
GAD	Generalized Anxiety Disorder

ABSTRACT OF THE DOCTORAL PROJECT

Parental Involvement as a Mediator of ACE Scores and Intelligence Among Children

by

Shirin Mostofi

Doctor of Psychology, Graduate Program in Psychology
Loma Linda University, September 2020
Dr. Cameron L. Neece, Chairperson

Adverse Childhood Experiences (ACEs) include physical, sexual, or psychological maltreatment, domestic violence, household mental illness, household substance abuse and incarceration of parents. ACEs may have negative impacts on children, including brain development and health outcomes. Parents are pivotal figures in children's lives that contribute significantly to their health, and cognitive development, and may be a critical protective factor, contributing to children's resiliency and healthy growth. This study focused on the intellectual development of 5-11 year-old children whom may have been exposed to ACEs in their homes. More specifically, the purpose of this study was to examine parental involvement as a mediator of the relationship between children's ACEs and their Intelligence Quotient (IQ). We hypothesized that parental involvement would significantly mediate the association between children's ACE scores and their IQ, such that as ACE scores increased, children's IQ decreased via the effect of lack of parental involvement. Children's ACE scores were determined via parent-report questionnaires. Children's intelligence were measured via Kauffman Brief Intelligence Test, which is a standardized test that measures verbal (crystallized) intelligence and non-verbal (fluid) intelligence. Parental involvement was measured via a subscale from the Parenting Relationship Questionnaire (PRQ) as a means of measuring the amount of time parents

engaged in various activities with their children. Results indicated that that parental involvement did not significantly mediate the relationship between children's ACE scores and their IQ. However, we determined a significant association between children's ACE scores and parental involvement. Our post-hoc analyses tested parental involvement as a mediator of the relationship between child ACE scores and verbal, as well non-verbal, intelligence. Results indicated that parental involvement did not significantly mediate the relationship between either children's ACE scores and their verbal intelligence or their non-verbal intelligence. Lastly, we considered the possibility that parental involvement may moderate the relationship between child's ACE scores and their IQ. We examined whether the amount of parental involvement may impact the relationship between children's ACE scores and their intelligence. Results indicated that low, medium, or high levels of parental involvement did not significantly effect the relationship between children's ACE scores and their IQ. Limitations and implications for future studies within this field were discussed.

CHAPTER ONE

INTRODUCTION

Adverse Childhood Experiences

The relationship between childhood exposure to household dysfunction and the negative consequences in adulthood began gaining importance in the primary care settings about a decade ago (Felitti et al., 1998). However, there is a lack of research in examining the consequences of ACEs on children's intellectual development and outcome. Specifically, potential mediators such as the possible impact of parents given that they play a pivotal role in children's lives, including academic performances and behaviors (Otto & Atkinson, 1997; Topor et al., 2010), and promoting intellectual development (Larivee et al., 1994).

A study by Felitti and colleagues (1998) examined the long-term effect of abuse and dysfunctions at home during childhood on adulthood medical and health problems. Their Adverse Childhood Experiences (ACE) Study at Kaiser Permanente's San Diego Health Appraisal Clinic included questionnaires from about 9,000 adults over 19 years of age, with the majority being 35-65+, who were receiving medical attention. The ACE Study questionnaire addressed experiences from the adult's first 18 years of life, and the items were contrived from the Conflicts Tactics Scale (Straus & Gelles, 1990) to define psychological and physical abuse as well as violence against mother, Wyatt (1985) to define sexual abuse, National Health Interview Survey (National Center for Health Statistics, 1991) to evaluate exposure to alcohol or drug abuse. The questionnaire pertaining to seven domains included abuse in the areas of psychological (two items),

physical (two items), and sexual (four items), and household dysfunction in the domains of substance abuse (two items), mental illness (two items), violence against mother (four items), and household criminal behavior (one item). Questions addressing adults' health problems were obtained from Behavioral Risk Factor Survey (Siegel, Frazier, Mariolis, Brackbill, & Smith, 1993), Third National Health and Nutrition Examination Survey (Crespo, Keteyian, Heath, & Sempos, 1996), and the Diagnostic Interview Schedule of National Institute of Mental Health (Robins, Helzer, Croughan, & Ratcliff, 1981). Other examined domains included risk factors (i.e., smoking, obesity, drug abuse, number of sexual partners, etc.) and lethal diseases (i.e., ischemic heart disease, cancer, stroke, chronic bronchitis, etc.) (Felitti et al., 1998).

The results of the ACE studies indicated that typically adults who responded positive on one of the ACE categories, responded positive to at least one other category as well (Felitti et al., 1998; Dong et al., 2004; Anda et al., 2006). There is a strong evidence of the relatedness between ACEs, where one reported ACE increases the likelihood of other ACEs (Dong et al., 2004). This implies the necessity of examining a broad range of adverse experiences in childhood in order to better understand the long-term health consequences in adulthood. Furthermore, Felitti's (1998) study found a strong correlation between the ACE scores and risk factors associated with adulthood mortality (e.g. severe obesity, depressed mood, physical inactivity, suicide attempts, a high lifetime number of sexual partners, and a history of having a sexually transmitted disease, etc.). Further studies indicated that at least one ACE was reported by more than half of the participants (Dong et al., 2004; Anda et al., 2006), and that substance and drug use/abuse, and risk of smoking in adulthood increased with an increase of ACE scores

(Anda et al., 2006). Comparing an increase in drinking for adults between the ages of 18 to 39 with ACE to those without it, indicated that the adults in the study began drinking earlier than peers and reported to drink as a coping method (Rothman et al., 2008). In addition, risky sexual behaviors such as early intercourse, promiscuity, and dissatisfaction were associated with the ACE score. Impaired memory of childhood, high stress perception, anger management difficulties, and intimate partner violence perpetration risk were also increased with an increase in the ACE score (Anda et al., 2006). In addition, Anda's (2006) study highlighted the association between childhood stress and the effects on the neurobiology and structure of the brain that will be further discussed in this section.

Intelligence

A focus of the current study was determining the impact of ACEs on children's cognitive development, specifically their verbal and non-verbal intelligence that involves various brain areas. Studies show that a history of childhood trauma is associated with a decreased cognitive performance in verbal intelligence (Aas et al., 2012). Early maltreatments among children have shown to be associated with abnormalities of the brain structure. A study by Teicher (2000) conducted among child and adolescent psychiatric patients demonstrated that there were brain abnormalities associated with childhood abuse including limbic irritability, deficiencies in development and differentiation of the left hemisphere and left-right hemisphere integration (corpus collosum), abnormal activity in the cerebellar vermis (middle strip between the two brain hemispheres), and electroen-cephalogram (EEG) abnormalities in the left side of the

brain. Furthermore, Teicher's (2000) study showed that the deficits in the left hemisphere of patients with a history of physical, sexual, or psychological abuse, were more than six times greater than the right side, with those who only experienced psychological abuse having eight times more deficiency prevalence. The deficits in the left hemisphere impacted the development of the left hippocampus, causing deficits in verbal memory and dissociative symptoms that continue into adulthood.

The results of Anda's (2006) study were closely associated with the neurobiological findings of other studies examining traumatic childhood experiences. Among adults who were victims of trauma in childhood, magnetic resonance imaging (MRI) showed smaller volumes in hippocampus (Bremner, 1997; Driessen, 2000), amygdala (Driessen, 2000), and impairments in verbal declarative memory (Teicher, 2000) that is a measurement of intelligence. The hippocampus is responsible for the memory process, and is closely connected with the amygdala, medial prefrontal cortex, and other limbic structures to process fear (Shin, Rauch, & Pitman, 2006). The combination of the results of neurobiological studies demonstrates an association of changes in the structure and function of the brain following adverse childhood experiences that may collaboratively impact children's intelligence.

Parental Involvement

Parents' interaction and socialization with their children play a significant role in children's lives and, in theory, the more parents are involved and interact with their children the larger their influence will be. The goal of the current study was to test parental involvement as a mediator of the association between child ACEs and

intellectual functioning. For the purpose of the current study, parental involvement was operationalized as the frequency of children and parents' engagement in various activities including outings, completing projects, outdoor activities as well as planning activities together (Kamphaus & Reynolds, 2006). Studies indicate that parental involvement is associated with academic performance and behaviors (Otto & Atkinson, 1997; Topor et al., 2010). For example, El Nokali and colleagues (2010) examined children's social development across 1st, 3rd, and 5th grades and found that children who had highly involved parents demonstrated enhanced social functioning and fewer behavior problems compared to other children whose parents were not highly involved. Another study with children and adolescents showed that parents' involvement with school has a direct positive influence on academic success and other outcomes related to school. Specifically for young children, parental involvement with school is associated with enhanced academic and language skills as well as social competence (Hill & Taylor, 2004). Head Start, the largest intervention program for children, emphasizes that parental involvement encourages positive academic experiences for children and impacts parents' own self-development and parenting skills (Hill & Taylor, 2004). In addition, parental involvement increases the quality of the student-teacher relationship, which is also increased academic performance, measured by standardized test scores and in classroom performance (Topor et al., 2010). Furthermore, parental involvement was strongly associated with academic performance, above and beyond the impact of the child's intelligence (Topor et al., 2010). However, other studies have provided conflicting results with regards to parental involvement. One study by Grinstein-Weiss and colleagues (2009) found that parental involvement variable, defined as the number of days caregiver ate breakfast with child,

was a significant mediator between parents' assets and children's academic outcomes. Conversely, the time parents spent engaging with their child via talking or playing with child, and praising child each week, was not a significant mediator (Grinstein-Weiss, Yeo, Irish, & Zhan, 2009). With the ample research in the domains of parental involvement and academic success, there is limited study examining parental involvement as a mediator between ACE and children's intelligence; specifically, whether higher ACE scores is associated with lower intelligence due to the effect of lack of parental involvement.

Research indicates that family interactions influence children's cognitive functioning (Estrada, Arsenio, Hess, & Holloway, 1987). In regards to parental involvement, one study indicated that the relationship between an adult and child, specifically via sharing responsibilities and parental support, promotes intellectual development (Larivee et al., 1994). Gordon (1970) posited that the five factors that best predicted children's intelligence were: 1) expectations for intellectual achievement, 2) mother's information on child's intellectual development, 3) opportunities to expand child's vocabulary, 4) created learning opportunities at home, 5) the amount of assistance in learning situations. Other studies demonstrated that the quality of the mother-child relationship significantly correlated with their children's IQ at the age of six and contributed significantly to their children's growth. The impactful attribution of the mother-child relationship was primarily driven by engaging and supporting children in problem-solving and persisting at tasks, developing children's social competence and communication, and increasing children's exploratory nature (Estrada, Arsenio, Hess, & Holloway, 1987).

Purpose of This Study

The purpose of this study was to examine parental involvement as a mediator of the relationship between children's ACE scores and their intelligence quotient. We hypothesized that parental involvement would significantly mediate the association between children's ACE scores and their IQ, such that as ACE scores increase, children's IQ decreases via the effect of lack of parental involvement.

CHAPTER TWO

METHODS

Participants and Procedures

The power analysis of a two-tailed linear regression analysis with an alpha level of .05, power of 0.80, and a medium effect size of 0.15 indicated that 55 participants were required for this study. Our study included 50 participants that resulted in a power of 0.70. Participants were recruited from the Loma Linda University Pediatric Resident Clinic after children ages five to 11 years old completed a Well-Child visit. The Loma Linda University Pediatric Resident Clinic serves low-income patients, most of whom receive Medicaid. After the Well-Child visit, families received an information letter about the study in the mail. Participants then received a telephone call recruiting them to participate in the study and, if upon consent, families were scheduled to come in for a research visit, were mailed research visit supplies, and received further information about participation in the study. Within eight weeks of their Well-Child visit, parent-child dyads came in to the lab to complete a one-time research visit. All parents at the research visit provided written consent to participate in this study and a copy was provided to them. Parents with children under 10 years of age provided consent to their own participation as well as their children's. Children of 10-11 years of age provided assent to their own participation in the study. At the research visit, parents completed self-report measures for demographic information, child ACE score, and psychosocial functioning. In addition, children were assessed on the Kaufman-Brief Intelligence Test, Second Edition (KBIT-II) by a trained research assistant. At the end of the research visit, parents

were offered a \$50 Target gift card and children were offered a small gift for their participation in the study.

The demographics of our participants included female (54%) and male (46%) children between the ages of five to eleven. Children of ages five (18%) and 10 (18%) were higher in frequency, and the pool of participants included LatinX/Hispanic (52%), White/Caucasian (20%), Black/African-American, (4%) and Asian/Pacific Islander (2%). The majority of the parents whom visited our clinic identified as the children's biological parent (96%), though one parent identified as the adoptive parent (2%) and one identified as other (2%). Parent's marital status included married (62%), single/never married (22%), or separated/divorced (8%). Parents' ages varied from 23 to 60 with an average age of 35 and mode of 34. Parent's education ranged from completing 10 to 20 years of education, with an average education of 17 years and modes of completing 12 and 16 years of education. The number of hours parent's worked weekly varied from nine to 88, with an average of 52 hours per week.

Table 1. Descriptive of Variables for 50 Participants.

	n (%)	M (SD)
Children's Age		8 (2.13)
Parent's Age		35.55 (8.22)
Parent's Education		17.15 (15.93)
Parent's Weekly Number of Work Hours		52 (26.46)
Children's Gender		
Female	27 (54)	
Male	23 (46)	
Children's Race		
LatinX/Hispanic	26 (52)	
White/Caucasian	10 (20)	
Black/African-American	2 (4)	
Asian/Pacific Islander	1 (2)	
Parent Marital Status		
Married	31 (62)	
Single/Never Married	11 (22)	
Separated/Divorced	8 (16)	
Child's ACE		1.46 (1.92)
Parental Involvement		16.22 (5.32)
Total IQ Score		98.20 (14.73)
Verbal Intelligence		96.06 (13.04)
Non-Verbal Intelligence		100.08 (16.38)

Measures

Child ACE Score

Child ACE score were assessed as a zero-ten count of total ACEs, reported at the research visit. Parents reported their child's ACE exposure, or risk of ACE exposure, and each ACE that was reported received a score of one. An overall ACE score was summed and a total ACE score was assigned based on the total number of ACEs endorsed (Appendix A)

Physical Abuse

Parents reported if their child “has ever lived with a parent or other adult who pushed, kicked, physically hurt, or threw something at the child?” Or, parents reported if they “need to hit/spank” their child? One point toward the total Child-ACE score was counted if parents respond affirmatively to either question.

Sexual Abuse

Parents reported if they “know or are concerned that [their] child was ever touched, or asked to touch, an adult or someone at least 5 years older sexually?” Or, parents reported if their child “ever lived away from home for more than a month.” One point toward the total Child-ACE score was counted if parents respond affirmatively to either question.

Emotional Abuse

Parents reported if they “ever swear at or insult their child?” Or, parents reported if they feel their child “is difficult to take care of.” One point toward the total Child-ACE score was counted if parents respond affirmatively to either question.

Physical Neglect

Parents reported if [they] “worried that [their] food would run out before [they] got money or Food Stamps to buy more? One point toward the total Child-ACE score was counted if parents respond affirmatively to this question.

Emotional Neglect

Parents reported if their family “look out for each other, feel close to each other and support each other?” One point toward the total Child-ACE score was counted if parents respond negatively to either question.

Parental Substance Abuse

Parents reported if their child has” ever lived with anyone who had a problem with drugs or alcohol?” Or, parents reported if they “have had more than 4 drinks containing alcohol in one day?” One point toward the total Child-ACE score was counted if parents respond positively to any of these questions.

Mental Illness in the Family

Parents reported if their child has “ever lived with anyone who was depressed,

mentally ill, or suicidal?” Parents were also asked to respond to the two-item Patient Health Questionnaire (PHQ-2) and the Generalized Anxiety Disorder scale (GAD-2; Löwe et al., 2010; Löwe, Kroenke, & Gräfe, 2005). One point toward the total Child-ACE score was counted if parents respond positively to the family mental health question, or score 2 or more on either the PHQ-2 or the GAD-2.

Parental Incarceration

Parents reported if their child has “ever lived with anyone who went to prison, jail, or other correctional facility?” One point toward the total Child-ACE score was counted if parents respond positively to this question.

Domestic Violence Exposure

Parents reported if their child has ever “witnessed adults in the home pushing, hitting, kicking, or physically threatening each other.” Or parents reported if they “have ever felt unsafe in [their] relationship” or if they fought a lot with a partner in the last year. One point toward the total Child-ACE score was counted if parents respond positively to any of these questions.

Parental Divorce / Separation

Parents reported if their “child’s parents [are] separated, divorced, or not living together?” One point toward the total Child-ACE score was counted if parents are separated, divorced, or not living with a partner.

Cognitive Ability

Verbal and non-verbal cognitive ability were assessed using the Kaufman Brief Intelligence Test, Second Edition (KBIT-II). The KBIT-II can be administered to individuals ages four through 90 and provides a brief measure of verbal and non-verbal intelligence (Kaufman & Kaufman, 2004). The verbal cognitive score measures word knowledge, a range of general information, verbal concept formation, and verbal reasoning ability. The verbal cognitive score was assessed using the verbal knowledge (tests receptive vocabulary and general knowledge) and riddles (comprehension, reasoning, and vocabulary knowledge) subtests. The non-verbal cognitive score measures problem-solving skills by assessing an individual's ability to perceive relationships and complete visual analogies. The non-verbal cognitive score was assessed using the matrices subtest (ability to complete visual analogies and understand relationships). The verbal and non-verbal subscales were combined into a total IQ score. Per the administrative manual, item responses were scored dichotomously: correct responses receive a score of one and incorrect responses receive a score of zero. Raw scores were then converted to standard scores and percentile ranks using the tables in the manual.

The KBIT-II has an internal consistency coefficient of .90 for verbal IQ for children and adolescents ages four through 18 (Kaufman & Kaufman, 2004). It has an internal consistency coefficient of .86 for nonverbal IQ for children and adolescents ages four through 18. It has an internal consistency coefficient of .92 for IQ composite for children and adolescents ages four through 18. The adjusted test-retest reliability of the KBIT-II for children ages four through 12 for verbal is $r = .88$, for non-verbal is $r = .76$, and for IQ composite of $r = .88$. KBIT-II scores have also been correlated with other IQ

assessments to determine validity. When compared with the Wechsler intelligence scale's measure for verbal IQ the KBIT-II had an adjusted correlation $r = .80$, for non-verbal IQ it had an adjusted correlation $r = .62$, and for IQ composite it had an adjusted correlation $r = .81$.

Parental Involvement

The Parental Involvement is a subscale from the Parenting Relationship Questionnaire (PRQ) (Kamphaus & Reynolds, 2006) that was utilized for this study as a means of measuring the number of activities that parents engage in with their children. The measure was developed from samples within 41 states in the United States (North East, North Central, South, and West) and normed for children 6 -18 years of age. The scale's reliability is above 0.82. Parents completed these items during the research visit. The eight items utilized for this subscale were on a four-point likert scale and combined to produce a continuous variable (0 = Never, 1 = Sometimes, 2 = Often, 3 = Almost Always). Refer to Appendix B for the complete list of eight questions and response options.

Statistical Analysis

We completed research visits for 50 participants and the assessments and questionnaires were used to analyze the results. PROCESS Macro was used as a bootstrapping method for testing mediation (Hayes, 2017). Bootstrapping was the preferred method as it does not assume a normal sample distribution, can be used with smaller sample sizes, and reduces Type I Error. Parental involvement was tested as a

mediator to explain the relationship between child's ACE scores and IQ. We predicted that parental involvement significantly mediates the relationship between child's ACE scores and their IQ.

CHAPTER THREE

RESULTS

Preliminary Analyses

Prior to our analyses, the dataset was examined for outliers using each variable's standard deviation and leverage, multicollinearity using Variance Inflation Factor (VIF) and tolerance, and assumptions using homoscedasticity, linear relationship between the variables, and normality of residuals. Outliers were initially identified by three standard deviations above or below a variable's mean due to our small sample size (Cohen, Cohen, West, & Aiken, 2002). One outlier was identified within the child's ACE scores and the data point was adjusted to equal the cutoff score of three standard deviations above its mean. Children's IQ scores was then regressed on child's ACE scores and Parental Involvement in order to determine other outliers by examining leverage. The leverage cutoff score of 0.18 was determined to be the mean value of the two regressed variables using the formula $3(k+1)/n$ due to our small sample size (Cohen, Cohen, West, & Aiken, 2003). All values were below the cutoff score except for one data point with a 0.19 value that was determined to be low leverage due to its close proximity to our cutoff score of 0.18. Therefore, it was left unchanged. Regression coefficients of VIF above 10 and tolerance below 0.10 were indicative of a concern for high correlations among the variable (Cohen, Cohen, West, & Aiken, 2003). Multicollinearity was not a concern for our VIF of 1.22 and tolerance of 0.82. There were no violations of assumptions in our dataset and no missing data.

Prior to running our primary analyses, the correlations among the primary study

variables was determined (Table 2). The Pearson Correlation indicated that there was a significant correlation between child ACE score and Parental Involvement ($r = -0.42, p < 0.01$). There was no significant correlation between child ACE scores and IQ ($r = 0.12, p > 0.05$) and Parental Involvement and IQ ($r = 0.08, p > 0.05$). Though a direct correlation between child's ACE scores and IQ was not established in our dataset, we examined whether parent's involvement would indirectly influence children's cognitive abilities among children exposed to adversities. There is previous evidence that childhood adversities and trauma negatively impact cognitive abilities, and that parental interventions could positively impact cognitive abilities. As child's ACE scores was significantly correlated with parental involvement in our dataset, we proceeded with testing the influence of parental interventions on the relation between children's adversities and their cognition.

Table 2. Correlation Among Variables Using Pearson Coefficients.

	Child's ACE	Total IQ Score	Parental Involvement
Child's ACE	-	-.012	-0.42*
Total IQ Score	-0.12	-	0.08
Parental Involvement	-0.42*	0.08	-

*Denotes significance at 0.05 level of a two-tailed test.

Demographic variables were examined for a significant correlation with both our independent (child ACE) and dependent (IQ) variables to determine possible covariables.

The variables examined included child age, child gender, child race, parent age, parent marital status, parent education, and parent number of work hours weekly. Categorical variables were dichotomized to determine significance of correlation in our analysis. Children's race was dichotomized to include LatinX/Hispanic and other category. Parent's marital status was also dichotomized to include married and not married category. Though parent's marital status was significantly correlated with child's ACE score ($p < 0.01$) it was not significantly correlated with children's IQ. Similarly, children's race was significantly correlated with children's IQ ($p < 0.05$) but not with their ACE scores. Therefore, there were no covariates included in our analyses.

Primary Analyses

The statistical significance of the analysis was determined via the indirect effect (ab) of the ACE scores on IQ via parental involvement. Parental involvement was tested as a mediator of the relationship between child ACE scores and cognitive ability (IQ) using the PROCESS macro bootstrapping strategy for testing mediation (Hayes, 2017). Results indicated that that parental involvement did not significantly mediate the relationship between children's ACE scores and their IQ ($ab = 0.13$, 95% CI [-1.17, 0.81], $p > 0.05$).

Children's ACEs and Parental Involvement

The pathway coefficient between CACEs and parental involvement was significant ($a = -1.16$, 95% CI [-1.89, -0.43], $p < 0.001$). As Children's ACEs increase, parental involvement decreases.

Parental Involvement and IQ

The pathway coefficient between parental involvement and IQ was not significant ($b = 0.12$, 95% CI [-0.78, 0.99], $p > 0.05$).

Children's ACEs and IQ

The pathway coefficient between CACEs and IQ was not significant ($c' = -0.78$, 95% CI [-3.24, 1.68], $p > 0.05$).

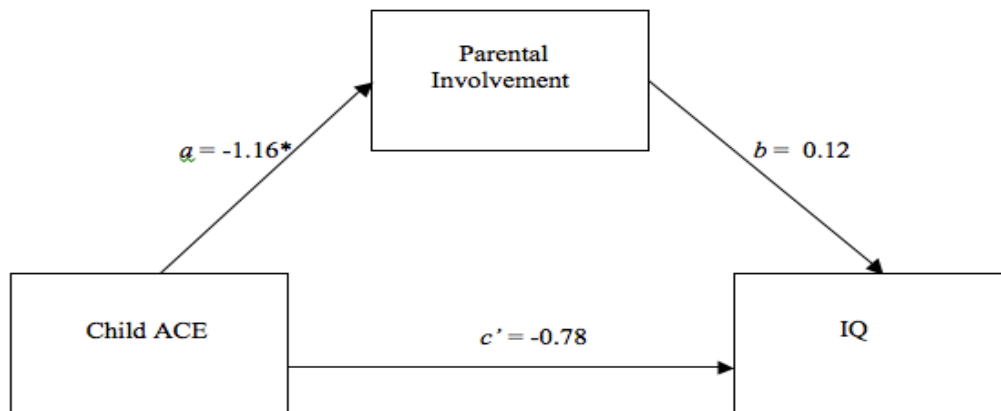


Figure 1. Mediating Path Analysis Diagram of Parental Involvement, ACEs, and Intelligence Quotient. The pathway coefficients are provided next the path. *Denotes significant path in diagram.

Post Hoc Analyses

As our primary analyses were not significant, further examination and expansion of our primary hypothesis were conducted. Our total IQ variable was a composite score

of verbal intelligence and non-verbal intelligence. As verbal intelligence was significantly correlated with IQ ($r = 0.69, p < 0.01$), non-verbal intelligence was also significantly correlated with IQ ($r = 0.65, p < 0.01$), and the two were significantly correlated with each other ($r = 0.51, p < 0.01$), we continued our post-hoc analyses to include these two variables independently in substitution for children's total IQ score. Prior to our analyses, the correlation between all variables was examined. Though verbal and non-verbal intelligence did not have a significant correlation with child ACE scores ($r = -1.08, p > 0.05$; $r = -0.10, p > 0.05$) and Parental Involvement ($r = 0.06, p > 0.05$; $r = -0.18, p > 0.05$), our post hoc analyses were conducted to rule out the possible mediation effect even without a main effect between child ACE score and verbal or non-verbal intelligence.

Parental involvement was tested as a mediator of the relationship between child ACE scores and verbal intelligence using the PROCESS macro bootstrapping strategy for testing mediation (Hayes, 2017). Results indicated that parental involvement did not significantly mediate the relationship between children's ACE scores and their verbal intelligence ($ab = -0.04, 95\% \text{ CI } [-1.00, 0.83], p > 0.05$). Parental involvement was also tested as a mediator of the relationship between child ACEs and non-verbal intelligence using the same method. Results indicated that that parental involvement did not significantly mediate the relationship between children's ACEs and non-verbal intelligence ($ab = 0.96, 95\% \text{ CI } [-0.05, 2.69], p > 0.05$).

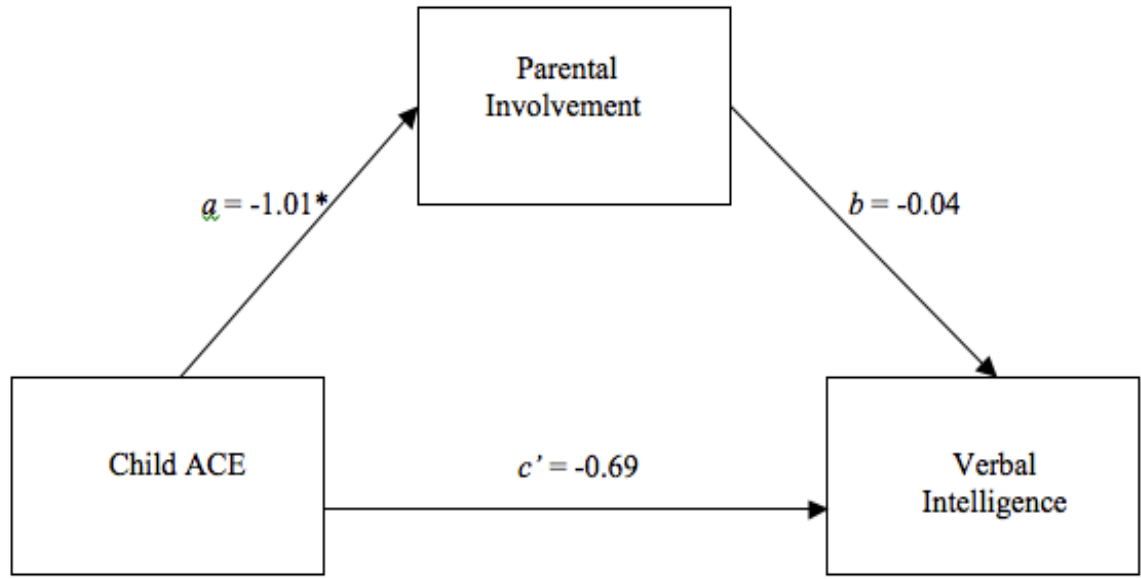


Figure 2. Mediating Path Analysis Diagram of Parental Involvement, ACEs, and Verbal Intelligence. The pathway coefficients are provided next the path. *Denotes significant path in diagram.

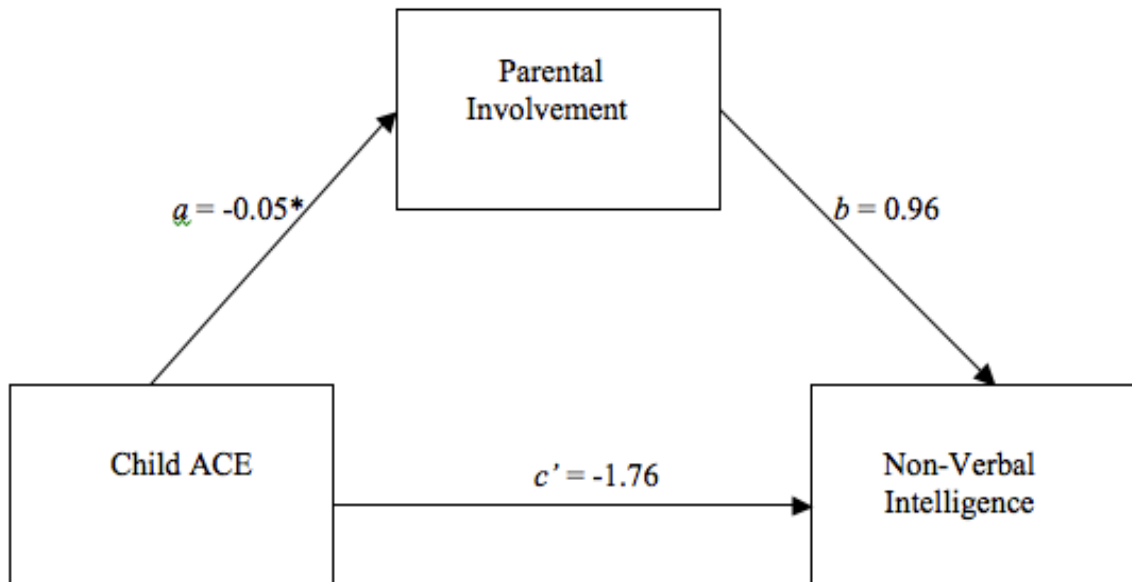


Figure 3. Mediating Path Analysis Diagram of Parental Involvement, ACEs, and Non-Verbal Intelligence. The pathway coefficients are provided next the path. *Denotes significant path in diagram.

Lastly, we considered the possibility that parental involvement may moderate the relationship between child’s ACE scores and their IQ. As Parental Involvement was not indicated to indirectly impact the relationship of our independent and dependent variable, we examined whether the amount of parental involvement may impact the relationship between children’s ACE scores and their intelligence. We used the program ModGraph for our moderation analysis (Jose, 2013). Unstandardized beta coefficients were obtained from a hierarchical multiple regression analysis and were input into the program along with the mean and standard deviation of child ACE scores and Parental Involvement (Table 3). Results indicated that low, medium, or high levels of parental involvement did not significantly effect the relationship between children’s ACE scores and their IQ. (Figure 4).

Table 3. Unstandardized Coefficients From a Hierarchical Multiple Regression Analysis.

	<i>B</i>	<i>M (SD)</i>
Constant	97.59	-
Child’s ACE	-0.91	1.46 (1.92)
Parental Involvement (PI)	-0.78	16.22 (5.32)
Interaction (ACExPI)	0.11	-

Note. None of the coefficients were significant at a 0.05 level.

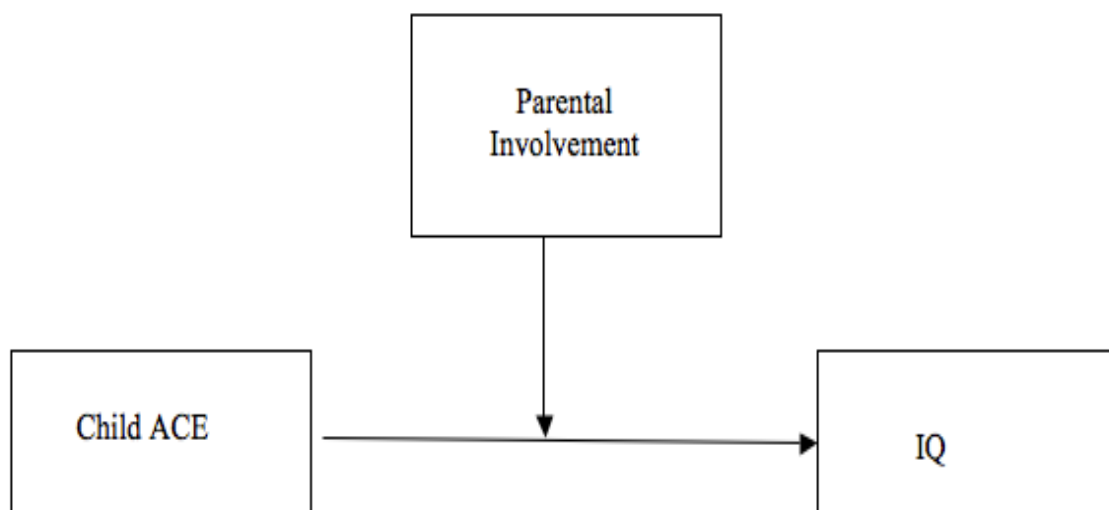


Figure 4. Moderating Path Analysis Diagram of Parental Involvement, ACEs, and Intelligence Quotient.

CHAPTER FOUR

CONCLUSION

Discussion

Our study examined parental involvement as a mediator of the relationship between Adverse Childhood Experiences (ACE) and child intelligence quotient (IQ). We measured parental involvement as a subcategory of the parenting relationship, specifically, by the number of different activities parents engaged with their children. Our primary results indicated that parental involvement did not significantly mediate the relationship between children's ACE scores and their IQ. Further analyses demonstrated that parental involvement did not mediate the relationship between children's ACE scores and their verbal or non-verbal intelligence. Other analyses did not indicate parental involvement as a significant moderator between children's ACEs and IQ. However, findings did indicate a significant association between children's ACE scores and parental involvement.

According to previous studies, there is evidence that childhood trauma could impact verbal intelligence which continues into adulthood. One study found that those with a history of physical, sexual, or psychological abuse, had more than six times the deficits in the left hemisphere (than to the right hemisphere) and those who only experienced psychological abuse having eight times more deficits (Teicher, 2000). Further, among adults who were victims of trauma in childhood, MRIs showed smaller volumes in hippocampus (Bremner, 1997; Driessen, 2000), amygdala (Driessen, 2000), and impairments in verbal declarative memory (Teicher, 2000). A history of childhood

trauma is associated with a decreased cognitive performance in verbal intelligence (Aas et al., 2012). The results of our study did not support results of similar studies, albeit our study focused on children between 5-11 years of age instead of adults whom have been the main focus of previous studies. Our findings may be attributed to that fact that previous studies examined long-term outcome of childhood trauma among adults, and examined the negative impact of cognitive functioning after the formation of various brain structures. Among children, their cognitive regions associated with verbal intelligence and cognitive performances are continuing to grow, expand, and form numerous new synapses. The children in our study may have been too young to capture the possible negative impact of adversities on intelligence. Child resiliency may also help explain our unexpected findings. Protective factors including distracting activities, engagement at school, peer support, presence of a significant role model, other siblings at home, may aid in their perception and processing of adverse experiences, and therefore, to some degree shield them from the negative impacts associated with childhood trauma as they are being experienced.

Furthermore, as previous research discussed the impact of brain development associated with childhood trauma, the individuality of experienced trauma was not considered in our study. Children may perceive traumatic experiences differently, and though our study was indirectly considering parental involvement as a possible protective factor, a limitation of our study was establishing adverse experiences as a collective traumatic experience among children. Therefore, we formed our hypotheses that the negative consequences of childhood trauma would resemble experienced childhood adversities. The intensity, frequency, duration, protective factors, personalities, and

possibly the age of experienced adversity may impact each child substantially differently, and consequentially, affect their intelligence differently than expected from a population as a whole.

With evidence that parents play an essential role in children's intellectual development, specifically at a young age, we expected to find a significant correlation between parental involvement and children's IQ. A possible reason to our inconsistent findings may be that parental involvement was measured by some activities that may not have been as applicable to our sample. The Parental Involvement scale was normed by a population where more than half of the participants were White and from the South; the other three identified races/ethnicities included Hispanic, African-American, and Other. Given that the majority of our participants were LatinX/Hispanic, perhaps the cultural disparities may partially explain the outcome of our study. For example, within the LatinX/Hispanic culture, the parent-child relationship may generally focus on verbal interactions, such as terms of endearment, informal conversations, and physical touch (Borrego et al., 2006), which differs from our measure of number of engaged activities together.

Additionally, the version of our parental involvement measure was normed for children ages six through 18, and among our participants, five year-olds were among the higher frequency (18%) of children within our sample size. Therefore, our measure of parental involvement may have not been well suited for the sample of our study. Another possible reason to our unexpected finding may be that the measure did not include items that would address parent's involvement with their children's academic functioning, which is a significant factor in cognitive development. Perhaps items such as helping

children with their homework, monitoring children's academic performance, attending school meetings, and maintaining communication with their teacher would have been of benefit in capturing all aspects of parental involvement that would impact a child's growth.

Instead, we found that children's ACE scores were only significantly correlated with parental involvement. This indicated that with the increase of adverse experiences in childhood, parental involvement decreases. As ACE scores were partially measured by detrimental parental behaviors towards children (i.e. abuse and neglect), our study supported the expectation that with an increase in negative parent-child relationship, the amount of positive activities engaged with them would decrease. Furthermore, parents' own life challenges (i.e. substance abuse, separation/divorce, incarceration) were also factored in child ACEs; therefore, parental hardships would also divert positive attention from their children and negatively impact their behaviors towards children.

In terms of considering parental involvement as a mediating factor in our study, there have been contradicting and limiting support in research. One study found that parental involvement, defined as the number of days caregiver ate breakfast with child, was a significant mediator between parents' assets and children's academic outcomes (Grinstein-Weiss et al., 2009). Conversely, the time parents spent engaging with their child via talking or playing with child, and praising child each week, was not a significant mediator (Grinstein-Weiss, Yeo, Irish, & Zhan, 2009). Though our study did not indicate parental involvement as a significant mediator between children's ACEs and their IQ, it is noticeable that parental involvement has been defined differently in various studies. A common feature among the different definitions is the parent-child engagement in

activities, including verbal praises which entails an interaction. Also, the frequency of each engaged activity is a shared factor when measuring parental involvement.

However, despite the commonality between the different definitions of parental involvement, there are noticeable differences in the type of parent-child activities among the studies, including ours. We used eight activities to measure parental involvement, which included engagement with outings, completing projects, outdoor activities as well as planning activities together, compared to other studies that either utilized fewer activities or mainly verbal interactions. Therefore, perhaps how parental involvement was measured in our study altered the results in our unexpected outcomes. Perhaps our questionnaire measured a different outcome of parental involvement, such as parent-child attachment, parent-child relationship, language development, or social skills that though are pivotal in development, may have had low accuracy in targeting intelligence.

Limitations

A main limitation in this field and our outcome may be that the quality of the parent-child interactions was not studied. Therefore, even if parents spend a significant amount of time interacting with their children, or engage in various activities with them, the poor quality of their interactions could continue to result in an insignificant contributor to their children's development. Another limitation of our study may be the cultural insensitivity of our parental involvement measure. Though the measure was normed by samples from different regions and background, the majority of the participants were White, which is significantly different than the majority of our participants whom had low-income and were Latinx/Hispanic. Additionally, the version

of the measure that we used was normed for children ages six through 18; however, our sample included many five year-olds as well. Lastly, many previous studies have focused on the benefits of parental involvement within school settings. Our measure did not include parents' engagement with academically-related activities given that involvement with academic performance is one of parents' essential roles and may be closely correlated with a child's cognitive functioning.

Future Directions

Our study and hypotheses aimed to fill the gap in research pertaining to studying the possible impact of children's ACEs and their intelligence via the indirect effect of parental involvement. According to our power calculations, we had 70% chance of detecting an effect if present. Our limited sample size, including little variability in the demographics of our participants, may have contributed to the outcome of our study. In future studies, a bigger sample size with increased diversity in race, parent education, parent weekly work hours, and parent income, may support our expected outcomes and provide additional valuable information.

Additionally, a better consensus with defining parental involvement in the literature and future studies would be essential in studying this significant factor in children's lives. In our study, adding items that include parental involvement with children's academic functioning, as well as including a broader range of items to capture culturally relevant aspects, would be beneficial. Factoring qualitative, alongside of quantitative, measures of parental involvement would be beneficial in studying the nature of parent-child interactions, relationships, and positive impact. Among children who

experience adversities at home, the increased frequency of parental interactions may not be a positive contributor to their development. Therefore, obtaining qualitative information on the parent-child interaction may better assist in determining the outcome of their interactions. An increase in parental involvement along with a positive parent-child quality of interaction may support the hypothesis that parental involvement is a significant mediator of the relationship between children's ACEs and their intelligence. However, an increased parental involvement with a poor quality or detrimental interaction may negate the potential positive impact. Finally, obtaining information on children's perception of parental involvement could be valuable in ensuring the alignment between parents' and children's' views of interactions.

In conclusion, it is well established that parent's play a significant role in children's development in many aspects of their lives, including cognitive, behavioral, and academic functioning. Children facing adverse experiences are susceptible to many negative outcomes in adulthood, including physical and mental health, as well as cognitive performance. While our study was built on previous studies, we focused on children facing adversities and examining the positive outcome of parental involvement on children's intelligence at a younger age. Though our study did not result in expected outcomes, we predict that with modifications to future studies, including creating a unified and inclusive measure of parental involvement and including a more diverse population, we may show that parents' are a significant mediator of the relationship between children's adverse experiences and their intelligence.

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APPENDIX A

ADVERSE CHILDHOOD EXPERIENCES QUESTIONNAIRE

Items	Response Options		
In the past year, did you worry that your food would run out before you got money or Food Stamps to buy more?	Never	Sometimes	Often
Has your child ever witnessed adults in the home pushing, hitting, kicking or physically threatening each other?	No	Unsure	Yes
Has your child ever lived with a parent or other adult who pushed, kicked, physically hurt or threw something at the child?	No	Unsure	Yes
Do you know or are you concerned that your child was ever touched, or asked to touch, an adult or someone at least 5 years older sexually?	No	Unsure	Yes
Do you swear at or insult your child?	No	Unsure	Yes
Are your child's parents separated, divorced, or not living together?	No	Unsure	Yes
Did your child ever live with anyone who went to prison, jail or other correctional facility?	No	Unsure	Yes
Did your child ever live with anyone who was depressed, mentally ill or suicidal?	No	Unsure	Yes
Did your child ever live with anyone who had a problem with drugs or alcohol?	No	Unsure	Yes
Does your family look out for each other, feel close to each other and support each other?	Yes	Unsure	No

APPENDIX B

PARENTAL INVOLVEMENT, SUBSCALE OF PARENTING

RELATIONSHIP QUESTIONNAIRE

Items	Response Options			
My child and I plan things to do together	Never	Sometimes	Often	Almost Always
My child and I go on outings together	Never	Sometimes	Often	Almost Always
I teach my child how to play new games	Never	Sometimes	Often	Almost Always
My child and I do arts and crafts together	Never	Sometimes	Often	Almost Always
My child and I take walks together	Never	Sometimes	Often	Almost Always
My child and I play games together	Never	Sometimes	Often	Almost Always
My child and I work on projects together	Never	Sometimes	Often	Almost Always
My child and I do things together outdoors	Never	Sometimes	Often	Almost Always