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Adverse Childhood Experiences and Behavioral Problems in Middle Childhood

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Abstract

Children who have been exposed to maltreatment and other adverse childhood experiences (ACEs) are at increased risk for various negative adult health outcomes, including cancer, liver disease, substance abuse, and depression. However, the proximal associations between ACEs and behavioral outcomes during the middle childhood years have been understudied. In addition, many of the ACE studies contain methodological limitations such as reliance on retrospective reports and limited generalizability to populations of lower socioeconomic advantage. The current study uses data from the Fragile Families and Child Well being Study, a national urban birth cohort, to prospectively assess the adverse experiences and subsequent behavior problems of over 3,000 children. Eight ACE categories to which a child was exposed by age 5 were investigated: childhood abuse (emotional and physical), neglect (emotional and physical), and parental domestic violence, anxiety or depression, substance abuse, or incarceration. Results from bivariate analyses indicated that Black children and children with mothers of low education were particularly likely to have been exposed to multiple ACE categories. Regression analyses showed that exposure to ACEs is strongly associated with externalizing and internalizing behaviors and likelihood of ADHD diagnosis in middle childhood. Variation in these associations by racial/ethnic, gender, and maternal education subgroups are examined. This study provides evidence that children as young as 9 begin to show behavioral problems after exposure to early childhood adversities.

Keywords

adverse childhood experiences; behavioral development; behavior problem; middle childhood

Introduction

In 2014, the Administration on Children, Youth, and Families estimated that 702,000 children were victims of maltreatment nationwide (U.S. Department of Health and Human Services [USDHHS], 2016). Survivors of child maltreatment suffer from adverse health consequences throughout their life span, including an increased risk for chronic diseases

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(Danese et al., 2009), mental health disorders (Edwards, Holden, Felitti, & Anda, 2003), and overall reduced health-related quality of life (Corso, Edwards, Fang, & Mercy, 2008). Researchers have found that the long-term health effects of child maltreatment are often due to the cumulative influence of multiple forms of childhood maltreatment and adverse household characteristics in areas such as alcohol and drug abuse, domestic violence, and criminal activity (Dong, Anda, Dube, Giles, & Felitti, 2003; Dube, Williamson, Thompson, Felitti, & Anda, 2004). Collectively, these co-occurring conditions have been termed adverse childhood experiences (ACEs; Felitti et al., 1998).

The Adverse Childhood Experiences (ACE) Study, a collaboration between the Centers for Disease Control and Prevention and Kaiser Permanente's Health Appraisal Clinic in San Diego, is one of the largest research endeavors ever conducted to examine associations between childhood adversity and adult health (Centers for Disease Control and Prevention, 2013). The original ACE questionnaire assessed 7 categories of ACEs: 3 categories of child maltreatment (psychological abuse, physical abuse, and sexual abuse) and 4 categories of household dysfunction (mother treated violently, living with a household member who was a substance abuser, mentally ill or suicidal, or was ever imprisoned). Subsequent ACE studies incorporated neglect and parental divorce or separation into the ACE index. The CDC-Kaiser ACE studies reported a strong, graded relationship between the number of ACEs a person was exposed to and the risk for cancer, ischemic heart disease, liver disease, substance abuse, depression, and chronic obstructive pulmonary disease, among other health problems (Felitti et al., 1998). Since then, numerous investigators have reported the link between ACE exposure and social and health problems, including teen pregnancy (Hillis et al., 2004); autoimmune disease (Dube et al., 2009); and use of psychotropic medications (Anda et al., 2007).

Despite this growing body of literature, the proximal effects of ACEs on behavioral outcomes during the middle childhood years have been understudied. The current study prospectively assessed ACEs and subsequent behavior problems of over 3,000 children. Eight ACE categories to which a child was exposed to by age 5 were investigated: emotional neglect, physical neglect, emotional abuse, physical abuse, and parental domestic violence, anxiety or depression, substance abuse, or incarceration.

Proximal Relationships between ACEs and Child Health Problems

The CDC-Kaiser ACE studies have linked childhood adversity to a wide range of health problems in adulthood. Whether ACEs predict behavioral problems in childhood has received relatively less empirical attention. Internalizing (e.g., anxiety, depression) and externalizing (e.g., aggression) problem behaviors, have been observed to have a higher likelihood of emerging after exposure to childhood adversity. In a study examining ACEs among a pediatric sample, exposure to 4 or more ACEs was associated with 33 times the odds of reporting a learning or behavioral problem as compared to children without ACE exposure (Burke et al., 2011). Other studies have found substantial increases in attention and behavioral problems among children as young as 5 after cumulative ACE exposure (Jimenez et al., 2016; McKelvey et al., 2016). These studies advance the ACE literature by indicating that cumulative adversity is not only associated with strong effects on adulthood health

outcomes but also childhood behavioral problems. Nevertheless, that most of these studies rely on cross-sectional and retrospective study designs introduces the possibility of reverse causation in regards to the associations between ACEs and child behavioral problems. A first step to overcoming this limitation involves examining these associations with a prospective lens.

Children with problem behaviors have an increased risk of developing clinical level mental illnesses and physical health problems later in life. Adults are more vulnerable to depression if they were anxious or depressed in childhood and more likely to have anxiety disorders if they experienced childhood externalizing problem behaviors (Roza, Hofstra, van der Ende, & Verhulst, 2003). Children with behavioral problems are also at risk of engaging in health risk behaviors later in childhood (Fanti & Heinrich, 2010). This association between behavioral problems and health risk behaviors is significant given that the development of the disease outcomes reported in the CDC-Kaiser ACE studies is likely mediated through engagement in health risk behaviors in adolescence or early adulthood. For instance, victims of maltreatment have been found to be susceptible to numerous health risk behaviors during adolescence, such as sexual promiscuity, substance use (Repetti, Taylor, & Seeman, 2002), and obesity (Shin & Miller, 2012), behaviors that may develop into disabling diseases and premature death in adulthood. In sum, existing evidence points to the value of including middle childhood problem behaviors in the examination of childhood adversity and subsequent health problems.

Subgroup Differences in Prevalence and Susceptibility to ACE Exposure

Differences exist in risk of adversity in families across levels of socioeconomic advantage. Children are more likely to be victims of child maltreatment if they come from low-income or single-parent households (Berger, 2004; USDHHS, 2015), characteristics that are highly correlated with low educational attainment among parents. Parents of such households may have insufficient financial, emotional, or social resources to adequately support their children. It is also possible that increased stress resulting from socioeconomic disadvantage contributes to more punitive parenting behaviors among these families (Graham, Weiner, Cobb, & Henderson, 2001). Relatedly, risk for exposure to adversity is not evenly distributed across racial and ethnic subgroups. Hispanic and Black children have disproportionately high rates of maltreatment victimization (USDHHS, 2015) and disproportionately grow up in disadvantaged communities. The CDC-Kaiser ACE studies demonstrated that child maltreatment and adverse household characteristics are highly co-occurring phenomenon, as the presence of one ACE significantly predicting the odds of exposure to additional ACEs (Dong et al., 2003). For this reason, it is likely that children in socioeconomically disadvantaged families will not only have higher exposure to maltreatment, but will also have greater exposure to other ACE categories compared to children of higher socioeconomic advantage.

Although ACE exposure may be greater in more vulnerable families, there has been scant research dedicated to potential differences in health or behavioral problems after ACE exposure across groups of differing levels of advantage. The studies that are available portray a mixed picture. Schilling et al. (2007) observed that the negative impact of

cumulative and individual ACEs on White adolescents was consistently greater than on Blacks and Hispanics in the areas of mental health and behavioral problems. For instance, White adolescents with 4 ACEs scored almost 0.5 standard deviations higher on antisocial behaviors than Whites experiencing no ACEs; there were no such associations found for Black or Hispanic adolescents. Similarly, Gerard and Buehler (2004) reported that the associations between multiple risk exposure and internalizing and externalizing behavior problems were stronger for White youth compared to Black and Hispanic youth. In contrast, using a nationally representative sample of over 15 thousand adolescents, Wickrama and colleagues (2005) found that while White adolescents were more vulnerable to the influence of family poverty on depressive symptoms, Black adolescents were more affected by the detrimental influence of community-level poverty.

Differential susceptibility to ACE exposure across gender has also been suggested. Studies using an urban, minority sample suggests that rates of exposure to ACEs may be higher for males than for females (Mersky, Topitzes, & Reynolds, 2013); yet there is mixed evidence as to whether boys or girls are more negatively affected by ACE exposure. Some researchers report that boys are more likely to develop attention-related or externalizing behavioral problems after exposure to adversity (Haskins, 2014; Cooper, Osborne, Beck, & McLanahan, 2011). Others have found that the influences of cumulative risk are stronger for girls than for boys when it comes to internalizing behavioral problems (Gerard & Buehler, 2004). Still others find that young men are equally likely to exhibit internalizing symptoms as young women (Schilling, Aseltine Jr., & Gore, 2007). Further research examining subgroup differences in ACE exposure and susceptibility is needed to provide clarification to these findings.

The Current Study

A notable strength of the CDC-Kaiser ACE studies is that the link between ACE exposure and a large range of physical and mental health results was examined. However, a weakness of these studies is the reliance on retrospective reports of ACEs, which are prone to recall bias and measurement error. The ACE studies also used of a predominately White sample of higher socioeconomic advantage (Felitti et al., 1998), so less is known as to whether ACEs would have similar effects on more socially and economically diverse subgroups. Moreover, this literature overlooks the proximal effects of ACEs by primarily focusing on outcomes in adulthood. Finally, the CDC-Kaiser ACE study and many subsequent investigations rarely provide sufficient controls for confounding influences that could account for effects attributed to ACEs. Our study extends the ACE literature by using a prospective longitudinal study design to examine the association between ACE exposure by age 5 and the presence of behavioral problems in middle childhood among a diverse sample of U.S. children.

Our analyses focus on both total amounts and clinical levels of internalizing and externalizing behavioral problems. We also examine the presence of an ADHD diagnosis, given the high comorbidity between attention related problems and behavioral problems after exposure to family adversity (Biederman, et al., 1995). Examining clinical levels of behavioral problems and ADHD diagnosis provides some indication as to whether early ACE exposure is associated with both the number of behavioral problems children

demonstrate as well as the likelihood of more severe, diagnosable behavioral problems. We hypothesize a positive relation between ACE exposure and each of the behavioral outcomes. A second aim of the study is to examine differences in susceptibility to ACE exposure across groups of race, gender, and maternal education. We cannot provide a hypothesis about which groups would develop worse behavioral problems after ACE exposure due to inconclusive findings in prior studies. The final aim of the study is to examine whether the ACE-specific categories or cumulative exposure to ACEs is more strongly associated with worse behavioral problems in middle childhood. We hypothesize that while some ACEs may have stronger associations than others, children exposed to the highest number of ACEs will have more serious problems compared to children with fewer ACEs.

Methods

Data

Our data were drawn from the Fragile Families and Child Well being Study (FFCW). The FFCW is a population-based, longitudinal birth cohort of 4,898 children born in large U.S. cities between 1998 and 2000 (Reichman, Teitler, Garfinkel, & McLanahan, 2001). The study design incorporated a three-to-one sample of non-marital-to-marital births. Thus, FFCW parents are disproportionately likely to be of minority race/ethnicity, have limited educational attainment, low-income, and be unmarried relative to the U.S. population. FFCW staff conducted interviews in hospitals with eligible families within 24 hours of the focal child's birth. Follow-up interviews were administered to parents by telephone when the child was approximately 1, 3, 5, and 9 years old. Families were also asked to participate in an in-home interview at the 3, 5, and 9 interviews to assess parental behaviors, mother-child interactions, and the quality of the child's home environment. A detailed description of the FFCW sampling strategy and interview protocol has been published elsewhere (Reichman et al., 2001). All information on the child's ACE exposures and behavioral problems for the current study were obtained from the primary caregiver's core surveys and in-home assessments from baseline to year 9; typically, the primary caregiver was the mother.

We used multiple imputation techniques to impute values for all variables with missing data for the full FFCW sample of 4,898 children using Stata's MI program. Specifically, we created and merged 40 data sets using a chained equations approach. Although multiple imputation is a valuable strategy for handling missing data with longitudinal data, imputing data that are not missing at random can produce biased estimates of coefficients and standard errors (Allison, 2001). Because families who left the study are not missing at random, we take a conservative approach outlined by von Hippel (2007) by using dependent variables to impute values of the independent variables, but ultimately excluded cases with imputed dependent variables from the analyses. The resulting analytical samples were 3,108 children with complete data on their externalizing behaviors and ADHD diagnosis and 3,043 children with complete data on their internalizing behaviors. Prior to imputation, missing data on most covariates were below 5%; however, rates were roughly 21% for the physical neglect, physical abuse, and emotional abuse variables which were obtained during the in-home assessments.

Roughly 32% of mothers in the externalizing behavior sample had less than a high school degree; 32% had a high school degree, and 36% had more than a high school degree. The racial and ethnic distribution is 21% White, 50% Black, 25% and 4% of other race or ethnicity. About 41% of mothers were single at the baseline interview, 23% were married, and 36% were cohabitating with a partner. Forty-eight percent of the focal children were female. There were no significant demographic differences between the two analytical samples.

Measures

Mirroring the CDC-Kaiser studies, we measured eight categories of child maltreatment and adverse household characteristics to represent ACEs: emotional neglect, physical neglect, emotional abuse, physical abuse, and parental domestic violence, anxiety or depression, substance abuse, or incarceration. ACE exposure was assessed from child's birth through age 5. There were two ACEs included in the CDC-Kaiser that we did not include in our study. First, we were unable to include sexual abuse as an ACE as there were no behaviorally approximated items on sexual abuse included in the FFCW interviews. Second, we chose not to include parental divorce or separation as an ACE because we did not consider it to be a relevant event to families participating in the FFCW study, which oversampled for non-marital births. Exclusion of this ACE is supported by findings from Wade et al.'s study (2014) in which focus groups were conducted to investigate the most prominent childhood adversities faced by youth who had grown up in low income neighborhoods in Philadelphia. Parental separation or divorce was not endorsed by the youth as most of the families in the study began as single-parent homes, making divorce/separation irrelevant to their lives.

Child Maltreatment—Items for the child maltreatment categories were taken from subscales of the Parent-Child Conflict Tactic Scale (CTS-PC; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998). Each subscale measured acts or circumstances of maltreatment that may have occurred in the 12 months preceding the interview. In FFCW, CTS-PC subscales were coded in an ordinal scale (e.g., none, once, twice, 3–5 times, 6–10 times, 11–20 times, and more than 20 times). To calculate the degree of physical and emotional abuse, we considered the midpoints of the category in each item (i.e., once = 1, twice = 2, 3–5 times = 4, 6–10 times = 8, 11–20 times = 15, and more than 20 times = 25) and totaled them. These totals were then transformed into a dichotomous variable indicating whether a family scored in the top 10th percentile for the total number of acts toward the child in the prior year. The physical and emotional neglect variables were dichotomized to indicate whether any of these acts had ever occurred. *Physical neglect* was measured using four items asked of the mother, including “were not able to make sure your child got the food he/she needed” and “were so drunk or high that you had a problem taking care of your child” ($\alpha = .84$). *Physical abuse* was measured with five items, such as whether the parent had “hit him/her on the bottom with something like a belt, hairbrush, or stick, or some other hard object” and “shook him/her” ($\alpha = .82$). *Emotional abuse* measures consisted of five items, such as whether the mother had “sworn or cursed at” or “called him/her dumb or lazy or some other name like that” ($\alpha = .80$). *Emotional neglect* was measured with 1 item from the CTS asking whether the mother had been so caught up with her own problems that she was not

able to show love to the child. Additional items regarding emotional neglect were taken from parental warmth and involvement section of the survey; sample items include how often the parent “told the child that she or he loves him/her” or “hugs or shows physical affection to the child” ($\alpha = .78$). Scores were obtained from the focal child’s mother and biological father, or mother’s current partner if the partner was currently residing in the household. Scores in the lowest decile of the parental warmth scale were also indicated as experiencing emotional neglect. While these behaviors do not directly measure child maltreatment, they can be seen as proxies for appropriate caregiving and are conceptually aligned with the major maltreatment subtypes. Other studies have used similar measures of parent behavior to approximate maltreatment risk (Font & Berger, 2015).

Household ACEs were computed from data pertaining to the child’s biological parents or the mother’s current partner who were residing in the household at the time of each assessment. To be considered as a household member for our analyses, the child’s mother had to live with the child at least half of the time. The child’s biological father or the mother’s current partner were considered to live in the household if the mother reported that she currently lived with either of them for “all or most of the time.”

Parental Substance Abuse—Substance abuse was assessed differently for mothers, biological fathers, and current partners, with significantly more detail collected about mothers. For maternal substance abuse, 14 items were used to create a single indicator variable of whether a mother has a drug or alcohol problem. Example items include: (a) “Since child was born, has your drug use interfered with your work at school, or a job, or at home?” (b) “Did you have such a strong desire or urge to use drugs that you could not keep from using them?” (c) “Did you have a period of a month or more when you spent a great deal of the time using drugs or getting over its/their effects?” Biological father and current partner substance abuse was assessed with a mother’s affirmative response to whether the father or the mother’s current partner had problems such as keeping a job or getting along with family and friends because of alcohol or drug use. A dichotomous variable representing parental substance abuse was created to indicate whether the child’s mother, biological partner, or mothers current partner had a substance abuse problem.

Parental Incarceration—Parental incarceration was indicated if the mother or biological father of the baby currently or recently spent time in prison or jail in the past year. This information was not available for the mother’s current partner.

Parental Anxiety and/or Depression—The Composite Interview Diagnostic Interview – Short Form (CIDI-SF; Kessler et al., 1998) was used to classify whether the mother and biological father had generalized anxiety disorder and/or major depression according to DSM-IV criteria. The CIDI is a standardized instrument for assessment of mental disorders intended for use in various research studies, containing 15 items to assess major depression and 20 items to measure generalized anxiety disorder. This scale has been found to have good inter-rater reliability, test-retest reliability, and validity for depression and anxiety (Patten, Brandon-Christie, Devji, & Sedmak, 2000; Wittchen, 1994). A dichotomous indicator was created if the child’s mother and/or father ever had generalized anxiety

disorder and/or major depression. This information was not available for the mother's current partner.

Parental Domestic violence—We use a broader definition of domestic violence compared to that used in the CDC-Kaiser studies. In those studies, only physical violence was considered. However, child's exposure to domestic violence was indicated in our study if a mother reported that she had experienced any amount of physical, emotional, or sexual abuse inflicted by the child's biological father or by her current romantic partner (whoever she was currently romantically involved with). Physical violence was measured with the items "he slapped or kicked you" and "he hit you with his fist or a dangerous object." Emotional violence items included (a) "he tried to isolate you from family and friends," (b) "he tried to prevent you from going to work and/or school," and (c) "he withheld money, made you ask for money, or took your money." Sexual abuse was measured with the item, "he tried to make you have sex or do sexual things you didn't want to do." For each item, mothers could respond with 0=*never*, 1=*sometimes*, and 2=*often*. If a mother reported never on all six items, domestic violence exposure was coded as *no*.

Child Internalizing and Externalizing Behaviors—We used the Child Behavior Checklist (Achenbach & Rescorla, 2001) to measure internalizing and externalizing behaviors when the child was 9 years old. Each mother was asked to rate whether each behavior is not true (0), somewhat or sometimes true (1), or very true or often true (2) of the focal child. To calculate each dimension, responses to each item are summed and standardized to have a mean of zero and a standard deviation of one with higher scores indicating more behavior problems. The total externalizing score (33 items $\alpha=.90$) includes all items from the aggressive behavior (18 items $\alpha=.88$) and rule breaking (15 items $\alpha=.78$) subscales. The total internalizing score (32 items $\alpha=.88$) was computed as the sum of the following subscales: anxious/depressed (13 items $\alpha=.78$), withdrawn/depressed (8 items, $\alpha=.70$), and somatic complaints (11 items $\alpha=.77$). Although regression analyses were conducted on all problem behavior domains, only the total internalizing and total externalizing scores are presented. We also created dichotomous variables of a normal range (T scores less than 65) vs. a range where the behaviors likely warrant professional help (T scores of ≥ 65), as recommended by Achenbach and Rescorla (2001).

Child ADHD Diagnosis—At the age 9 in-home assessment, mothers were asked if they had ever been told by a doctor or health professional that their child had a diagnosis of attention deficit disorder (ADD) or attention deficit hyperactivity disorder (ADHD).

Covariates—Our regression analyses account for a set of birth and sociodemographic characteristics that may be correlated with both behavioral problems and adverse childhood experiences. These covariates include maternal race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic), maternal education (less than a high school degree, a high school degree or GED, more than a high school education), maternal marital status (married, cohabitating, single), maternal age at focal child's birth, number of children the mother has given birth to, whether the focal child was the mother's first birth, prenatal drug or alcohol use, child gender, whether the child was of low birth weight, whether the focal child's

grandmother was living in the household, the number of children and adults in the household, and family income, which was operationalized as the logarithm of average household income from child's birth to age 5.

Analytic Strategy

All analyses were conducted using Stata statistical software (v13; Stata Corp LP, College Station, TX). The number of ACE categories to which each child was exposed was totaled to obtain an overall summary score, ranging from 0 (unexposed) to 8 (exposed to all categories). That is, if a particular ACE was reported at any of the baseline, 1 year, 3 year, and 5 year interviews, then the child was assigned a score of 1 for that ACE. Due to the small sample sizes and to be consistent with the CDC-Kaiser ACE literature, ACE scores of 4 through 8 were combined into one category (4 or more). Thus, analyses were conducted with the summed score as five dichotomous variables, with zero experiences as the referent.

Descriptive analyses document the prevalence of ACEs and study outcomes for the full sample as well as their variation across, race/ethnicity, gender, and maternal education. We estimated ordinary least squares linear and logistic regressions to investigate various components of the associations between ACEs and child behavioral outcomes. In the first set of regression models, we assessed whether there was a positive association between the amount of adverse exposures experienced by age 5 and behavioral outcomes reported at age 9 (total externalizing, clinical externalizing, total internalizing, clinical internalizing, and ADHD diagnosis). Next, we examined whether there were differential associations of ACE exposure and child behavioral outcomes across racial, gender, and maternal education subgroups. In each regression, we tested the statistical equivalence of the coefficients for each variable across equations. Finally, we investigated the individual contributions of each ACE category in predicting behavioral outcomes.

Results

Table 1 presents the prevalence of ACE categories experienced by age 5. There were no significant differences in ACE prevalence between the analytical sample used for the externalizing behaviors and ADHD diagnosis outcomes (N=3108) and the sample used for the internalizing behaviors (N=3043), thus results are only shown for the former. In the full sample, the most prevalent ACEs were parental anxiety or depression, domestic violence exposure, emotional abuse, and emotional neglect. Level of ACE exposure ranged from 0 to 8. The majority of children (77.4%) in the sample were exposed to 1 or more ACEs. Specifically, 22.6% had an ACE score of 0, 29.1% had an ACE score of 1, 22.4% had an ACE score of 2, 14.1% had an ACE score of 3, and 11.3% had an ACE score of 4 or more. It is important to note, each adversity was found to be weakly correlated with one another, with the exception of physical abuse and emotional abuse ($r=.45$ $p<.05$). These ACEs can generally be considered to describe related yet distinct experiences.

Black children reported the highest prevalence of each maltreatment type and were also much more likely to live with an adult who had spent time in jail or prison compared to the other racial groups. White children were more likely to report two household ACEs, substance abuse and parental anxiety or depression, and Hispanic children had the highest

prevalence of domestic violence exposure compared to the other children. In general, boys and girls reported similar exposure to each ACE. Boys, however, were more likely to experience physical and emotional abuse compared to girls. Children of mothers with a high school education or lower typically had more exposure to each ACE compared to children of mothers with more education. Furthermore, Black and White children, males, and children of mothers with lower education were more likely to display higher levels of behavioral problems compared to other groups of children.

Results for our primary regression analyses are presented in Table 2. We standardized internalizing and externalizing scores in all analyses to have a mean of 0 and standard deviation of one such that estimates can be interpreted in standard deviation units. To assess the impact of this decision, regression analyses were conducted with unstandardized scores and substantial differences in the results were not found. In the full model, we found a relatively monotonic and statistically significant association of ACEs with behavior problems. Compared to those with 0 ACEs (the reference group), children with 1 ACE had an increase of .20 standard deviations in externalizing behaviors ($p < .001$), those with 2 ACEs had a .35 standard deviation increase ($p < .001$), children with 3 ACEs had an increase of .59 standard deviations ($p < .001$), and children with 4 or more ACEs had .86 standard deviation increase in externalizing behaviors ($p < .001$). Similarly, children with 1 ACE had roughly 2.5 times the odds of demonstrating the level of externalizing behavior warranting professional attention ($p < .01$), children with 2 ACEs had 3.4 times the odds ($p < .001$), children with 3 ACEs had 4.7 times the odds ($p < .001$), and children with 4 or more ACEs had 9.3 times the odds ($p > .001$) compared to children who had never experienced any ACEs. The internalizing and ADHD outcomes exhibit a similar positive and increasing association, although the influence of ACE exposure are not as strong. For example, compared to children with 0 ACEs, those with 2, 3, and 4 or more ACEs had 1.7 ($p < .01$), 1.8 ($p < .01$), and 2.7 ($p < .001$) times the odds, respectively, of having an ADHD diagnosis. The likelihood of having a diagnosis among children with 1 ACE compared to children with 0 ACEs was not significantly different.

We also assessed to what extent the associations between ACE exposure and behavioral outcomes may be influenced by family income (results not shown). We generally found that adjusting for the control variables and family income accounted for a relatively small to moderate portion of the difference in behavioral problems between children with 0 ACEs and children with 1 or more ACEs. Thus, results overall indicate that even after adjusting for family income and other covariates, children exposed to ACEs were more likely to exhibit a higher amount of externalizing and internalizing behaviors and were more likely to have an ADHD diagnosis compared to children who had not experienced any adverse childhood events.

These subsequent regression models investigate whether there were differences in the associations between ACE exposure and behavioral outcomes across race, gender, and maternal education. Heightened ACE exposure increased the likelihood of experiencing each behavioral outcome for White and Black children, but to a lesser extent for Hispanic children. For example, White and Black children reporting 4 or more ACEs had roughly 19 ($p < .001$) and 9 ($p > .001$) times the odds, respectively, of experiencing clinical levels of

externalizing behaviors compared to children of their own races who had never experienced an adverse event. However, there was no association found for Hispanic children. This pattern was also evident for the clinical levels of internalizing behaviors and ADHD diagnosis outcomes. ACE exposure had a particularly strong association with total externalizing behaviors and ADHD diagnosis for Black children while for White children were most likely to demonstrate clinical levels of externalizing and internalizing behaviors as well as total internalizing behaviors.

Boys were more likely to demonstrate total externalizing and internalizing behavioral outcomes after ACE exposure, although girls were much more likely to demonstrate clinical levels of externalizing behaviors. Despite these differences, both boys and girls reporting ACEs were at higher risk for each behavioral outcome, especially at higher ACE exposure, compared to those without ACE exposure. As for maternal education, children in the maternal high school education subgroup demonstrated the strongest association between ACE exposure and the total externalizing and clinical externalizing outcomes. Children of mothers with more than a high school education were more likely to have clinical levels of internalizing behaviors compared to children in the other groups. Compared to children without any ACE exposure, children with 4 or more ACEs had over 7 times ($p<.001$) the odds of demonstrating these high levels of internalizing behaviors for the high maternal education subgroup. In contrast, children with an ACE score of 4 or more had roughly 5 times ($p<.001$) times the odds of reporting clinical levels compared to children with 0 ACEs for those with mother with a high school education. Although risk of each behavioral outcome increased with increasing ACE exposure for children of mothers in the lowest education group, this group did not display drastically higher rates of problems compared to the children of the other subgroups. Finally, the positive association of ACE exposure on ADHD was roughly the same across each maternal education subgroup.

Our final set of regressions examined, for the full sample, the relative association of each specific type of adverse event with behavioral problems after controlling for covariates (Table 3). All ACEs had some influence on at least one behavioral outcome and all outcomes were predicted by more than one ACE. The only ACE to consistently predict each behavioral outcome was parental anxiety or depression, which also was the most frequently reported ACE in the sample. Although particular ACEs were found to have larger associations with behavioral outcomes compared to others, associations between each ACE and outcome were not nearly as large as the associations found between cumulative ACEs and behavioral problems.

Discussion

There is a substantial body of research linking childhood maltreatment and adverse household characteristics to a number of adult chronic diseases and health risk behaviors, yet the studies examining the early effects of ACE exposure are lacking. Our study begins to fill this gap by examining the relation between early adverse experiences and the presence of behavioral problems at age 9. We observed differences in the prevalence of ACEs reported in our study compared to that of the CDC-Kaiser ACE studies. Roughly 75% of our study group was exposed to at least 1 adverse exposure compared with 64% of the CDC-Kaiser

ACE study participants. In our study, parental anxiety or depression (44%), domestic violence exposure (26%) and emotional abuse (22%) were the most commonly reported ACEs. In contrast, physical abuse (28%), household substance abuse (27%) and parental separation or divorce (23%) were the most prevalent ACEs reported in the CDC-Kaiser studies. We speculate that some of these differences in ACE prevalence are due to the fact that we used a much more socioeconomically diverse and, indeed, less advantaged sample than the CDC-Kaiser studies (Dube et al., 2004; Felitti et al., 1998). Seventy-five percent of the participants in the CDC-Kaiser studies were White, 75% had some college education or higher education, 18% were high school graduates, and only 7% had not graduated from high school.

Prevalence and distribution of ACEs in our study were more comparable to those found by Flaherty and colleagues (2013), which used a sample consisting of children who had been maltreated or possessed several risk factors for maltreatment. There were two noticeable differences between our results and those of Flaherty and colleagues. First, our rates of neglect are much lower (21% and 8.5% of children experienced emotional and physical neglect, respectively compared to 50% in the Flaherty study) perhaps because we did not assess supervisory neglect (lack of adequate supervision for various reasons including substance abuse, criminal activity, mental illness problems) as the Flaherty study did. Second, our domestic violence rate is much higher (26% vs 5.8%), likely due to the fact that our measure includes emotional and sexual violence, not just physical violence.

We examined whether early childhood exposure to ACEs would predict behavioral problems at age 9 and whether increasing counts of ACEs were associated with increases in behavioral problems. We found that, after accounting for a rich set of sociodemographic controls and family income, there was a strong association between exposure to childhood adversity and amount of internalizing and externalizing behaviors children demonstrated at age 9. Of the two types of problem behaviors, our results suggest that, on average, there is a stronger association between ACEs and externalizing behaviors than internalizing behaviors. When examining the clinical levels of these behaviors, we observed that only at higher levels of ACEs (3 or more) was exposure to these adversities significantly more likely to result in a child displaying the amount of internalizing or externalizing behaviors warranting professional attention compared to children with 2 or fewer ACEs. The same pattern was observed for ADHD diagnosis. That is, although each additional ACE was associated with significantly greater odds that the child would have an ADHD diagnosis compared to children with 0 ACEs, children with 3 or more ACEs also typically had higher odds than children with 1 or 2 ACEs.

Investigation of subgroup differences indicated that Black children and children of mothers with a high school education or lower were the most likely to have been exposed to multiple ACEs, yet there were no differences in exposure by gender. Our regression results revealed that Black children demonstrated higher total externalizing behaviors and were more likely to have an ADHD diagnosis compared to the other Hispanic and White children after exposure to 2 or more ACEs. White children were more likely to demonstrate clinical levels of both types of behavioral problems as well as increased total internalizing behaviors across each level of ACE exposure compared to the other children. Our results share some

similarities with the work of Schilling, Aseltine Jr., and Gore (2007), who examined the effects of ACEs on mental health outcomes among a socioeconomically diverse sample of young adults. In their study, White participants generally demonstrated more susceptibility to the influence of ACEs compared to Black and Hispanics. One distinction, though, is that White participants in Schilling's study were particularly vulnerable to externalizing behaviors, whereas in ours, White children also demonstrated higher risk for the internalizing outcomes compared to children from the other racial groups. These differences may be partially explained by the fact that respondents in Schilling et al.'s study were much older, and the study included some ACEs that were not measured in ours, including sexual abuse, witnessing a murder, parents' unemployment, and being threatened or held captive.

Interestingly, although White children were less likely to be exposed to high levels of adversity compared to Black and Hispanic children, it appeared that highly exposed White children were at particular risk for problem behaviors. The relative deprivation theory (Crosby, 1976) suggests that people evaluate themselves by drawing comparisons to those around them. Feelings of anger, resentment, and grievance may occur when one evaluates their current status or circumstances negatively compared to others and feels entitled to those better circumstances. Because African American and Hispanic children have disproportionately higher exposure to socioeconomic disadvantage compared to White children, these groups may have less variety in their references for social comparisons than do White children. As a result, White children exposed to higher adversity may be particularly reactive to these effects and demonstrate higher levels of behavioral problems. Alternatively, these results may depict a "steeling effect" such that children in high-stress environments eventually develop some degree of immunity (Rutter, 2006). These children are better able to cope with adversity in a way that makes them less susceptible to behavioral problems. Research demonstrating cognitive coping styles more common among certain racial groups explaining differential vulnerability to stress provides some support this explanation (Chapman & Mullis, 2000; Farley, Galves, Dickinson, & Perez, 2005). The relative deprivation or steeling theories may also provide an explanation for the findings that children with mothers with a high school education or higher were more likely to demonstrate behavioral problems after ACE exposure despite that children of lower socioeconomic status tend to have higher incidence of behavioral problems compared to the general population due to having to face a number of risk factors (Qi & Kiasser, 2003). To our knowledge, our study was the first to investigate differences in the impact of ACEs across maternal education subgroups.

Our results underscore the need for further longitudinal research on ACE exposure across different indicators of socioeconomic well being. Our gender results were not aligned with findings from prior studies indicating that boys are more likely to develop attention-related or externalizing behavioral problems after exposure to adversity (Haskins, 2014; Cooper et al., 2011), whereas girls are more likely to demonstrate internalizing behaviors (Gerard & Buehler, 1999). In our analyses, girls had noticeably higher odds of demonstrating clinical levels of externalizing behaviors at each level of ACE exposure compared to boys. Boys, in contrast, were more likely to demonstrate total internalizing and externalizing behaviors compared to girls. Schilling and colleagues (2007) similarly demonstrated that young men

and women were susceptible to elevated levels of both internalizing and externalizing behavioral problems after ACE exposure.

A general issue with the original ACE studies is that by summing each ACE category into a total exposure score, the individual influences of each adverse experience in predicting outcomes is masked. We sought to expand this area by examining the relative association of each ACE category on each behavioral outcome. Of all the ACEs, only physical neglect had a statistically insignificant association with more than one behavioral outcome. This finding is in line with prior studies that report little specificity in the effects of ACEs on later mental health and behavioral problems (Kilpatrick et al., 2003; Mullen, Martin, Anderson, Romans, & Herbison, 1996; Turner, Finkelhor, & Ormrod, 2006). Household mental illness in particular has been documented to be a significant risk factor for a number of these outcomes, which was evident in our study. Parental anxiety or depression was the most commonly reported and the only ACE to significantly predict all five the behavioral outcomes assessed. That each outcome examined was predicted by more than one ACE was in line with research that adverse childhood adjustment is more often attributed to the influence of multiple risk factors rather than any single risk factor (Flaherty et al., 2013; Gerard, & Buehler, 1999; Deater-Deckard et al., 1998; Sameroff, Seifer, Baldwin, & Baldwin, 1993). Despite the differences in the individual associations, we found support for our hypothesis that the influence of cumulative ACEs was greater than the relative influence of each ACE on behavioral problems, consistent with previous research.

Several limitations of our analyses warrant consideration. First, it is possible that there are unmeasured variables that predict behavioral problems and are also correlated with ACEs. As a result, the development of behavioral problems may be caused by unmeasured characteristics of the children or their environment, rather than due to exposure to ACEs. Due to the temporal aspect of the study design and the rich set of covariates used in the analyses, we expected that the magnitude of resulting bias will be modest, but it cannot be ruled out. Future research might use more sophisticated approaches to modeling that better address issues of selection and omitted variable bias.

Second, because we sought to examine ACEs that were analogous to those examined in the CDC-Kaiser studies, it is possible that there were adversities predictive of behavioral outcomes that were not included in our analyses. For example, Wade et al. (2014) found that although a sample of low-income urban youth endorsed many of the ACEs from the CDC-Kaiser studies, additional adversities included single-parent homes, exposure to violence and criminal behavior; personal victimization, economic hardship and discrimination. Future studies are needed that examine a broader set of ACEs that may be relevant to different populations in predisposing to poor childhood health or behavioral outcomes (Finkelhor, Shattuck, Turner, & Hamby, 2015). Third, the CDC-Kaiser ACE studies assessed information on mental illness, substance use problems, and criminal behavior on all adult member of the household. Unfortunately, we had these measures only for the mother, biological father, and sometimes, the mother's current partner. Thus, the household ACE categories largely represent the child's parental characteristics for our study rather than the characteristics of all adult household members. Similarly, our child maltreatment measures only assessed behaviors conducted by the mother whereas the CDC-Kaiser ACE studies did

not specify a particular perpetrator. Mothers are the mostly likely to perpetrate maltreatment, however biological father, partners, and relatives make up the next largest categories of maltreatment perpetrators (USDHHS, 2016). Nevertheless, we may be underestimating the prevalence of ACE exposure in this study. A final concern is that the same respondent (i.e., the mother) reported on both the ACEs and the child outcomes. It is possible that mothers exposed to higher number of risks experience more stress and thus perceive and report their child's behavior to be more negative than it truly is. It is also possible that mothers influenced by social desirability bias would be motivated to underreport the prevalence of ACEs.

Despite these caveats, our research provides substantial contributions to the existing literature on children's exposure to adversity. This study was able to expand upon the CDC-Kaiser literature by investigating the more proximal impacts of ACE exposure. Results indicate that children as young as 9 that are exposed to ACEs (particularly 3 or more) are experiencing behavioral problems, which may result in later adverse health and behavioral outcomes. Finally, our research extends observations from the previous ACE study to racially, economically, and socially diverse subgroups of the population to gain awareness of how these groups may be differentially impacted by ACEs.

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References

- Achenbach, TM., Rescorla, LA. Manual for ASEBA school-age forms & profiles. Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families; 2001.
- Allison, PD. Missing Data. Thousand Oak, CA: Sage; 2001.
- Anda RF, Brown DW, Felitti VJ, Bremner JD, Dube SR, Giles WH. Adverse childhood experiences and prescribed psychotropic medications in adults. *American Journal of Preventive Medicine*. 2007; 32(5):389–394. [PubMed: 17478264]
- Berger LM. Income, family structure, and child maltreatment risk. *Children and Youth Services Review*. 2004; 26(8):725–748. DOI: 10.1016/j.childyouth.2004.02.017
- Biederman J, Milberger S, Faraone SV, Kiely K, Guite J, Mick E, ... Reed E. Family-environment risk factors for attention-deficit hyperactivity disorder: a test of Rutter's indicators of adversity. *Archives of General Psychiatry*. 1995; 52(6):464–470. [PubMed: 7771916]
- Burke NJ, Hellman JL, Scott BG, Weems CF, Carrion VG. The impact of adverse childhood experiences on an urban pediatric population. *Child Abuse & Neglect*. 2011; 35(6):408–413. [PubMed: 21652073]
- Centers for Disease Control and Prevention. Adverse Childhood Experiences (ACE) Study. 2013. Retrieved from <http://www.cdc.gov/ace/about.htm>
- Chapman PL, Mullis RL. Racial differences in adolescent coping and self-esteem. *The Journal of Genetic Psychology*. 2000; 161(2):152–160. [PubMed: 10851678]
- Cooper CE, Osborne CA, Beck AN, McLanahan SS. Partnership instability, school readiness, and gender disparities. *Sociology of Education*. 2011; 84(3):246–259. [PubMed: 21949448]
- Crosby F. A model of egoistical relative deprivation. *Psychological Review*. 1976; 83(2):85.

- Danese A, Moffitt TE, Harrington H, Milne BJ, Polanczyk G, Pariante CM, et al. Adverse childhood experiences and adult risk factors for age-related disease. *Archives of Pediatrics and Adolescent Medicine*. 2009; 163:1135–1143. [PubMed: 19996051]
- Deater-Deckard K, Dodge KA, Bates JE, Pettit GS. Multiple risk factors in the development of externalizing behavior problems: Group and individual differences. *Development and Psychopathology*. 1998; 10(03):469–493. [PubMed: 9741678]
- Dong M, Anda RF, Dube SR, Giles WH, Felitti VJ. The relationship of exposure to childhood sexual abuse to other forms of abuse, neglect, and household dysfunction during childhood. *Child Abuse & Neglect*. 2003; 27(6):625–639. [PubMed: 12818611]
- Dube SR, Fairweather D, Pearson WS, Felitti VJ, Anda RF, Croft JB. Cumulative childhood stress and autoimmune diseases in adults. *Psychosomatic Medicine*. 2009; 71(2):243–250. DOI: 10.1097/PSY.0b013e3181907888 [PubMed: 19188532]
- Dube SR, Williamson DF, Thompson T, Felitti VJ, Anda RF. Assessing the reliability of retrospective reports of adverse childhood experiences among adult HMO members attending a primary care clinic. *Child Abuse & Neglect*. 2004; 28(7):729–737. DOI: 10.1016/j.chiabu.2003.08.009 [PubMed: 15261468]
- Edwards VJ, Holden GW, Felitti VJ, Anda RF. Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: Results from the adverse childhood experiences study. *American Journal of Psychiatry*. 2003; 160(8):1453–1460. DOI: 10.1176/appi.ajp.160.8.1453 [PubMed: 12900308]
- Fanti KA, Henrich CC. Trajectories of pure and co-occurring internalizing and externalizing problems from age 2 to age 12: findings from the National Institute of Child Health and Human Development Study of Early Child Care. *Developmental Psychology*. 2010; 46(5):1159. [PubMed: 20822230]
- Farley T, Galves AL, Dickinson LM, Perez MDJD. Stress, coping, and health: a comparison of Mexican immigrants, Mexican-Americans, and non-Hispanic whites. *Journal of Immigrant Health*. 2005; 7(3):213–220. [PubMed: 15900422]
- Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, ... Marks JS. Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults: The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*. 1998; 14(4):245–258. [PubMed: 9635069]
- Finkelhor D, Shattuck A, Turner H, Hamby S. A revised inventory of adverse childhood experiences. *Child abuse & neglect*. 2015; 48:13–21. [PubMed: 26259971]
- Flaherty EG, Thompson R, Dubowitz H, Harvey EM, English DJ, Proctor LJ, Runyan DK. Adverse childhood experiences and child health in early adolescence. *JAMA Pediatrics*. 2013; 167(7):622–629. [PubMed: 23645114]
- Flaherty EG, Thompson R, Litrownik AJ, Zolotor AJ, Dubowitz H, Runyan DK, ... Everson MD. Adverse Childhood Exposures and Reported Child Health at Age 12. *Academic Pediatrics*. 2009; 9(3):150–156. <http://doi.org/10.1016/j.acap.2008.11.003>. [PubMed: 19450774]
- Font SA, Berger LM. Child Maltreatment and Children's Developmental Trajectories in Early to Middle Childhood. *Child Development*. 2015; 86(2):536–556. <http://doi.org/10.1111/cdev.12322>. [PubMed: 25521556]
- Gerard JM, Buehler C. Multiple Risk Factors in the Family Environment and Youth Problem Behaviors. *Journal of Marriage and Family*. 1999; 61(2):343–361. <http://doi.org/10.2307/353753>.
- Gerard JM, Buehler C. Cumulative environmental risk and youth problem behavior. *Journal of Marriage and Family*. 2004; 66(3):702–720.
- Graham S, Weiner B, Cobb M, Henderson T. An Attributional Analysis of Child Abuse Among Low Income African American Mothers. *Journal of Social and Clinical Psychology*. 2001; 20:233–257.
- Haskins AR. Unintended consequences: effects of paternal incarceration on child school readiness and later special education placement. *Sociological Science*. 2014; 1(1):141–58. [PubMed: 27642614]
- Hillis SD, Anda RF, Dube SR, Felitti VJ, Marchbanks PA, Marks JS. The association between adverse childhood experiences and adolescent pregnancy, long-term psychosocial consequences, and fetal death. *Pediatrics*. 2004; 113(2):320–327. [PubMed: 14754944]

- Jimenez ME, Wade R, Lin Y, Morrow LM, Reichman NE. Adverse Experiences in Early Childhood and Kindergarten Outcomes. *Pediatrics*. 2016; 137(2):1–9.
- Kessler RC, Andrews G, Mroczek D, Ustun TB, Wittchen HU. The World Health Organization Composite International Diagnostic Interview Short-Form (CIDI-SF). *International Journal of Methods in Psychiatric Research*. 1998; 7:171–185.
- Kilpatrick DG, Ruggiero KJ, Acierno R, Saunders BE, Resnick HS, Best CL. Violence and risk of PTSD, major depression, substance abuse/dependence, and comorbidity: results from the National Survey of Adolescents. *Journal of Consulting and Clinical Psychology*. 2003; 71(4):692. [PubMed: 12924674]
- McKelvey LM, Whiteside-Mansell L, Conners-Burrow NA, Swindle T, Fitzgerald S. Assessing adverse experiences from infancy through early childhood in home visiting programs. *Child Abuse & Neglect*. 2016; 51:295–302. [PubMed: 26455263]
- Mersky JP, Topitzes J, Reynolds AJ. Impacts of adverse childhood experiences on health, mental health, and substance use in early adulthood: A cohort study of an urban, minority sample in the US. *Child abuse & neglect*. 2013; 37(11):917–925. [PubMed: 23978575]
- Mullen PE, Martin JL, Anderson JC, Romans SE, Herbison GP. The long-term impact of the physical, emotional, and sexual abuse of children: A community study. *Child Abuse & Neglect*. 1996; 20(1): 7–21. [PubMed: 8640429]
- Patten SB, Brandon-Christie J, Devji J, Sedmak B. Performance of the composite international diagnostic interview short form for major depression in a community sample. *Chronic Dis Can*. 2000; 21(2):68–72. [PubMed: 11007657]
- Qi CH, Kaiser AP. Behavior problems of preschool children from low-income families review of the literature. *Topics in Early Childhood Special Education*. 2003; 23(4):188–216.
- Reichman NE, Teitler JO, Garfinkel I, McLanahan SS. Fragile families: Sample and design. *Children and Youth Services Review*. 2001; 23(4):303–326.
- Repetti RL, Taylor SE, Seeman TE. Risky families: family social environments and the mental and physical health of offspring. *Psychological Bulletin*. 2002; 128(2):330. [PubMed: 11931522]
- Roza SJ, Hofstra MB, van der Ende J, Verhulst FC. Stable Prediction of Mood and Anxiety Disorders Based on Behavioral and Emotional Problems in Childhood: A 14-Year Follow-Up During Childhood, Adolescence, and Young Adulthood. *American Journal of Psychiatry*. 2003; 160(12): 2116–2121. DOI: 10.1176/appi.ajp.160.12.2116 [PubMed: 14638580]
- Rutter, M. The promotion of resilience in the face of adversity. In: Clarke-Steward, A., Dunn, J., editors. *Families count*. New York, NY: University Press; 2006. p. 26-52.
- Sameroff AJ, Seifer R, Baldwin A, Baldwin C. Stability of intelligence from preschool to adolescence: The influence of social and family risk factors. *Child development*. 1993; 64(1):80–97. [PubMed: 8436039]
- Schilling EA, Aseltine RH Jr, Gore S. Adverse childhood experiences and mental health in young adults: a longitudinal survey. *BMC Public Health*. 2007; 7(1):30. [PubMed: 17343754]
- Shin S, Miller D. A longitudinal examination of childhood maltreatment and adolescent obesity: Results from the National Longitudinal Study of Adolescent Health (AddHealth) study. *Child Abuse & Neglect*. 2012; 36(2):84–94. [PubMed: 22398304]
- Straus MA, Hamby SL, Finkelhor D, Moore DW, Runyan D. Identification of child maltreatment with the Parent-Child Conflict Tactics Scales: Development and psychometric data for a national sample of American parents. *Child Abuse & Neglect*. 1998; 22(4):249–270. [PubMed: 9589178]
- Turner HA, Finkelhor D, Ormrod R. The effect of lifetime victimization on the mental health of children and adolescents. *Social science & medicine*. 2006; 62(1):13–27. [PubMed: 16002198]
- U.S. Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. *Child Maltreatment 2014*. 2016.
- von Hippel PT. Regression with Missing Ys: An Improved Strategy for Analyzing Multiply Imputed Data. *Sociological Methodology*. 2007; 37:83–117.
- Wade R, Shea JA, Rubin D, Wood J. Adverse Childhood Experiences of Low-Income Urban Youth. *Pediatrics*. 2014; 134(1):e13–e20. DOI: 10.1542/peds.2013-2475 [PubMed: 24935995]

- Wickrama KAS, Noh S, Bryant CM. Racial differences in adolescent distress: Differential effects of the family and community for blacks and whites. *Journal of Community Psychology*. 2005; 33(3): 261–282.
- Wittchen HU. Reliability and validity studies of the WHO-Composite International Diagnostic Interview (CIDI): a critical review. *Journal of psychiatric research*. 1994; 28(1):57–84. [PubMed: 8064641]

Table 1

Prevalence of Adverse Childhood Experiences

	Full Sample	White	Black	Hispanic	Female	Male	<HS	HS	>HS
Maltreatment ACEs									
Emotional abuse (%)	21.9 (.008)	18.2 (.016)	27.0 (.012)	14.3 (.013)	19.0 (.011)	24.5 (.011)	22.0 (.014)	23.6 (.014)	20.3 (.012)
Physical abuse (%)	14.6 (.007)	11.4 (.013)	19.2 (.010)	7.9 (.010)	11.6 (.009)	17.4 (.010)	13.4 (.011)	16.6 (.012)	13.8 (.011)
Emotional neglect (%)	21.2 (.007)	15.2 (.014)	23.6 (.011)	21.5 (.015)	20.5 (.011)	21.8 (.010)	24.3 (.014)	20.8 (.013)	18.7 (.012)
Physical neglect (%)	8.3 (.005)	4.2 (.008)	10.0 (.008)	8.7 (.011)	8.7 (.008)	8.0 (.007)	11.5 (.010)	8.9 (.010)	5.1 (.007)
Household ACEs									
Substance abuse (%)	15.1 (.006)	19.8 (.016)	14.4 (.009)	13.6 (.012)	16.3 (.010)	14.1 (.009)	15.5 (.012)	15.0 (.011)	15.0 (.011)
Incarceration (%)	20.3 (.007)	12.7 (.013)	26.8 (.011)	14.5 (.013)	18.3 (.010)	22.1 (.010)	26.2 (.014)	23.7 (.013)	12.1 (.010)
Anxiety or depression (%)	43.8 (.009)	48.5 (.020)	42.9 (.013)	41.6 (.018)	44.1 (.013)	43.6 (.012)	44.7 (.016)	44.1 (.016)	42.9 (.015)
Domestic violence (%)	25.6 (.008)	24.2 (.017)	22.5 (.011)	31.5 (.017)	26.9 (.012)	24.5 (.011)	31.6 (.015)	24.7 (.014)	21.2 (.012)
Behavior Problems									
Externalizing	.004 (.019)	.012 (.038)	.057 (.027)	-.106 (.035)	-.093 (.025)	.093 (.026)	.098 (.038)	.054 (.032)	-.123 (.025)
Clinical Ext (%)	8.2 (.005)	9.2 (.011)	8.9 (.007)	5.8 (.008)	7.7 (.007)	8.7 (.001)	10.8 (.010)	9.1 (.009)	5.1 (.007)
Internalizing	-.011 (.019)	-.008 (.035)	-.075 (.025)	.103 (.040)	-.001 (.026)	-.020 (.026)	.098 (.039)	-.010 (.029)	-.108 (.025)
Clinical Int (%)	7.3 (.005)	7.7 (.011)	5.6 (.006)	9.9 (.011)	5.3 (.006)	9.1 (.007)	9.6 (.010)	7.0 (.008)	5.5 (.007)
ADHD (%)	11.8 (.006)	15.5 (.014)	11.5 (.008)	9.8 (.011)	7.2 (.007)	16.0 (.009)	11.8 (.010)	13.0 (.011)	10.7 (.009)

Note. N=3108. Percentages and means (standard errors in parentheses) are presented. HS = High School

Table 2

Linear and Logistic Regression Models Estimating the Association of ACEs on Behavioral Problems at Age 9

Externalizing behaviors		Clinical externalizing		Internalizing behaviors		Clinical internalizing		ADHD diagnosis	
No. of ACEs	B (SE)	Odds Ratio [95% CI]		B (SE)		Odds Ratio [95% CI]		Odds Ratio [95% CI]	
Panel 1: Full Sample									
(0)									
1	.15 (.05) **	2.21 [1.27,3.86]	**	.13 (.05) *		1.26 [0.76,2.08]		1.19 [0.83,1.72]	
2	.30 (.05) *** ^a	2.93 [1.68,5.10]	***	.26 (.05) *** ^a		2.07 [1.27,3.39]	** ^a	1.62 [1.12,2.34]	*
3	.49 (.06) *** ^{a,b}	3.70 [2.07,6.62]	*** ^a	.41 (.06) *** ^{a,b}		3.09 [1.85,5.17]	*** ^a	1.66 [1.10,2.49]	*
4+	.74 (.06) *** ^{a,b,c}	6.96 [4.00,12.09]	*** ^{a,b,c}	.55 (.07) *** ^{a,b}		3.76 [2.26,6.27]	*** ^{a,b}	2.30 [1.54,3.43]	*** ^a
Constant	1.13 (.29) ***	0.83 [0.10,6.70]		.66 (.30) *		0.38 [0.04,3.25]		1.69 [0.29,10.01]	
Panel 2: Race									
White									
(0)									
1	.21 (.09) *	4.70 [1.30,17.0]	*	.24 (.09) *		2.61 [0.77,8.87]		1.18 [.62,2.23]	
2	.27 (.11) *	6.31 [1.68,23.7]	**	.36 (.10) ***		3.63 [1.00,13.2]	*	1.67 [.83,3.37]	
3	.42 (.13) **	6.47 [1.59,26.3]	**	.65 (.12) *** ^{a,b}		10.1 [2.92,34.7]	*** ^{a,b}	.94 [.38,2.30]	
4+	.75 (.14) *** ^{a,b,c}	18.7 [4.97,70.1]	*** ^{a,b,c}	.69 (.13) *** ^{a,b}		12.4 [3.55,43.3]	*** ^{a,b}	2.28 [1.06,4.88]	*
Constant	1.80 (.67) **	20.8 [0.095,4541.2]		1.63 (.64) *		24.3 [0.098,5998.5]		.60 [.010,34.3]	
Black									
(0)									
1	.12 (.08)	2.07 [0.87,4.91]		.082 (.08)		1.04 [0.41,2.62]		1.29 [.69,2.40]	
2	.34 (.08) *** ^a	3.03 [1.30,7.05]	**	.22 (.08) **		2.49 [1.07,5.78]	* ^a	2.57 [1.43,4.61]	*** ^a
3	.54 (.09) *** ^{a,b}	3.94 [1.67,9.32]	*** ^a	.35 (.09) *** ^a		2.70 [1.11,6.52]	* ^a	2.57 [1.38,4.79]	*** ^a
4+	.85 (.09) *** ^{a,b,c}	8.68 [3.81,19.8]	*** ^{a,b,c}	.53 (.09) *** ^{a,b}		4.11 [1.73,9.71]	** ^a	3.35 [1.79,6.27]	*** ^a
Constant	1.00 (.40) *	0.24 [0.013,4.38]		.40 (.40)		0.030 [0.00088,1.00]	* ^a	.80 [.060,10.5]	

Externalizing behaviors		Clinical externalizing		Internalizing behaviors		Clinical internalizing		ADHD diagnosis	
No. of ACEs	B (SE)	Odds Ratio [95% CI]		B (SE)	Odds Ratio [95% CI]		Odds Ratio [95% CI]	Odds Ratio [95% CI]	
Hispanic									
(0)									
1	.11 (.09)	1.11 [0.40,3.06]		.071 (.11)	1.07 [0.50,2.29]			.90 [.45,1.80]	
2	.21 (.10) [*]	1.42 [0.53,3.81]		.19 (.11)	1.46 [0.67,3.18]			.74 [.34,1.61]	
3	.47 (.13) ^{***a,b}	2.04 [0.69,6.04]		.33 (.14) [*]	2.31 [0.93,5.74]			1.22 [.51,2.92]	
4+	.46 (.13) ^{***a}	1.54 [0.49,4.84]		.43 (.15) ^{*a}	2.27 [0.91,5.70]			1.34 [.58,3.13]	
Constant	.58 (.51)	1.45 [0.032,66.8]		−.052 (.58)	0.18 [0.0077,4.37]			1.91 [.078,46.8]	
Panel 3: Gender									
Female									
(0)									
1	.21 (.07) ^{**}	3.74 [1.33,10.5] [*]		.13 (.07)	1.49 [.59,3.72]			1.12 [.58,2.15]	
2	.36 (.07) ^{***a}	5.90 [2.12,16.4] ^{***}		.25 (.08) ^{**}	2.78 [1.16,6.67] [*]			1.67 [.86,3.22]	
3	.56 (.09) ^{***a,b}	6.69 [2.36,19.0] ^{***}		.42 (.09) ^{***a}	4.36 [1.80,10.6] ^{***a}			1.40 [.66,2.96]	
4+	.63 (.09) ^{***a,b}	10.5 [3.70,29.9] ^{***a}		.42 (.10) ^{***a}	3.37 [1.30,8.76] ^{*a}			2.58 [1.26,5.27] ^{***a}	
Constant	1.12 (.40) ^{**}	.95 [.036,24.8]		.54 (.43)	.11 [.0023,5.57]			2.83 [.11,73.0]	
Male									
(0)									
1	.098 (.07)	1.61 [0.82,3.18]		.13 (.07)	1.15 [.62,2.11]			1.24 [.80,1.93]	
2	.24 (.08) ^{**}	1.80 [0.89,3.64]		.27 (.08) ^{***}	1.79 [.97,3.29]			1.65 [1.05,2.58] [*]	
3	.44 (.09) ^{***a,b}	2.57 [1.24,5.32] [*]		0.42 (.09) ^{***a}	2.72 [1.43,5.18] ^{***a}			1.79 [1.09,2.92] [*]	
4+	.79 (.09) ^{***a,b,c}	5.53 [2.82,10.8] ^{***a,b,c}		.64 (.09) ^{***a,b,c}	4.01[2.16,7.44] ^{***a,b}			2.18 [1.35,3.54] ^{***a}	
Constant	.99 (.41) [*]	.70 [.046,10.5]		.75 (.41)	.41 [.029,5.86]			.98 [.12,8.21]	
Panel 4: Maternal Education									

Externalizing behaviors		Clinical externalizing		Internalizing behaviors		Clinical internalizing		ADHD diagnosis	
No. of ACEs	B (SE)	Odds Ratio [95% CI]		B (SE)	Odds Ratio [95% CI]		Odds Ratio [95% CI]	Odds Ratio [95% CI]	
<HS									
(0)									
1	.091 (.11)	.98 [.45,2.15]		.069 (.12)	0.84 [.42,1.71]		.79 [.40,1.56]		
2	.34 (.12) ^{**a}	1.72 [.82,3.61]		.25 (.13) [*]	1.10 [.54,2.26]		1.36 [.70,2.62]		
3	.44 (.13) ^{**a}	1.48 [.64,3.40]		.38 (.14) ^{** a}	1.59 [.74,3.40]		1.14 [.54,2.37]		
4+	.61 (.14) ^{***a,b}	3.06 [1.44,6.50] ^{** a,c}		.54 (.14) ^{*** a,b}	2.05 [.98,4.28] ^a		1.81 [.91,3.63] ^a		
Constant	.57 (.54)	.12 [.0058,2.39]		.17 (.57)	.26 [.016,4.21]		.68 [.034,13.5]		
HS									
(0)									
1	.12 (.09)	3.40 [0.97,12.0]		.10 (.09)	1.38 [.50,3.85]		.92 [.47,1.81]		
2	.29 (.10) ^{**}	7.02 [2.07,23.8] ^{** a}		.30 (.09) ^{** a}	3.33 [1.29,8.57] ^{* a}		1.99 [1.06,3.73] ^{* a}		
3	.47 (.10) ^{***a}	6.66 [1.91,23.2] ^{**}		.32 (.10) ^{** a}	2.85 [1.03,7.83] [*]		1.74 [.86,3.49] ^a		
4+	.91 (.11) ^{***a,b,c}	17.6 [5.26,58.8] ^{*** a,b,c}		.52 (.11) ^{*** a,b}	4.57 [1.68,12.5] ^{*** a}		2.24 [1.11,4.53] ^{* a}		
Constant	1.32 (.51) ^{**}	7.99 [.16,395.4]		.86 (.49)	.30 [.0043,21.5]		.54 [.021,14.2]		
>HS									
(0)									
1	.22 (.06) ^{***}	5.99 [1.74,20.6] ^{**}		.20 (.07) ^{**}	2.20 [.73,6.65]		1.96 [1.09,3.53] [*]		
2	.23 (.07) ^{***}	2.18 [0.52,9.08] ^a		.21 (.07) ^{**}	3.11 [1.02,9.45] [*]		1.34 [.68,2.64]		
3	.53 (.09) ^{***a,b}	9.20 [2.49,34.0] ^{*** b}		.51 (.09) ^{*** a,b}	11.5 [3.83,34.4] ^{*** a,b}		2.27 [1.09,4.70] [*]		
4+	.63 (.09) ^{***a,b}	9.45 [2.52,35.4] ^{*** b}		.51 (.09) ^{*** a,b}	7.33 [2.35,22.8] ^{*** a}		2.74 [1.34,5.62] ^{*** b}		
Constant	1.34 (.41) ^{**}	1.00 [.0075,134.4]		.64 (.44)	.38 [.0034,43.7]		102.4 [3.18,3289.4] ^{***}		

Note. N=3108 for the externalizing behavioral problems and ADHD diagnosis models. N= 3043 for the internalizing behavior problems models. The externalizing behaviors and internalizing behaviors outcomes have been standardized to have a mean of 0 and standard deviation of 1 in the full sample. Models adjust for birth and sociodemographic characteristics. The reference group is children with 0 ACEs.

^a = Differs from 1 ACE at p<.05;

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 $d > .001$
**
 $p < .01$
*
 $p < .05$
c
= Differs from 2 ACEs at $p < .05$;
q
= Differs from 3 ACEs at $p < .05$.

Table 3

OLS Models Estimating Associations of Specific Types of ACEs Experienced with Behavioral Problems at Age 9

	Externalizing problems		Clinical externalizing		Internalizing problems		Clinical internalizing		ADHD diagnosis	
	B (SE)	Odds Ratio [95% CI]	B (SE)	Odds Ratio [95% CI]	B (SE)	Odds Ratio [95% CI]	B (SE)	Odds Ratio [95% CI]	B (SE)	Odds Ratio [95% CI]
Child maltreatment										
Physical neglect	.071 (.07)	1.06 [0.68,1.66]	.17* (.07)	1.39 [0.88,2.21]					1.19 [0.79,1.78]	
Physical abuse	.24*** (.06)	1.64** [1.14,2.36]	.018 (.06)	0.94 [0.61,1.45]					1.63** [1.17,2.28]	
Emotional abuse	.18*** (.05)	1.45* [1.04,2.03]	.11* (.05)	1.29 [0.88,1.88]					0.97 [0.72,1.31]	
Emotional neglect	.17*** (.04)	1.33 [0.98,1.82]	.17*** (.05)	1.24 [0.89,1.72]					1.19 [0.91,1.57]	
Household items										
Substance abuse	.12* (.05)	1.27 [0.90,1.80]	.12* (.05)	1.35 [0.94,1.93]					1.24 [0.91,1.70]	
Incarceration	.18*** (.05)	1.30 [0.95,1.78]	.036 (.05)	1.08 [0.76,1.54]					1.40* [1.06,1.84]	
Anxiety or depression	.18*** (.04)	1.62*** [1.22,2.15]	.19*** (.04)	1.64** [1.22,2.20]					1.43** [1.13,1.81]	
Domestic violence	.13* (.04)	1.40* [1.04,1.89]	.16*** (.04)	1.80*** [1.33,2.43]					0.84 [0.64,1.10]	
Constant	1.09*** (.29)	1.17 [0.15,9.21]	.68* (.30)	0.43 [0.049,3.80]					1.21 [0.20,7.29]	
Observations	3108	3108	3043	3043					3108	

Note. The externalizing behaviors and internalizing behaviors outcomes have been standardized to have a mean of 0 and standard deviation of 1 in the full sample. The models adjust for birth and sociodemographic characteristics. The reference group is children with 0 ACEs.

* $p < .05$,

** $p < .01$,

*** $p < .001$