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Pathways from Childhood Abuse and Other Adversities to Adult Health Risks: The Role of Adult Socioeconomic Conditions

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Abstract

Adverse Childhood Experiences (ACEs), including child abuse, have been linked with poor health outcomes in adulthood. The mechanisms that explain these relations are less understood. This study assesses whether associations of ACEs and health risks are mediated by adult socioeconomic conditions, and whether these pathways are different for maltreatment than for other types of adversities.

Using the Behavioral Risk Factor Surveillance System 2012 survey ($N=29,229$), we employ structural equation modeling to (1) estimate associations of the number and type of ACEs with five health risks – depression, obesity, tobacco use, binge drinking, and self-reported sub-optimal health; and (2) assess whether adult socioeconomic conditions— marriage, divorce and separation, educational attainment, income and insurance status—mediate those associations.

Findings suggest both direct and indirect associations between ACEs and health risks. At high numbers of ACEs, 15–20% of the association between number of ACEs and adult health risks was attributable to socioeconomic conditions. Associations of three ACEs (exposure to domestic violence, parental divorce, and residing with a person who was incarcerated) with health risks were nearly entirely explained by socioeconomic conditions in adulthood. However, child physical, emotional and sexual abuse were significantly associated with several adult health risks, beyond the effects of other adversities, and socioeconomic conditions explained only a small portion of these associations. These findings suggest that the pathways to poor adult health differ by types of ACEs, and that childhood abuse is more likely than other adversities to have a direct impact.

Keywords

health; mediation; adverse childhood experiences; socioeconomic status; abuse

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A significant body of research has documented associations between adverse childhood experiences (ACEs), including child maltreatment, and poor health behaviors and outcomes (Anda, et al., 1999; Anda, et al., 2001; Anda, et al., 2002; Dietz, et al., 1999; Dong, Anda, Dube, Giles, & Felitti, 2003; Dube, et al, 2001a; Dube, et al., 2001b; Felitti, et al., 1998). Additionally, researchers widely agree that social and economic characteristics (especially poverty) are associated with poor health outcomes (Wilkinson & Marmot, 2003). Yet, little research has sought to understand the extent to which ACEs influence socioeconomic status (SES), and whether some portion of the established associations between ACEs and health reflect an indirect effect operating through SES. The current study focuses on poverty and its correlates as key mediating mechanisms through which ACEs might contribute to poor health and health behaviors. In addition, we assess whether these mechanisms differ across types of ACEs. Specifically, we address 3 research questions: (1) What is the direct effect of ACEs (ACE scores and ACE types) on three adult socioeconomic factors—education level, marital status, and income level?; (2) What is the direct effect of ACEs (ACE scores and ACE types) on five health risks—depression, tobacco use, binge drinking, obesity, and self-reported health status?; and (3) Is part of the association between ACEs (ACE scores and ACE types) and the four health-related outcomes mediated by adult socioeconomic factors?

Literature Review

ACEs and Health

Experiences during childhood have a profound effect on health and well-being later in life. Much of our knowledge about this issue stems from studies of ACEs. Generally speaking, studies of ACEs include the following types of adversities: physical, sexual and emotional abuse, as well as exposure to domestic violence, parental divorce or separation, or having resided with someone who abuse drugs or alcohol, was incarcerated, or had a mental illness. In the initial ACEs study, which involved over 17,000 adults in California, researchers asked adult respondents to retrospectively report ACEs, and assessed how these reported ACEs predicted their current health status (Felitti et al, 1998). The authors found that individuals who had experienced 4 or more ACEs were more likely to report smoking, poor self-rated health, sexual transmitted infections, physical inactivity, and severe obesity as well as increased health risks for alcoholism, drug abuse, depression, and suicide attempt compared to those with no ACEs (Felitti, et al., 1998). Additionally, there was a strong graded relationship between multiple categories of ACEs and ischemic heart disease, cancer, chronic lung disease, skeletal fractures, and liver disease (Felitti, et al., 1998). This important work spurred an entire body of research dedicated to understanding how childhood experiences impact health (Chartier, Walker, & Naimar, 2010; Dong, Dube, Felitti, Giles, & Anda, 2003; Dong et al., 2004; Dube, Williamson, Thompson, Felitti, & Anda, 2004; Ramiro, Madrid, & Brown, 2010) and whether effects differ across types of ACEs or demographic characteristics (Chartier et al, 2010; Dube et al, 2004).

Count of ACEs vs. Type of ACEs

Notably, some of the commonly-measured ACEs constitute clear child abuse (physical, sexual, and emotional) and others could be considered neglect (e.g., exposure to domestic

violence or substance abuse in the home). Yet, some items (e.g., parental divorce) are stressful, but are not maltreatment. Yet, much of the work on ACEs has focused on the count of ACEs, treating each adversity with equal weight. Much evidence suggests that maltreatment is associated with poor physical and psychological health throughout the life course (Normal et al., 2012; Hussey et al., 2006; Springer, Sheridan, Kuo, & Carnes, 2007; Widom, Czaja, Bentley, & Johnson, 2012), but the ACE studies have also suggested that these other, non-maltreatment, adversities may be equally important. All types of ACEs have been associated with negative psychological outcomes, such as drug use and suicidality, though abuse-related ACEs may have a slightly larger impact on suicidality (Dube, et al., 2003; Dube, et al., 2001a). However, we are not aware of any studies that assess whether specific types of ACEs differentially impact physical health outcomes. To assess whether the measurement of ACEs matters, the current study specifically examines the relationship between both the count of ACEs as well as the different types of ACEs and their relation with adult health outcomes.

Socioeconomic Status as a Mediating Mechanism

Despite numerous studies examining associations between ACEs and health behaviors and outcomes, there is limited understanding of the specific mechanisms through which these associations occur. Prior studies documented associations between ACEs and risky health behaviors, such as smoking and a greater number of sexual partners (Anda et al., 1999; Felitti et al, 1998), which may partly explain broader associations between ACEs and poor health. However, social and economic conditions must also be considered. Although many factors contribute to an individual's socioeconomic conditions, some evidence suggests that childhood adversities are associated with adult economic outcomes. First, associations between ACEs and aspects of job performance have been reported, including self-reported absenteeism, self-reported financial problems, and self-reported job problems (Anda et al., 2004). Second, a small body of research has identified associations between maltreatment (as identified through child protection records) and income, earnings, and educational attainment in early and mid-adulthood (Currie & Widom, 2010; Merskey & Topitzes, 2010). Other childhood experiences such as growing up with a single mother, experiencing economic hardship, living apart from parents, and experiencing housing hardship have been found to be associated with experiencing homelessness as an adult (Koegel, Melamid, & Burnam, 1995). Additionally, it is well established the socioeconomic factors, including poverty, marriage, educational attainment, social status, and stress, are associated with health outcomes (Conroy, Sandel, & Zuckerman, 2010; Johnson, Kyvik, Mortensen, Skytthe, & Deary, 2010; Kiecolt-Glaser & Newton, 2005; Morris, Donkin, Wonderling, Wilkinson, & Dowler, 2000; Wilkinson & Marmot, 2003). Despite evidence suggesting that childhood experiences are associated with lower adult SES and evidence documenting the relationship between SES and adult health, it remains unclear whether various types of adverse childhood experiences are differentially associated with adult SES, or whether SES plays a mediating role in associations between childhood adversities and adult health.

Method

Data and Sample

This study uses the Behavioral Risk Factor Surveillance System (BRFSS) data from the year 2012 (U.S. Center for Disease Control and Prevention, 2012). Although each state contributes data to this survey, only 5 states included the ACEs module in their 2012 interviews (Iowa, North Carolina, Wisconsin, Tennessee, and Oklahoma). Hence, only observations from these 5 states were used, amounting to 39,434 observations. Twenty-six percent of observations were excluded ($N=10,205$) due to not completing the ACEs module – the majority of exclusions came from Oklahoma, which only asked a subset of the respondents to complete the ACE module. The analytic sample consists of 29,229 respondents. When weighted, each state's sample is intended to be representative of the state's non-institutionalized population. Thus, all models are estimated using sample probability weights, which are provided as part of the BRFSS data set.

Measures

Health Risks—We examine 5 health risks: (1) a dichotomous indicator of whether the respondent was ever diagnosed with a depressive disorder; (2) a dichotomous indicator of whether the respondent is a current tobacco user, including cigarettes and smokeless tobacco products; (3) whether the respondent had one or more binge drinking episodes in the past month, as defined by consuming more than 4 drinks (women) or 5 drinks (men) in a single sitting; (4) obesity, measured as a Body Mass Index (BMI) greater than 30; and (5) self-reported sub-optimal health, as measured by respondents' report of their general health on a 5 point scale, which we dichotomize to indicate sub-optimal health if a respondent indicated 1 (poor) or 2 (fair).

Key Predictors—Adverse Childhood Experiences (ACEs) are our primary predictors. The ACE module includes questions detailed in Table 1. From these items, we collapse the 3 sexual abuse questions into a single indicator. We also dichotomize the 3 items (physical and emotional abuse, and exposure to domestic violence), which were originally measured on a scale of 0 (never), 1 (once), or 2 (more than once), to indicate “ever experienced”. The remaining items were originally measured as dichotomous indicator. We then create a count measure of the number of ACEs a respondent indicated as having ever experienced; this count is then categorized into 4 levels: 0 ACEs, 1 ACE, 2–3 ACEs and 4 or more ACEs.

To examine different effects of individual ACEs, we combined some items to limit collinearity, given moderate overlap across items. Specifically, we created a single variable for having lived with a person with a mental illness (MI) or alcohol or other drug abuse (AODA). We also combined physical and emotional abuse, which tend to co-occur. The remaining ACEs were retained as single items.

Mediators—We consider several social and economic factors as mediators: income (8 categories), educational attainment (high school dropout and college degree, reference group has high school diploma or equivalent), marital status (married or widowed and divorced or separated, reference group is never married), and health insurance status (dichotomous

indicator equal to 1 if respondent is insured). Notably, health insurance status is modeled as a second-order mediator – that is, it is assumed to be affected by ACEs only through income and marital status.

Covariates—We control for demographic characteristics: race and ethnicity (non-Hispanic black, Hispanic – any race, and other race, reference non-Hispanic white), sex (male or female), age (years) and age squared, whether there are any children living at home, and state of residence. Given that children living in the home is chronologically subsequent to ACEs, our models allow that variable to be affected by ACEs as well as demographics, and to affect health risks directly.

Analytic Approach

We use structural equation modeling to estimate the direct and indirect effects of ACE scores on each health-related outcome. The basic model is diagrammed in Figure 1. Our primary pathways of interest are (1) the direct pathway between ACE scores and health outcomes and (2) the indirect pathways of ACE scores to health through income, education and marital status. The covariance structure is adjusted to account for the correlations between income and marital status. We use STATA13 to estimate these models. We use the *mlmv* (maximum likelihood with missing values) option to retain observations with missing values. This approach to missing data is considered to be more efficient and less prone to error in decision-making than multiple imputation (Alison, 2012). This option assumes that the variables follow a multivariate normal distribution. However, models excluding missing values (not shown) produced substantively similar results.

With the missing data option specified, the only fit statistic provided is the coefficient of determination, which is similar to an R^2 in that it can vary between 0 and 1 and estimates the amount of variation in the outcome explained by the model (StataCorp, 2013). All of our presented models meet the threshold of $< .08$ for the RMSR value. The coefficients of determination range from .55 to .63 and are reported at the bottom of Tables 4 and 6. Another statistic often used to assess fit, the standardized root mean square residual [RMSR], could not be calculated for SEM models using maximum likelihood with missing values; however, this statistic was able to be calculated for the supplementary models using complete case analysis (not shown) and those models demonstrated acceptable fit using a maximum threshold of .08.

Results

Sample Description

Descriptive statistics are presented in Table 2. We estimate the lifetime prevalence of a depressive disorder and recent binge drinking to affect about 18% of the respondents, whereas tobacco use and obesity are present for 25% and 31% of respondents, respectively. About 17% of respondents self-reported sub-optimal health. Over half of the sample experienced at least 1 ACE and 17% experienced 4 or more ACEs. Turning to socioeconomic characteristics, 62% of the sample is married or widowed and about 88% has

a high school diploma or equivalent. Lastly, the sample is 51% male and 80% non-Hispanic white, and the average respondent is 48 years old.

Structural Equation Modeling Results

Count of ACEs, SES and Health Risks—In Table 3, we show the associations between ACE scores and adult socioeconomic characteristics. As compared with no ACEs, respondents reporting any ACEs have a statistically significantly higher probability of dropping out of high school, and being either divorced or separated, and a lower probability of having a college degree or being married or widowed. Respondents reporting 2 to 3 or 4 or more ACEs also have lower income as compared with respondents with no ACEs. The income category of respondents reporting 1 ACE is not significantly different from respondents reporting 0 ACEs.

Results of the primary pathways of interest are presented in Table 4. Reported ACE scores are directed associated with the probability of having ever been diagnosed with a depressive disorder. This is particularly true for 4 or more ACEs, which predicts a 23.9 percentage point (PP) higher probability of ever-diagnosed depression as compared with 0 ACEs. Income is negatively associated with the probability of ever-diagnosed depression, and education level has a significant association with ever-diagnosed depression that operates through income. Compared with single/never married respondents, divorced or separated respondents have increased risk of a depression diagnosis. Health insurance status also predicts higher risk of ever-diagnosed depression; however, this likely reflects that access to care increases the probability that a depressive disorder would be identified. The indirect effects of ACE scores, operating through education, income and marital status, are a small but statistically significant portion of the total effect (which is the sum of the direct and indirect effects). The percentage of the total effect that is mediated by socioeconomic characteristics is 8% for 1 ACE, 11% for 2–3 ACEs, and 12% for 4 or more ACEs.

Findings for tobacco use are similar overall, with a few exceptions. First, being married or widowed (–), in addition to the other SES measures, is a significant predictor of tobacco use. Second, those with health insurance are estimated to be 8.3PP *less* likely to use tobacco. Third, the indirect effects of ACE scores on tobacco use are somewhat more prominent – in this case, the indirect effects constitute between 18% and 27% of the total effect of ACE scores on tobacco use.

ACEs were most weakly associated with recent binge drinking than with other outcomes. For example, whereas 4 or more ACEs predicted 23.9 PP and 13.7 PP increases in the probabilities of ever-diagnosed depression and tobacco use, respectively, it predicted only a 3.1 PP increase in recent binge drinking. Estimated indirect effects of ACEs on recent binge drinking were small and directionally inconsistent. Socioeconomic characteristics were not associated with binge drinking in the same way that they were associated with the other health outcomes. That is, being a high school dropout was associated (through income) with a lower probability of binge drinking, whereas having a college degree predicted an increased probability. The direct association between income and binge drinking was negative, but quite small. As with tobacco use, however, being married or widowed predicted a lower probability of binge drinking.

Reported ACE scores were associated with a 3.5 to 6.4 PP increase in the probability of being obese. Education and income were also significantly associated with obesity, but the extent to which socioeconomic characteristics mediated the association between ACE scores and obesity varied by number of ACEs. There was no indirect effect on obesity for 1 ACE, and the indirect effect of 2–3 ACEs accounted for only 7.8% of the total effect. The indirect effect of 4 or more ACEs on obesity accounted for 14.6% of the total effect. As with ever-diagnosed depression, having health insurance predicted higher risk of obesity compared with the uninsured.

Lastly, turning to self-reported sub-optimal health, we find that each ACE count grouping predicted a higher probability of sub-optimal health compared with no ACEs: the size of these associations were 2 PP, 5.1 PP and 10 PP for those reporting 1 ACE, 2 to 3 ACEs and 4 or more ACEs, respectively. All socioeconomic characteristics are significantly associated with self-reported sub-optimal health, and the indirect effects of ACE scores on self-reported sub-optimal health were also somewhat large. The effect of 2 to 3 and 4 or more ACEs on this outcome that are mediated through socioeconomic characteristics amount to 1.9 and 5.2 PP increases in the probabilities of self-reported sub-optimal health, respectively. Lastly, health insurance was associated with a higher probability of self-reported sub-optimal health.

Types of ACEs, SES and Health Risks—In Table 5, we depict the direct associations among specific types of ACEs and socioeconomic factors. We find that only living with someone who was incarcerated, parental divorce or separation and exposure to domestic violence were associated with educational attainment. Income and marriage (but not divorce) were associated with most types of ACEs. In Table 6, we present the remainder of the SEM results—the direct and indirect associations between ACE types and the health-related outcomes. Three ACE types have direct associations with depression: living with a person with MI or AODA p (9.8 PP increase), sexual abuse (14.9 PP increase), and physical or emotional abuse (6.9 PP increase). Four ACE types have direct associations with tobacco use: living with someone with MI or AODA (4.2 PP), living with someone who was incarcerated (9.3 PP), divorce or separation (6.0 PP) and sexual abuse (3.9 PP). Most ACE types were associated with higher probabilities of ever-diagnosed depression and tobacco use through socioeconomic factors, except for living with a person with MI or AODA and physical and emotional abuse (indirect effect for tobacco use only).

Only living with a person with MI or AODA and physical or emotional abuse were directly associated with binge drinking (1.7 PP and 2.5 PP, respectively) and no ACE types increased the risk of binge drinking via socioeconomic factors. Two ACE types directly predicted obesity: living with someone with MI or AODA (2.7 PP) and sexual abuse (5.6 PP). Most ACE types had indirect associations (through socioeconomic factors) with obesity, except for living with a person with MI or AODA and physical and emotional abuse. Lastly, turning to self-reported health, we find significant direct associations with all ACE types except living with someone who was incarcerated and parental divorce or separation. However, we find relatively large indirect effects of living with someone who was incarcerated (4 PP) and smaller indirect effects for parental divorce or separation (1.5 PP), exposure to domestic violence (1.8 PP) and sexual abuse (1.8 PP).

Limitations

As is the case with all studies using the ACE survey, we note several limitations to our study. First, retrospective reporting of childhood experiences may be biased due to inaccurate recall, although prior work suggests that the ACE data are reliable (Dube et al., 2004). Second, we cannot determine whether these associations are causal in nature. There are possible confounding factors for which we are unable to account. For example, we cannot account for childhood poverty, which is likely to be associated with ACEs, adult socioeconomic status, and adult health. In addition, many adult health conditions, such as obesity, depression and substance use, have a heritable component which is not observed in these data. Fourth, a portion of the sample opted not to complete the ACE module of the survey. Comparison of respondents who did and did not respond to the ACE module suggests that individuals who did not respond to the ACE items are socioeconomically disadvantaged and are more likely to be nonwhite than are respondents who completed the ACE survey. Lastly, these data are cross-sectional. Associations between socioeconomic conditions and health risks are likely bidirectional; we are not able to account for this in our estimations. Additional research addressing these limitations is recommended.

Discussion

This study examined three main research questions: (1) What are the direct effects of ACEs (ACE scores and ACE types) on three adult socioeconomic factors—education level, marital status, and income level?; (2) What are the direct effects of ACEs (ACE scores and ACE types) on five health risks—depression, tobacco use, binge drinking, obesity, and self-reported health status?; and (3) Are associations between ACEs (ACE scores and ACE types) and the five health risks partially or fully mediated by adult socioeconomic factors?

This study extends the prior work on ACEs by focusing on potential mechanisms through which ACEs may increase health risks. While preventing the occurrence of ACEs is an important goal, so too is understanding how to interrupt the chain between ACEs and poor health outcomes. This study also helps to identify which types of ACEs are most influential for adult SES and health risks.

With regard to associations between ACEs and SES, we find that a higher number of ACEs is associated with lower levels of income, educational attainment, and marriage. Of the different types of ACEs, having lived with someone who was incarcerated and having experienced parental divorce or separation were most consistently and strongly associated with multiple domains of SES, including educational attainment, income levels, and marriage. Exposure to domestic violence was associated with education and income levels, but not with either marriage or divorce. This may reflect that children exposed to domestic violence are more likely to perpetrate or be victimized by violence in their adult relationships; thus, they may partner and dissolve partnerships at similar rates as others, but experience more dysfunctional or conflict-oriented relationships. Unfortunately, we are not able to measure the quality of adult relationships. Turning to experiences of abuse, physical or emotional abuse was only associated with marriage, whereas sexual abuse was associated with both marriage and income. Living with someone with mental illness or alcohol or drug problems was not significantly associated with any of the SES outcomes. These findings

suggest that ACEs that may relate to the dissolution of the relationship between parents (i.e., living with someone who is incarcerated, parental divorce or separation, and domestic violence) or to direct actions taken against the child (i.e. physical, emotional, and sexual abuse) are more likely to affect other realms of adult well-being, including SES. These findings are consistent with prior work suggesting that maltreatment and separation from parents are associated with lower SES in adulthood (Currie & Widom, 2010; Koegel, Melamid, & Burnam, 1995; Merskey & Topitzes, 2010). On the other hand, ACEs that may reflect or be confounded by genetic risk factors (i.e., living with someone struggling with mental illness or a substance use problem), have primarily direct associations with the health risk behaviors. Although mental health and substance abuse in the household can negatively affect the quality of the home environment and parenting a child receives, data from this sample indicate those experiences do not have statistically significant associations with socioeconomic attainment.

Second, consistent with the prior research (e.g., Fellitti et al., 1998), our findings also suggested a graded association between ACE scores and many health risks. There were also many significant associations between ACE types and health risks. ACEs reflecting abusive experiences and having lived with a person with mental illness or alcohol or drug problems were most consistently directly associated with health risks, especially depression, tobacco use and self-reported fair or poor health. Few ACE types had significant direct associations with either binge drinking or obesity. These differential findings by health risk outcome suggest that efforts to increase SES may decrease binge drinking and obesity by interrupting the chain from ACEs to health outcomes, but risks such as depression, tobacco use, and self-reported poor health would require a more targeted approach, such as counseling to buffer the traumatic impacts of ACEs.

Finally, many of the associations between ACEs and health-related outcomes are fully or partially mediated by these indicators of socioeconomic status. Three of the ACE types (experiencing parental divorce, living with an incarcerated person, and exposure to domestic violence) had few direct associations with health risks, but were indirectly associated with most outcomes through adult SES factors. Living with someone with MI or AODA had no indirect associations with health risks (except a small indirect effect on tobacco use), consistent with the non-significant associations between this ACE type and SES characteristics. Experiencing sexual abuse had both direct and indirect associations with all outcomes except binge drinking; on the whole, however, the majority of associations between sexual abuse and health risks were not mediated by SES. Similarly, although there were some indirect effects of physical and emotional abuse, impacts of physical or emotional abuse on health risks were not primarily explained by adult SES. These findings suggest that childhood experiences of physical, emotional, and sexual abuse have profound impacts for adults, affecting many realms of their overall well-being, including their SES and health. The effects tend to spread from one domain to another, which is evident in the associations we see here between these childhood experiences, SES, and health risk outcomes.

Prevention of adverse childhood experiences is critical to preventing negative health outcomes in adulthood. Our findings further indicate that the prevention of physical,

emotional and sexual abuse will likely reduce adult health risks and improve well-being in other areas of life. This is particularly important because, unlike other adversities children may face, the responsibility and authority of the government to protect children from abuse, and to intervene when abuse has occurred, is explicit. Similarly, under some state maltreatment statutes, other ACEs, such as exposure to domestic violence or parental substance abuse, can be defined as forms of child neglect (Child Welfare Information Gateway, 2012a; 2012b). Thus, those ACEs with the most direct associations with adult health risks are also those in which the governmental authority to intervene is most explicit. Hence, improving the efficacy of states' child protection systems—which are tasked with prevention, identification and redress of child abuse and neglect—may reduce impacts of childhood adversities on adult health.

Moreover, our findings on the socioeconomic mechanisms through which ACEs contribute to a range of health risks suggest additional opportunities for improving adult health. Although policies and programs may have some capacity to prevent non-abuse childhood adversities, there is no explicit governmental authority to protect children from parental divorce or incarceration. Thus, mitigating the impacts of these adversities is particularly important. Our findings suggest that, for those who have experienced non-abuse adversities, interventions focused on improving their socioeconomic opportunities may have a protective effect against depression, tobacco use, obesity, and self-reported sub-optimal health. Prior to adulthood, there are numerous opportunities to disrupt associations between ACEs and adult socioeconomic outcomes. In childhood, early learning opportunities and kindergarten readiness may be an appropriate focus, whereas in adolescence and emerging adulthood, dropout prevention and preparedness for the workforce may improve economic opportunities. With regard to mitigating the associations between ACEs and adult relationships (i.e., marriage and divorce), intervention opportunities may be less clear. Efforts to improve promote marriage and prevent divorce have shown little success among adults (Berger & Font, 2015). However, earlier interventions may help. To the extent that childhood adversities can result in insecure attachments and interfere with the formation of healthy relationships throughout the life course (Miller et al, 2011), interventions promoting secure attachment in childhood may reduce the risks of divorce and separation in adulthood.

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Figure 1.
Analytic Model

Table 1**Survey Questions for Identifying Adverse Childhood Experiences**

Question	Original Scoring
Did you live with anyone who was depressed, mentally ill, or suicidal?	
Did you live with anyone who was a problem drinker or alcoholic?	
Did you live with anyone who used illegal street drugs or who abused prescription medications?	1. Yes 2. No
Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?	
Were your parents separated or divorced?	
How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?	
Before age 18, how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking.	
How often did a parent or adult in your home ever swear at you, insult you, or put you down?	1. Never 2. Once 3. More than once
How often did anyone at least 5 years older than you or an adult, ever touch you sexually?	
How often did anyone at least 5 years older than you or an adult, try to make you touch them sexually?	
How often did anyone at least 5 years older than you or an adult, force you to have sex?	

Table 2

Descriptive Statistics

	M or %	95% CI	
Depressive disorder	17.96	17.26	18.65
Tobacco user	24.51	23.68	25.34
Recent binge drinking	17.79	17.03	18.56
Sub-optimal health	17.02	16.36	17.69
Obese	30.92	30.08	31.76
0 ACEs	39.19	38.30	40.08
1 ACE	23.94	23.13	24.74
2–3 ACEs	20.44	19.68	21.20
4+ ACEs	16.43	15.72	17.15
Lived with person with MI or AODA	33.54	32.65	34.42
Lived with person who was incarcerated	8.06	7.48	8.64
Parental divorce or separation	27.25	26.38	28.12
Exposure to domestic violence	16.91	16.22	17.60
Sexual abuse	10.74	10.18	11.29
Physical abuse	35.36	34.45	36.26
High school dropout	11.92	11.20	12.63
College degree	25.11	24.39	25.84
Income category (0–8)	5.58	5.54	5.62
Divorce/separated	13.47	12.90	14.04
Has health insurance	84.60	83.86	85.34
Married/widowed	62.44	61.50	63.38
White	80.54	81.99	79.10
Black	11.65	11.01	12.28
Hispanic	4.66	4.19	5.14
Other race	3.15	2.82	3.49
Male	50.73	49.80	51.65
Age	47.74	47.41	48.07
Children in home	35.75	34.82	36.68
Oklahoma	12.03	14.98	9.07
Iowa	36.02	35.15	36.89
North Carolina	8.03	7.65	8.40
Tennessee	20.44	19.66	21.23
Wisconsin	23.48	22.57	24.40

Notes: Total sample = 29, 229. Variables differ in the amount of missing data, however, so *N* varies across variables. Estimates use sampling weights.

Table 3

Associations between ACEs and Adult Socioeconomic Status

	High school dropout	College degree	Income category	Divorced or separated	Married or widowed
0 ACEs (reference)					
1 ACE	.017* (.008)	-.029*** (.009)	-.013 (.045)	.020** (.007)	-.039*** (.009)
2–3 ACEs	.043*** (.009)	-.047*** (.009)	-.249*** (.047)	.039*** (.007)	-.063*** (.010)
4+ ACEs	.092*** (.011)	-.122*** (.009)	-.606*** (.055)	.067*** (.008)	-.104*** (.011)

Notes: N=29,229. Estimates refer to direct effects coefficients from structural equation models. Estimates use sampling weights. Standard errors in parentheses.

*

 $p < .05$

**

 $p < .01$

 $p < .001$

Table 4

Direct and Indirect Associations between ACEs and Health-Related Outcomes

	Depressed		Tobacco use		Binge drinking		Obese		Self-reported sub-optimal health	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
0 ACEs (reference)										
1 ACE	.047*** (.007)	.004* (.002)	.031*** (.009)	.007** (.002)	.022* (.008)	.001** (.000)	.035*** (.010)	.000 (.001)	.020** (.007)	.004 (.003)
2-3 ACEs	.117*** (.008)	.015*** (.002)	.073*** (.010)	.023*** (.003)	.033*** (.009)	.000 (.000)	.047*** (.011)	.004*** (.001)	.051*** (.008)	.021*** (.003)
4+ ACEs	.239*** (.011)	.034*** (.002)	.137*** (.012)	.051*** (.003)	.031** (.011)	-.002** (.000)	.064*** (.013)	.011*** (.001)	.100*** (.010)	.051*** (.003)
HS graduate (reference)										
HS dropout		.050*** (.002)		.071*** (.003)		-.008*** (.001)		.021*** (.001)		.084*** (.004)
College graduate		-.046*** (.001)		-.067*** (.002)		.006*** (.000)		-.019*** (.000)		-.075*** (.002)
Income	-.035*** (.002)	.002*** (.000)	-.040*** (.002)	-.004*** (.000)	.006** (.002)	-.001*** (.000)	-.017*** (.002)	.001*** (.000)	-.058*** (.002)	.001*** (.000)
Never married (reference)										
Divorced or separated	.028* (.013)		.042** (.015)		-.014 (.015)		-.025 (.015)		.024* (.009)	
Married or widowed	-.016 (.011)		-.055*** (.013)		-.049*** (.013)		.004 (.013)		.024* (.012)	
Has health insurance	.037*** (.011)		-.083*** (.013)		-.023 (.012)		.027* (.013)		.023* (.009)	

Fit Statistics

CD .558 .564 .578 .559 .561

Notes: N=29,229. Estimates refer to direct and indirect effects coefficients from structural equation models. Estimates use sampling weights. Standard errors in parentheses. Models control for demographic characteristics.

*
 $p < .05$ **
 $p < .01$ ***
 $p < .001$

Table 5

Associations among ACE types and socioeconomic characteristics

	HS dropout	College degree	Income level	Divorced or separated	Married or widowed
Lived with someone with MH/AODA problem	-.001 (.008)	.003 (.008)	-.083 (.043)	.009 (.006)	-.014 (.009)
Lived with someone who was incarcerated	.131*** (.019)	-.092*** (.010)	-.419*** (.075)	.023 (.013)	-.062*** (.016)
Parental divorce/separation	.033*** (.009)	-.079*** (.008)	-.094* (.046)	.041*** (.007)	-.023* (.009)
Exposure to domestic violence	.047*** (.011)	-.047*** (.009)	-.197*** (.055)	.009 (.009)	-.010 (.011)
Sexual abuse	.008 (.012)	-.014 (.011)	-.299*** (.059)	.030* (.010)	-.048*** (.012)
Physical or emotional abuse	-.004 (.008)	.002 (.008)	-.065 (.042)	.008 (.006)	-.027** (.008)

Notes: N=29,229. Estimates refer to direct effects coefficients from structural equation models. Estimates use sampling weights. Standard errors in parentheses.

*
 $p < .05$ **
 $p < .01$ ***
 $p < .001$

Table 6

Associations between Types of ACEs and Health-Related Outcomes

	Depressed		Tobacco use		Binge drinking		Obese		Self-reported sub-optimal	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
Lived with someone with MH/AODA problem	.098*** (.008)	.003 (.002)	.042*** (.009)	.005* (.002)	.017* (.008)	.000 (.000)	.027** (.010)	.001 (.001)	.028*** (.007)	.004 (.003)
Lived with someone who was incarcerated	.022 (.016)	.026*** (.003)	.093*** (.018)	.038*** (.004)	.022 (.017)	-.002** (.001)	.005 (.018)	.010*** (.001)	-.002 (.013)	.040*** (.004)
Parental divorce/separation	-.012 (.008)	.010*** (.002)	.060*** (.010)	.015*** (.002)	-.004 (.009)	-.000 (.000)	.002 (.010)	.002*** (.001)	-.001 (.008)	.015*** (.003)
Exposure to domestic violence	.019 (.011)	.011*** (.002)	.002 (.012)	.016*** (.003)	-.014 (.011)	-.002** (.000)	.002 (.013)	.004*** (.001)	.028** (.010)	.018*** (.003)
Sexual abuse	.149*** (.013)	.013*** (.002)	.039** (.013)	.018*** (.003)	.007 (.012)	-.000 (.000)	.056*** (.014)	.004*** (.001)	.048*** (.011)	.018*** (.004)
Physical or emotional abuse	.069*** (.008)	.002 (.002)	.012 (.009)	.004* (.002)	.025** (.008)	.001 (.000)	.012 (.010)	.001 (.001)	.034*** (.007)	.003 (.003)
High school dropout		.049*** (.002)		.068*** (.003)		-.008*** (.001)		.020*** (.001)		.083*** (.004)
College degree		-.047*** (.001)		-.065*** (.002)		.006*** (.000)		-.018*** (.000)		-.075*** (.002)
Income level	-.035*** (.002)		-.039*** (.002)		.008*** (.002)		-.016*** (.002)		-.058*** (.002)	
Divorced or separated	.030* (.013)		.040** (.015)		-.002 (.013)		-.025 (.015)		.025* (.012)	
Married or widowed	-.015* (.010)		-.055*** (.013)		-.039*** (.012)		.004 (.013)		.022* (.009)	
Has health insurance	.036*** (.011)		-.082*** (.013)		-.023 (.012)		.027* (.013)		.022* (.010)	
<i>Fit Statistics</i>										
CD	.611		.618		.630		.614		.615	

Notes: N=29,229. Estimates refer to direct and indirect effects coefficients from structural equation models. Estimates use sampling weights. Standard errors in parentheses. Models control for demographic characteristics.

* $p < .05$

100>*d*

10>*d*
**

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