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Adverse Childhood Experiences and Health-Risk Behaviors in Vulnerable Early Adolescents

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Abstract

Adverse childhood experiences (ACEs) are associated with health-risk behaviors in general samples of adults and adolescents. The current study examined the association between ACEs and these behaviors among a high-risk sample of early adolescents. Five hundred and fifteen 9-11-year-old children placed in foster care due to maltreatment were interviewed about their engagement in violence, substance use, and delinquency. A multi-informant ACEs score was derived based on exposure to six adverse experiences. Regression analyses examined the relationship between ACEs and risk behaviors and the potential moderating effects of age, sex, and minority status. ACE scores were predictive of risk behaviors after controlling for age, sex, and minority status. Although males and older youth were more likely to engage in risk behaviors, none of the demographic characteristics moderated the ACE-risk behavior association. This study extends previous research by demonstrating an association between ACEs and risk behaviors in extremely vulnerable early adolescents.

Health-risk behaviors in adolescence, including violence, substance use, and delinquency, are leading causes of morbidity and mortality (Center for Disease Control and Prevention, 2011). Adolescents who are victims of maltreatment, and those in foster care, are at significantly greater risk of engaging in these behaviors and experiencing negative sequelae (Fang & Corso, 2007; Jonson-Reid & Barth, 2000; Ryan & Testa, 2005; Stevens, Brice, Ale, & Morris, 2011; Widom, 1991; Widom, Schuck, & White, 2006). According to recent estimates, the average lifetime financial burden of risk behaviors associated with victims of nonfatal child maltreatment is over \$210,000, which is comparable to other costly health-care conditions such as stroke and type 2 diabetes (Fang, Brown, Florence, & Mercy, 2012). Although intervention programs have been developed to attenuate the negative health behavior impact associated with child maltreatment, examining factors associated with

health-risk behaviors in this population can help identify those children who could maximally benefit from these programs.

Early studies examining factors associated with the development of negative child outcomes focused on single environmental risk factors. These studies, however, often found that single predictors did not account for a large amount of variance in the outcomes (Sameroff, Bartko, Baldwin, Baldwin, & Seifer, 1999). As a result, Rutter, Sameroff and colleagues developed Cumulative Risk Theory, which posits that the number of adverse events a child is exposed to will determine outcomes in a dose-dependent manner such that multiple adverse exposures will result in poorer outcomes than single-event exposures. Previous research has provided support for the Cumulative Risk Theory. Youth exposed to multiple types of maltreatment, in comparison to those exposed to a single type, had poorer cognitive development (Mackner, Starr, & Black, 1997), school behavior (Kerr, Black, & Krishnakumar, 2000), and mental health (Trickett, Kim, & Prindle, 2011).

Consistent with Cumulative Risk Theory, previous research with adults suggests that exposure to multiple adverse childhood experiences (ACEs), such as abuse, neglect, exposure to domestic violence, parental substance abuse and incarceration, is predictive of many of the leading causes of health-risk behaviors in community samples of adults. Indeed, adults with a history of exposure to four or more ACEs, compared to those with no ACEs, are more likely to smoke, abuse alcohol, use illicit drugs, and engage in risky sexual behavior, and there appears to be a dose-response effect (Dube et al., 2003; Felitti et al., 1998; Strine et al., 2012).

Although the literature on the association between ACEs and adverse health outcomes in adulthood is fairly robust, fewer studies have examined the link between ACEs and health-risk behaviors in youth. Two longitudinal studies, however, demonstrated this relationship, finding that the accumulation of childhood risk factors predicted health-risk behaviors (i.e., aggressive behaviors, rule-breaking, general delinquency) in adolescence (Appleyard, Egeland, van Dulmen, & Sroufe, 2005; Forehand, Biggar, & Kotchick, 1998). In other studies, the number of ACEs was linearly associated with adolescent bullying, alcohol use, suicidality, and externalizing behaviors (Dube, et al., 2006; Duke, Pettingell, McMorris, & Borowsky, 2010; Greeson et al., 2014; Rothman, Bernstein, & Strunin, 2010). Similarly, in a study of adolescents with a history of juvenile offending, the number of ACEs was incrementally associated with risk for reoffending (Baglivio, Jackowski, Greenwald, & Howell, 2014). Other than this study of youth with juvenile offenses, studies that have found a relationship between ACEs and health-risk behaviors in youth have been conducted with community samples of adolescents. No known studies have examined whether ACEs are associated with health-risk behaviors in maltreated foster youth. Because maltreated youth in foster care, by definition, have all been exposed to at least some adverse childhood experiences, the relationship between ACEs and health-risk behaviors may differ from the typical dose-response relationship observed in community samples. In other words, in a population with high levels of ACEs, the risk associated with increased ACEs exposure may not be witnessed at relatively lower levels of the ACEs index. Instead, the negative impact of ACEs exposure may only be evidenced at relative high levels of the index. Alternatively,

because of their relatively high levels of ACEs exposure, youth in foster care may all exhibit high rates health-risk behaviors.

In addition to the lack of studies examining ACEs in high-risk children, previous studies involving ACEs and risk behaviors in youth have focused primarily on outcomes in middle and late adolescence. Examining the association between ACEs and risk behaviors in early adolescence, especially for maltreated children, is crucial for two reasons: (1) maltreated children have an earlier average age of onset of health-risk behaviors (Loeber, Farrington, & Petechuk, 2003; Maxfield & Widom, 1996) and (2) earlier onset of risk behaviors predicts their persistence into adulthood (Snyder, 2001). Identifying risk factors central to the development of health risk behaviors when youth are relatively young (i.e., preadolescence), is crucial to intervening with high risk populations such as youth who have been maltreated.

The current study had two primary objectives: (1) To determine, among a sample of early adolescent (ages 9-11) maltreated children, whether a cumulative ACEs score was associated with health-risk behaviors (violence, substance use, delinquency, and an overall index of risk behavior); and 2) To conduct exploratory analyses examining whether age, sex, and minority status moderate the association between ACE and health-risk behaviors.

METHODS

All 9-11-year-old children who entered foster care in a large, Western metro area were recruited each summer between 2002 and 2011 for a randomized controlled trial (RCT) of a preventive intervention (Taussig & Culhane, 2010; Taussig, Culhane, Garrido, & Knudtson, 2012; Taussig, Culhane, & Hettelman, 2007). Children were eligible for the study if: 1) they had been court-ordered into foster care due to maltreatment within the preceding year, 2) they remained in foster care at the time of the baseline interview, and 3) their cognitive functioning was sufficient to comprehend the interview questions. Ninety-one percent of children meeting eligibility requirements were interviewed, which included participants enrolled in the RCT ($n = 425$) and participants who did not take part in the RCT and received a baseline interview only ($n = 91$). The current study examined data collected from baseline interviews (pre-randomization) of 516 children. One youth had missing data on the outcome variables and was excluded from analyses, leaving a final sample size of 515.

Participants

The sample was 52.0% ($n=268$) male, with a mean age of 10.3 years ($SD=.90$). Almost half (47.2%) of the youth reported their ethnicity as Hispanic, 48.0% as White, 27.2% as African American, 9.9% as Native American, and 4.1% as Asian/Pacific Islander. Racial and ethnic identity was reported in non-exclusive categories, such that youth could identify as more than one racial/ethnic background (e.g., as both White and African American). Children were living in non-relative foster care (44.3%), kinship care (52.2%), or congregate care (3.5%) at the time of the interview and had been in out-of-home care an average of 7.1 months ($SD=3.5$). Children had been at their current placement an average of 6.0 months ($SD = 3.8$).

Procedure

The study protocol was IRB-approved. Informed consent was obtained from legal guardians and assent was obtained from children prior to beginning the interview. Children were interviewed at their current residence (e.g., foster home, kinship home, residential treatment facility) or other community location with the stipulation that they had been living at their current placement for at least three weeks. Children were paid \$40 for their participation in the interview.

Measures

Adverse Childhood Experiences (ACEs) Index—A previously-developed 6-item continuous measure of ACEs was used in the current study. This ACEs measure was empirically derived in a prior study by examining the predictive validity of a set of 18 theoretically relevant risk variables (Raviv, Taussig, Culhane, & Garrido, 2010). The 6 items that were ultimately chosen for the measure were those that had significant bivariate associations with mental health problems. Internal consistency was not assessed given that the measure was a causal risk indicator of unique adverse experiences, and endorsement of additional experience was not necessarily expected given one's endorsement of a single experience (Bollen & Lennox, 1991).

The ACE index is comprised of the following adverse experiences: (1) *Physical Abuse*; (2) *Sexual Abuse*; (3) *Removal from a single parent household*; (4) *Exposure to community violence*; (5) *Number of caregiver transitions*; and (6) *Number of school transitions*. From a review of child welfare records, the abuse exposure and single parent household items were dichotomously coded as “present” (1) or “absent” (0) based on events occurring in the 2 years prior to study entry. Slightly greater than a quarter of the sample (27.2%) had been exposed to physical abuse, 11.7% had been exposed to sexual abuse, and 58.6% had been removed from a single parent household. Exposure to community violence, caregiver transitions, and school transitions (all continuous variables) were dichotomized such that a score of 1 was assigned to scores in the upper quartile of the sample distribution, and a score of 0 was assigned for all others (Appleyard et al., 2005). To determine exposure to community violence, an adapted 8-item version of the *Things I Have Seen and Heard* scale (Richters & Martinez, 1993) was used. Children were asked to indicate the number of times in the past year they had seen or heard acts such as, “guns being shot” or “seeing someone getting arrested.” Responses ranged from never (0) to four or more times (4), with the overall score representing the sum of the 8 items. The upper quartile included children with scores of 13.00 and higher (range=0-30.00, $M=8.47$, $SD=6.70$). For caregiver transitions, children reported the number of caregiver transitions (with or without child welfare involvement) experienced since birth (range=1-11, $M=2.79$, $SD=2.07$). Children in the upper quartile were those who had experienced 4 or more caregiver transitions. For school transitions, children reported the number of school transitions they had experienced (range=0-29, $M=3.22$, $SD=2.85$), with 4 or more transitions representing the upper quartile group. Children's scores of 1 or 0 for each of the six ACE items were summed to form a composite ACE index.

Dependent Variables—Children were asked to report whether they had ever engaged in any of 13 health-risk behaviors (0=not engaged; 1=engaged), with the stipulation that these were behaviors they had “chosen to do, not things you were forced to do.” Three items assessed violence: *started a fist fight or shoving match, hurt or tortured animals, and used a weapon to attack someone or to get things from someone*; five items measured substance use: *smoked cigarettes, used marijuana, had a full drink of alcohol, used inhalants, and used methamphetamines*; finally, five items assessed delinquency: *shoplifting, purposely damaged or destroyed the property of others, set fire or tried to set fire to anything, carried a hidden weapon like a knife or gun, and went into a house or building to steal something*.

Three dichotomous health-risk behavior indices were constructed by summing the values for each of the items and assigning a value of 0 when no risk behaviors were reported or 1 when at least one risk behavior in each domain was endorsed. Each of the three risk behavior index scores were combined to form an overall, dichotomous composite score, with 0 representing no risk behaviors and 1 representing one or more risk behaviors across the 3 domains.

Moderator Variables—The moderator variables consisted of sex (0=females; 1=males), age (continuous), and minority status (Non-minority=0; Minority=1). Participants who identified as both Caucasian and another race or ethnicity were assigned a value of 1.

Analysis Plan

We first examined the prevalence of risk behaviors and ACEs in the overall sample and in each demographic subgroup. Bivariate logistic regression and correlational analyses, as well as chi-square tests, were then used to determine the associations between study variables. Next, we conducted hierarchical multiple logistic regression analyses that predicted the occurrence of risk behaviors within each of the three risk behavior categories, and a fourth model predicted the occurrence of any risk behavior (across the three categories). In the first step of each model, the relationship of the ACEs index with each health-risk behavior was examined, over-and-above the potential moderators, followed by the addition of the ACEs $\times$ moderator variable interaction terms in a second step. Because previous research has suggested that there may be a non-linear association between cumulative risk and problem behaviors (Gerard & Buehler, 2004), we also tested whether a quadratic model of the relationship between ACEs and risk behaviors best fit the data.

RESULTS

Rates of Health-Risk Behaviors and Exposure to ACEs

The prevalence of health-risk behaviors is reported in Table 1. Almost 20% of children reported violent behaviors, 13% used substances, and slightly more than a third reported delinquency. Almost half indicated they had engaged in at least one of the risk behaviors. Males were significantly more likely than females to engage in violence, $\chi^2(1, N=515) = 31.94, p < .001$, and delinquency, $\chi^2(1, N=515) = 14.52, p < .001$, but there were no significant sex differences in rates of substance use. Slightly more than half of males had engaged in at least one risk behavior, whereas only about a third of females had done so, χ^2

(1, $N = 515$) = 18.08; $p < .001$. Age was significantly, positively correlated with all of the risk behavior indices.

Descriptive statistics related to children's exposure to ACEs are presented in Table 2. Youth were exposed, on average, to fewer than two ACEs. There were no significant sex differences in the number of ACEs youth were exposed to, $t(513) = .31$, $p = .52$. Non-Caucasians, however, experienced significantly more ACEs than Caucasians, $t(513) = 2.43$, $p < .05$ and age was positively correlated with the ACE index ($r = .16$, $p < .001$).

Bivariate Relationships between ACEs and Health-Risk Behaviors

The number and percentages of children who reported engaging in health-risk behaviors as a function of number of ACEs they had been exposed to are presented in Table 3. In general, there was a linear trend suggesting that a greater number of ACEs was associated with increased likelihood of engaging in risk behaviors. In order to confirm this, we conducted bivariate logistic regression analyses examining the odds of children engaging in risk behaviors as a function of the number of ACEs they had experienced. Results of these analyses are presented in Table 4. There was a significant bivariate association between the ACE index and violence, with the odds of engaging in violence increasing by 27% with every additional ACE. Similarly, there was a significant bivariate association between the ACE index and substance use, with the likelihood of children engaging in substance use increasing by 59% for every one-unit increase in ACE. There was also a significant association between the ACE index and delinquency, with the odds of engaging in delinquency increasing by 54% with every additional ACE. Finally, the bivariate association between the ACE index and any risk behavior was significant, with the odds of engaging in any health-risk behavior increasing by 48% with every additional ACE. In order to study the possibility that a non-linear relationship might exist between ACEs and health risk behaviors, we tested a quadratic model for each health risk behavior. Results of the analyses were not significant.

Multivariate Relationships between ACEs and Health-Risk Behaviors

In a final series of analyses, we set out to examine whether the associations between ACEs and risk behaviors were significant after controlling for demographic factors (i.e., sex, age, and minority status) and whether these demographic factors moderated the ACEs-risk behavior association. Multiple hierarchical logistic regression analyses were conducted, testing for main effects in a first step, followed by the examination of possible interaction effects in a second step. None of the interaction terms in step 2 of the models was significant (see Table 5). Thus, we focused our attention on main effect results from step 1 of the analyses. In the first model predicting violence, sex was a significant predictor, with males almost four times more likely than females to have engaged in violent behavior. Over-and-above effects attributable to demographic factors, the ACEs index was a significant predictor. For every point increase in ACEs, there was a 24% increase in the odds of violent behavior. In examining the association between the ACEs index and substance use, age was a significant predictor. With each year increase in age, there was a 66% increase in the odds of engaging in substance use. The ACEs index also significantly predicted substance use after controlling for demographic variables, with each point increase in ACE associated with

a 50% increase in the odds of substance use. In the model predicting delinquency, sex and age were both significant predictors. Males were more than twice as likely as females to have engaged in delinquency and each year increase in age was associated with a 47% increase in the odds of delinquency. Holding demographic variables constant, the ACEs index also significantly predicted delinquency, with each additional ACEs associated with a 48% increase in the likelihood of engaging in delinquency. In a final model predicting any risk behaviors, age and sex were both significant predictors. The odds of males engaging in risk behaviors were more than twice those of females and each year increase in age was associated with a 49% increase in the odds of any risk behavior. The ACEs index, independent of the impact associated with the covariates, was a significant predictor of engaging in any risk behaviors. With each additional ACEs, there was an associated 42% increase in the odds of any risk behavior engagement.

DISCUSSION

This study of children in foster care due to maltreatment provides evidence of an association between ACE exposure and health-risk behaviors in extremely high-risk early adolescent children. Consistent with studies involving adults and adolescents, we found a direct association between the number of ACEs children had been exposed to and their engagement in health-risk behaviors. For each additional adverse experience, there was a 24% increase in the likelihood of engaging in violence and a 48% increase in delinquency odds and a 50% increase in the likelihood of substance use. These findings are noteworthy as they suggest that even within a group of children that has, by definition, been exposed to a number of adverse experiences, ACEs are linearly associated with risk behaviors.

In bivariate analyses, age was found to be a significant predictor of both ACEs and risk behaviors. Even though there was a limited age range among study participants, these findings were not unexpected, as older children had more opportunity to experience ACEs and to engage in risk behaviors. Sex was not associated with ACEs, but was predictive of health-risk behaviors. Consistent with previous studies of childhood-onset delinquency (Moffitt & Caspi, 2001), males were more likely than females to have engaged in risk behavior. Finally, consistent with studies of young adults (Schilling, Aseltine, & Gore, 2007), non-Caucasian children had significantly higher ACE scores than Caucasian children. These differences, however, did not translate into higher rates of risk behavior among racial/ethnic minority children, suggesting that protective factors may attenuate the link between ACEs and risk behaviors for these children. Future studies should explore this possibility.

Although older age and being minority were significantly related to higher ACE scores, neither moderated the ACE-risk behavior association. Sex also did not moderate the association between ACEs and risk behaviors. While these findings suggest that the link between ACEs and risk behaviors may be invariant across different subgroups, our findings were inconsistent with those of Schilling and colleagues (2007) who found that the link between childhood ACEs and health-risk behaviors in young adulthood was stronger for boys and for Caucasians. Previous empirical findings regarding the moderating effect of sex and race on the impact of ACEs have generally been mixed (Garcia, O'Brien, Kim, Pecora,

Harachi, & Aisenberg, 2015; Mersky, Topitzes, & Reynolds, 2013; Nayak, Lown, Bond, & Greenfield, 2012). Future studies should explore possible reasons for these inconsistencies.

Longitudinal research on juvenile delinquency finds that the likelihood of persistence of offending into adulthood is greatest for those who begin engaging in these behaviors before age 12 (Loeber & Farrington, 2011, Moffitt, 1993). In addition to being most likely to persist with delinquency into adulthood, early initiators, tend to commit more offenses and more serious offenses over time than do youth who begin initiating in these acts later in adolescence (Farrington, 2003; Farrington, et al., 2006). Identifying and intervening with children at greatest risk of engaging in risk behaviors early in life may decrease the likelihood of these behaviors persisting into adulthood. Evidence from at least two studies suggests that early-life interventions targeting high-risk youth result in lower recidivism rates (Schaeffer & Borduin, 2005), when compared to controls, and increase the likelihood of educational and economic attainment, as well as positive mental and sexual health (Hawkins, et al, 2008).

In addition to their greater likelihood of persisting into adulthood, delinquency behaviors in adolescence exact a tremendous financial burden. Evidence from previous studies suggests that costs associated with health-risk behaviors in adolescence and early adulthood are rooted in childhood. Children diagnosed with conduct disorder by age 10, for example, incurred service-related costs by age 28 that were 10 times greater than those not diagnosed with conduct problems (Osius & Rosenthal, 2009). Thus, preventive interventions designed to deter children from engaging in risk behaviors have the potential to yield significant savings. Among prevention programs designed to reduce childhood problem behaviors, program effects were strongest among children at highest risk (Foster, Jones, & Conduct Problems Prevention Research, 2006). Our results suggest that ACE exposure might be used to identify and those who would potentially benefit the most from preventive interventions.

The current study had several strengths. First, it utilized both child welfare administrative data and children's self-reports to construct the ACE index. Most other studies of ACEs rely solely on participants' retrospective self-reports, which can be subject to recall biases (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Another strength of the study was the use of children's reports of their involvement in health-risk behaviors. Relying on official records or teachers' and caregivers' reports to assess these behaviors may underestimate their prevalence. Finally, we recruited a high percentage of eligible participants who were racially and ethnically diverse, which speaks to the generalizability of our findings for this population. Future studies are needed, however, to determine whether the results of the current study are replicated among other high-risk samples.

Despite its strengths, several limitations of the current study should be considered. First, while some of the ACEs examined in the current study overlapped with those used in the seminal ACE studies with adults (e.g. physical abuse, sexual abuse), other ACEs examined were unique to this study. We are thus unable to directly compare our results to those gleaned from studies of adults. It is important to note, however, that those ACEs unique to the current study, such as caregiver transitions and community violence exposure, have been shown to be associated with negative mental health and behavioral outcomes in previous

studies of adolescents (Garrido, Culhane, Petrenko, & Taussig, 2011). Furthermore, there have been recent calls for expanding the original ACEs items when examining diverse populations, such as ours, to include items such as community violence exposure and foster care experiences (Cronholm et al., 2015; Greeson et al., 2014; Wade et al., 2014). Indeed, in a study by Finkelhor et al. (2013), expanded ACEs items were, in some cases, more predictive of mental health symptoms than the original ACEs. Second, we cannot conclude that a greater number of ACEs caused more risk behaviors. Nor, for that matter, can we establish directionality. It is quite possible that more health-risk behaviors cause youth to be exposed to more ACEs. Third, although the use of child welfare records to identify maltreatment is based on interviews with multiple informants, it nevertheless relies on self-report and thus likely underestimates occurrence. It is also important to note that the dichotomization (present/absent) of the individual ACE items and health-risk behaviors may have obscured important relationships between these constructs that would have been identified if we had been able to operationalize these variables in a more nuanced way that accounted for frequency, severity, etc. Finally, although demographic variables that have been found to be associated with health-risk behaviors were controlled for in study analyses, it is possible that other, unaccounted for individual and socio-demographic factors may explain the ACEs-risk behavior association.

Conclusion

Health-risk behaviors among adolescents are pervasive, costly, and when not addressed, often result in acts of increasing severity that persist into adulthood (Snyder, 2001). While evidence-based programs designed to prevent these behaviors exist, the early identification of children most vulnerable may increase the return on investment of these programs. ACE exposure, according to our results, appears to be one promising means by which to identify children who are most at risk for early risk behaviors. Future studies should examine those factors that may attenuate this association. These studies can help inform prevention and intervention programs aimed at promoting the healthy functioning of high-risk children, thereby reducing morbidity and mortality.

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Table 1
Rates of Health-Risk Behaviors and Associations with Participants' Sex, Race/Ethnicity, and Age^a

Health-Risk Behaviors	Overall Sample (<i>n</i> = 515)	Sex		Race/Ethnicity		Age ^a
		Males (<i>n</i> = 268)	Females (<i>n</i> = 247)	Caucasian (<i>n</i> = 125)	Non-Caucasian (<i>n</i> = 390)	
Violence	19.6%	29.1%	9.3% ***	18.4%	20.0%	.09 *
Started a fist fight or shoving match	16.7%	25.4%	7.3% ***	13.6%	17.5%	
Hurt or tortured animals	3.7%	4.9%	2.4%	6.5%	2.8%	
Used a weapon to attack or get things from someone	1.7%	3.0%	0.4% *	0.8%	2.1%	
Substance Use	13.4%	15.7%	10.9%	8.0%	8.2%	.15 **
Cigarettes	11.1%	12.3%	9.8%	10.5%	11.3%	
Marijuana	6.3%	8.8%	3.3%	2.4%	2.6%	
Alcohol (full drink)	4.5%	4.7%	4.3%	1.6%	1.8%	
Inhalants	2.0%	0.9%	3.3%	1.6%	0.5%	
Methamphetamines	0.5%	0.0%	1.1%	0.1%	0.0%	
Delinquency	35.9%	43.7%	27.5% ***	34.4%	36.4%	.19 ***
Shoplifted	22.5%	26.9%	17.8% *	18.4%	23.8%	
Purposely damaged or destroyed the property of others	10.9%	15.3%	6.1% ***	8.1%	11.8%	
Set fire or tried to set fire to something	6.8%	9.3%	4.0% *	6.4%	6.9%	
Carried a hidden weapon like a knife or gun	4.7%	6.3%	2.8%	7.2%	3.8%	
Went into a house or building to steal something	2.9%	4.1%	1.6%	3.2%	2.8%	
Any Risk Behavior	43.7%	52.6%	34.0% ***	41.6%	44.4%	.20 ***

Note.

^a values in this column represent point-biserial correlation coefficients;

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 2

Rates of ACE Exposure by Participants' Sex and Race/Ethnicity

Number of ACEs	Overall Sample	Sex		Race/Ethnicity	
		Males	Females	Caucasian	Non-Caucasian
0	12.8%	13.4%	12.1%	19.2%	10.8%
1	37.0%	33.6%	40.9%	39.2%	36.4%
2	29.3%	31.0%	27.5%	27.2%	30.0%
3	14.1%	13.0%	15.3%	8.0%	16.2%
4	5.6%	6.3%	7.7%	4.8%	5.9%
5	1.0%	0.4%	2.0%	1.6%	0.8%
<i>M</i>	1.66	1.69	1.62	1.45	1.72*
<i>SD</i>	1.11	1.10	1.11	1.13	1.09

Note. ACE = Adverse Childhood Experiences;

* $p < .01$

Table 3

Proportions and Rates of Health-Risk Behaviors as a Function of the Number of ACEs

Number of ACEs	0	1	2	3	4	5
Violence	10/66 (15.2%)	28/191 (14.7%)	32/151 (21.2%)	24/73 (32.9%)	7/29 (24.1%)	0/5 (0.0%)
Substance Use	2/66 (3.0%)	16/191 (8.4%)	27/151 (17.9%)	17/73 (23.3%)	6/29 (20.7%)	1/5 (20.0%)
Delinquency	17/66 (25.8%)	51/191 (26.7%)	56/151 (37.1%)	42/73 (57.5%)	16/29 (55.2%)	3/5 (60.0%)
Any Risk Behaviors	22/66 (33.3%)	66/191 (34.6%)	70/151 (46.4%)	46/73 (63.0%)	18/29 (62.1%)	3/5 (60.0%)

Note. ACEs = Adverse Childhood Experiences

Table 4

Bivariate Logistic Regression Models Predicting Engagement in Health-Risk Behaviors

Predictor	OR (95% CI)
Model Predicting Violence	
ACE Index	1.27 [*] (1.05, 1.54)
Model Predicting Substance Use	
ACE Index	1.59 ^{***} (1.27, 1.98)
Model Predicting Delinquency	
ACE Index	1.54 ^{***} (1.05, 1.54)
Model Predicting Any Risk Behavior	
ACE Index	1.48 ^{***} (1.25, 1.74)

Note. ACE = Adverse Childhood Experiences;

^{*}
 $p < .05$;

^{**}
 $p < .01$;

^{***}
 $p < .001$

Table 5

Hierarchical Logistic Regression Models Predicting Engagement in Health-Risk Behaviors

Step/Predictor	Step 1	Step 2
Models Predicting Violence		
1. Age	1.22 (.95, 1.58)	1.01 (.62, 1.64)
Sex	3.97 *** (2.39, 6.60)	4.69 ** (1.81, 12.23)
Caucasian/Non-Caucasian	1.02 (.59, 1.06)	1.38 (.55, 3.48)
ACE Index	1.24 * (1.02, 1.52)	.41 (.03, 5.12)
2. Age × ACE Index		1.12 (.89, 1.42)
Sex × ACE Index		.92 (.60, 1.41)
Caucasian/Non-Caucasian × ACE Index		.82 (.52, 1.30)
Models Predicting Substance Use		
1. Age	1.66 ** (1.22, 2.25)	1.65 (.89, 3.08)
Sex	1.45 (.85, 2.47)	2.26 (.76, 6.71)
Caucasian (Y/N)	.89 (.47, 1.69)	.76 (.22, 2.58)
ACE Index	1.50 *** (1.19, 1.87)	1.69 (.09, 33.56)
2. Age × ACE Index		1.00 (.75, 1.32)
Sex × ACE Index		.81 (.51, 1.27)
Caucasian/Non-Caucasian × ACE Index		1.09 (.64, 1.83)
Models Predicting Delinquency		
1. Age	1.47 *** (1.18, 1.82)	1.52 * (1.00, 2.30)
Sex	2.04 *** (1.39, 3.00)	2.52 * (1.21, 5.26)
Caucasian/Non-Caucasian	1.04 (.66, 1.64)	.81 (.36, 1.83)
ACE Index	1.48 *** (1.25, 1.77)	1.98 (.22, 17.56)
2. Age × ACE Index		.98 (.79, 1.20)
Sex × ACE Index		.89 (.63, 1.26)
Caucasian/Non-Caucasian × ACE Index		1.17 (.77, 1.79)
Models Predicting Any Risk Behavior		
1. Age	1.49 *** (1.21, 1.83)	1.17 (.79, 1.73)
Sex	2.16 *** (1.49, 3.13)	3.02 ** (1.51, 6.52)
Caucasian/Non-Caucasian	1.01 (.65, 1.56)	.88 (.41, 1.90)
ACE Index	1.42 *** (1.19, 1.68)	.34 (.04, 2.91)
2. Age × ACE Index		1.16 (.94, 1.42)
Sex × ACE Index		.82 (.58, 1.16)
Caucasian/Non-Caucasian × ACE Index		1.07 (.71, 1.62)

Note. ACE = Adverse Childhood Experiences;

* $p < .05$;

** $p < .01$;

 $p < .001$

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