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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 U.S.

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Abstract

Research has shown that adverse childhood experiences (ACEs) increase the risk of poor health-related outcomes in later life. Less is known about the consequences of ACEs in early adulthood or among diverse samples. Therefore, we investigated the impacts of differential exposure to ACEs on an urban, minority sample of young adults. Health, mental health, and substance use outcomes were examined alone and in aggregate. Potential moderating effects of sex were also explored. Data were derived from the Chicago Longitudinal Study, a panel investigation of individuals who were born in 1979 or 1980. Main-effect analyses were conducted with multivariate logistic and OLS regression. Sex differences were explored with stratified analysis, followed by tests of interaction effects with the full sample. Results confirmed that there was a robust association between ACEs and poor outcomes in early adulthood. Greater levels of adversity were associated with poorer self-rated health and life satisfaction, as well as more frequent depressive symptoms, anxiety, tobacco use, alcohol use, and marijuana use. Cumulative adversity also was associated with cumulative effects across domains. For instance, compared to individuals without an ACE, individuals exposed to multiple ACEs were more likely to have three or more poor outcomes (*OR* range = 2.75–10.15) and four or more poor outcomes (*OR* range = 3.93–15.18). No significant differences between males and females were detected. Given that the consequences of ACEs in early adulthood may lead to later morbidity and mortality, increased investment in programs and policies that prevent ACEs and ameliorate their impacts is warranted.

Keywords

Adverse childhood experiences; Health; Mental health; Substance use

Introduction

Expanding on five decades of evidence documenting the deleterious effects of child abuse and neglect (Curtis, 1963; Kempe, Silverman, Steele, Droegemueller, & Silver, 1962), research has shown that an array of adverse childhood experiences (ACEs) are associated with similar consequences. The ACE framework has helped to orient and advance the field in at least three ways. First, it acknowledges that similar consequences can result from different antecedent risks, and that these risks typically correlate. Thus, individuals who experience one ACE are often exposed to multiple ACEs. Second, ACEs tend to have a dose-response relationship with many unwanted outcomes. That is, accumulating levels of adversity often produce graded decrements in development and functioning across domains. Third, ACEs can lead to lifelong consequences. It is now widely accepted that early adversity contributes to morbidity and mortality over the life course, although the mechanisms that effectuate long-term outcomes are not well understood.

Much of this progress can be credited to the original ACE Study initiated by the Centers for Disease Control and Prevention and Kaiser Permanente. This investigation involves over 17,000 Kaiser Health Plan members in San Diego, California who were surveyed from 1995 to 1997. Retrospective accounts of ACEs such as abuse and neglect, parental divorce, and household violence were matched to health outcome data gathered from patient medical records. Results have shown that greater exposure to ACEs increases the risk of mortality and many forms of morbidity, including autoimmune, liver, coronary, and pulmonary diseases (Anda et al., 2008; Dong, Dube, Felitti, Giles, & Anda, 2003; Dong, Giles, et al., 2004; Dube et al., 2009; Felitti et al., 1998). Increasing ACE levels also have been linked to poor self-rated health (Felitti et al., 1998), mental health problems such as mood and anxiety disorders (Anda et al., 2006; Chapman et al., 2004), as well as increased use of tobacco, alcohol, and illicit drugs (Anda et al., 1999; Dube, Anda, Felitti, Edwards, & Croft, 2002; Dube et al., 2003).

Researchers have recently begun the important work of replicating the ACE Study. For instance, cross-sectional data from the Behavioral Risk Factor Surveillance System (BRFSS; Centers for Disease Control & Prevention, 2011) have been used to correlate ACEs with poor health, disease, and injury (Andersen & Blosnich, 2013; Chapman et al., 2013; Nurius, Logan-Greene, & Green, 2012). Other longitudinal investigations have also concluded that increments of ACEs foreshadow physical health and mental health conditions (Afifi et al., 2008; Danese et al., 2009; Schilling, Aseltine, & Gore, 2007). Nevertheless, there are many uncharted areas of ACE scholarship that require further exploration.

For one, there is a lack of ACE research on diverse populations. Most published evidence has originated from seminal ACE Study sample that is comprised of predominantly white (75%), high school graduates (93%) with private health insurance (Felitti et al., 1998). Few studies have examined the impact of early adversity on low-income, urban, minority samples—groups that are at a high risk of ACEs and poor health-related outcomes (Burke, Hellman, Scott, Weems, & Carrion, 2011). In addition, ACE Study respondents averaged 57 years of age (Anda et al., 1999), which helped to illuminate connections between childhood adversity and health later in life. Less is known about the effects of ACEs in early

adulthood, however, a developmental period when many mental health symptoms (e.g., depression; substance use) often emerge. Moreover, like the ACE Study, most subsequent investigations have lacked sufficient controls for confounding influences that could account, at least in part, for effects attributed to ACEs.

Finally, although it is often hypothesized that sex moderates associations between adverse experiences and their consequences, empirical tests have produced limited evidence to this effect. Some research suggests that, compared to males, females are at an elevated risk of certain anxiety disorders following potentially traumatic events (Afifi et al., 2008; Olff, Langeland, Draijer, & Gersons, 2007), but the ACE Study and other similar investigations have shown that adversity increases the risk of poor health and well-being for both males and females (Dube et al., 2002, 2005; Herman, Susser, Struening, & Link, 1997; Schilling et al., 2007). Most of these studies have demonstrated descriptive differences based on stratified analyses, which have well-known methodological limitations (Brookes et al., 2004); few studies have tested ACE-by-sex interactions to detect statistically significant differences.

To help close the above gaps in the literature, the current investigation has three objectives. First, using data from a panel study of economically disadvantaged, racial/ethnic minorities we examine the connection between ACEs and indicators of health, mental health, and substance use. Second, in addition to examining each outcome independently, we analyze outcomes in aggregate to estimate the impact of cumulative adversity on cumulative functioning across domains. Third, we test whether the effects of ACEs on health are moderated by sex.

Methods

Data for this investigation originate from the Chicago Longitudinal Study (CLS), which tracks the development of a cohort of racial and ethnic minority children (93% African American; 7% Hispanic) who were born into underprivileged, urban-dwelling families in 1979 or 1980. The study's quasi-experimental design is described in detail elsewhere (Reynolds, 2000; Reynolds & Robertson, 2003). Briefly, the CLS sample included a cohort of 1,539 children who attended public schools offering full-day kindergarten programs in 1985–1986. Approximately two-thirds of the sample ($n = 989$) attended preschool in a Chicago Child-Parent Center (CPC), and the remaining third ($n = 550$) attended schools that were randomly selected from similar low-income neighborhoods without a CPC site. The CLS has collected records from various public databases dating to the child's birth. Survey data also have been gathered periodically since 1985 from parents, teachers, and the participants themselves.

The present study includes 1,142 CLS participants (74.2% of full sample) who responded to an adult survey between ages 22 and 24 (2002–2004). Multiple modes of data collection were used, including mail, telephone, and in-person surveys, which helped to reduce non-response rates in this economically disadvantaged and often transient sample of young adults (de Leeuw, 2005). Before data collection commenced, the study was approved by the institutional review board at the University of Wisconsin-Madison (FWA# 00005399).

Measures

Study outcomes are listed in Table 1. Drawing from survey responses in early adulthood, seven dichotomous outcomes were created. *Overall health* denotes if on a 5-point Likert scale respondents rated their health as *very good* (4) or *excellent* (5). *Overall life satisfaction* also derives from a 5-point Likert scale; participants are coded 1 if their ratings of life satisfaction since high school ranged from *good* (3) to *excellent* (5).

Survey responses also provided data used to measure depressive symptoms. Respondents indicated if in the past month they felt: (a) *very sad*, (b) *hopeless*, (c) *lonely*, (d) *depressed*, or (e) *life isn't worth living*. Participants who endorsed a given symptom reported their symptom frequency, ranging from (1) *once a month* to (5) *almost every day*. We used these data to create a measure of *frequent depressive symptom(s)* indicating if a participant experienced at least one depressive symptom a few times a week or more in the past month. We created a similar measure of anxiety from a single item that asked respondents if they felt anxious in the prior month and, if so, their symptom frequency ranging from 0 (*none*) to 5 (*almost every day*). *Frequent anxiety* denotes if a respondent felt anxious a few times a week or more in the past month.

In addition, three measures of substance use were created. *Frequent tobacco use* indicates if sample members reported currently using tobacco almost every day or daily. *Frequent alcohol use* and *frequent marijuana use* reflect whether respondents reported currently drinking alcohol or smoking marijuana, respectively, a few times a week or more.

A *cumulative outcome index* was constructed from the seven indicators above by summing the number of poor outcomes for each participant. *Overall health* and *overall life satisfaction* were reverse coded so that they aligned with the negative valence of the other five outcomes. Two dichotomous outcomes were also derived from the cumulative index: 3 *poor outcomes* and 4 *poor outcomes*.

Adverse childhood experiences

CLS data yielded eight dichotomous ACE variables: (1) household Child Protective Service (CPS) record for reported abuse or neglect, (2) personal victim or witness of violent crime, (3) parent substance abuse, (4) prolonged absence of parent, (5) divorce of parents, (6) death of close friend or relative, (7) frequent family conflict, and (8) family financial problems. CPS records from birth through age 17 were gathered from databases maintained by the Chapin Hall Center for Children at the University of Chicago. The other seven ACEs were derived from survey responses in early adulthood (i.e., ages 22–24). As part of the survey, participants completed the Life Events Checklist (LEC; Johnson & McCutcheon, 1980), a widely-used measure of stressful and adverse experiences. For the LEC items listed above, respondents indicated whether each event occurred during four periods of the life course: (a) birth to age 5, (b) age 6–10, (c) age 11–15, and (d) age 16. In order to limit the scope of inquiry to adverse events during childhood, participants were coded 1 for an ACE if they reported experiencing the corresponding LEC item from ages 0–15. Individuals were coded 0 for an ACE if they did not endorse the corresponding LEC item from ages 0 to 15, even if they reported experiencing the life event after the age of 16.

Displayed in Table 1, a *cumulative ACE index* was created by summing the eight dichotomous ACE variables. Only one respondent was exposed to all eight ACEs, so the index was truncated at a maximum value of seven. The index also yielded a series of dichotomous variables indicating if a participant was exposed to 0, 1, 2, 3, 4, or 5 ACEs, respectively.

Covariates

Multivariate analyses controlled for several dichotomous variables, including participant sex, race/ethnicity, and low birth weight status (<2500 g) as well as four household measures: (a) mother a teen parent (<age 18), (b) mother did not complete high school, (c) 4 children in the household, and (d) single-parent family. Models also controlled for preschool and elementary school attendance in a Chicago Child-Parent Center, an early childhood program that has been linked to many positive long-term outcomes (Reynolds et al., 2007). Missing covariate values (~10%) were imputed using an expectation-maximization (EM) algorithm (Schafer, 1997).

Analysis plan

Descriptive analyses document the prevalence of ACEs and study outcomes overall as well as their variation between males and females. Hypothesized associations between ACEs and dichotomous indicators of health, mental health, and substance use were then tested using multivariate logistic regression. Analyses of the seven-item outcome index were performed using Ordinary Least Squares (OLS) regression with robust standard errors (Huber/White/sandwich estimator). Main-effect analyses were performed by regressing study outcomes on all dichotomous ACE variables simultaneously except the 0-ACE category, which served as the referent group. Subgroup effects for males and females were first explored through stratified (i.e., separate) analyses by estimating associations between the cumulative ACE index and each study outcome. Formal tests of moderation were then conducted by repeating the analyses with the full sample, adding an interaction term to the model that multiplies the ACE index by sex.

All statistical analyses were conducted using Stata/IC 12.1 (StataCorp, 2011). Adjusted means are reported for each outcome based on marginal effect calculations, which estimate the percentage-point difference between groups exposed to different increments of ACEs after controlling for covariates. Significance tests are reported at the .05, .01, and .001 alpha-levels.

Results

Descriptive analyses presented in Table 1 indicate that nearly four out of five CLS participants (79.5%) experienced at least one ACE, and almost half of the sample (48.9%) was exposed to multiple ACEs. Results suggest that rates of exposure to ACEs were higher for males than for females. To illustrate, 25.2% of females and 14.8% of males were not exposed to an ACE, while 5.0% of females and 12.3% of males were exposed to five or more ACEs. In aggregate, females averaged 1.38 outcomes and males averaged 2.20 outcomes on the 7-item cumulative ACE index.

Multivariate analyses uncovered significant, graded associations between health and mental health outcomes and levels of exposure to ACEs. Results shown in Table 2 revealed that, compared to the group with no ACEs, participants exposed to two ACEs ($OR = .50$), three or four ACEs ($OR = .57$), and five ACEs ($OR = .45$) reported significantly poorer overall health. Likewise, compared to the group with no ACEs, all multiple-ACE groups were significantly more likely to report low life satisfaction (OR range = .52–.22), frequent depressive symptoms (OR range = 2.01–8.09), frequent anxiety (OR range = 1.77–4.19), frequent tobacco use (OR range = 2.31–4.70), and frequent marijuana use (OR range = 2.08–6.75).

Analyses of alcohol use yielded a divergent pattern of results. Effects appeared to cluster largely at the upper end of the ACE distribution, as only the group exposed to five or more ACEs differed significantly from the group with no ACEs ($OR = 3.08$). Given this discrepant finding, and because using alcohol a few times a week may not reflect problem behavior, we conducted robustness tests with a measure of *daily alcohol use*. Approximately 4.5% of participants indicated that they used alcohol at least once per day. Results from analyses of this threshold of alcohol use did not differ substantively from our primary analyses, as only the group with five or more ACEs differed significantly from the group with no ACEs ($OR = 3.91$; $p = .012$).

As shown in Table 3, increasing ACE levels also were associated large effects on aggregate functioning across domains. For example, participants exposed to five or more ACEs averaged roughly two more negative outcomes ($\mu = 3.16$) on the seven-item outcome index than did participants exposed to 0 ACEs ($\mu = 1.18$). Logistic regression analyses of select cut-points on the seven-item index reinforced these findings. All groups exposed to multiple ACEs were more likely than the group with 0 ACEs to have three or more poor outcomes (OR range = 2.75–10.15) and four or more poor outcomes (OR range = 3.93–15.18).

Finally, stratified analyses assessed whether the relationship between ACEs and study outcomes varied between males and females. Results displayed in Table 4 indicate that ACE effects were comparable for males and females. Tests of interaction effects with the full sample (not shown) confirmed that sex did not moderate the association between the ACE index and any study outcome.

Discussion

Taken together, results confirmed that increased exposure to ACEs was associated with an increased likelihood of poor health, mental health, and substance use outcomes in early adulthood. The hypothesized dose-response relationship between cumulative adversity and cumulative consequences across domains also was supported. The estimated effects of ACEs did not differ between males and females.

Our findings largely correspond with the results of the original ACE Study, though by comparison ACEs were even more prevalent in the CLS. For example, at least one adverse event was reported by approximately 64% of respondents in the ACE Study, compared to nearly 80% of CLS participants. These results are unsurprising given the sociodemographic

composition of the CLS sample. For instance, illustrating the rate of poverty, approximately 84% of participants were eligible for free lunch at school entry (Reynolds, 2000). It is compelling, however, that ACEs contributed significantly to adult outcomes above and beyond other risk factors that were widely distributed in the sample. Thus, the impacts of ACEs appear to be detectable even in low-income, urban minority populations that are often exposed to many other demographic and ecological risks.

Another distinction between the CLS and the ACE Study is in the average age of the samples. Most ACE Study members had reached midlife or late adulthood; we examine CLS participants in early adulthood. We found that increased adversity was associated with poorer overall physical health by age 24, though the estimated effects of ACEs on most mental and behavioral health outcomes were even larger in magnitude. These results comport with expectations given that many compromising physical health conditions manifest later in the life course, whereas the onset of mood, anxiety, and substance use problems often occurs during late adolescence and early adulthood (Kessler et al., 2012; Kessler, Chiu, Demler, & Walters, 2005). A key implication is that mental health consequences in early adulthood may act as pathways that lead from ACEs to long-term physical health consequences (Prince et al., 2007; Repetti, Taylor, & Seeman, 2002).

In addition, this study makes a unique contribution by demonstrating that cumulative adversity is associated with strong, graded effects on health-related outcomes measured in aggregate. For instance, more than half (56.4%) of participants exposed to five or more ACEs were found to have at least four negative outcomes. Comparatively, four or more unwanted outcomes were discovered in less than 5% of participants who were not exposed to an ACE. It has been shown previously that ACEs tend to cluster within populations (Dong, Anda, et al., 2004; Felitti et al., 1998), and it is also well known that physical health and mental health problems are often comorbid (Grant et al., 2004; Merikangas et al., 2010). Our results suggest that there is a connection between levels of adversity in childhood and comorbidity in early adulthood. Put another way, cumulative disadvantage appears to predict cumulative dysfunction.

Furthermore, we rejoin the important question of whether adversity has differential impacts on males and females. Consistent with most research in this area, we found no evidence of ACE-by-sex variation. Our results should be viewed with some caution, however, because data were not available to evaluate PTSD and other specific anxiety disorders that may be more prevalent among females than among males in the wake of adverse events (Afifi et al., 2008; Dube et al., 2005; Olff et al., 2007).

Results also should be interpreted in light of four other study limitations. First, records of CPS reports prohibited exploration of different forms of abuse and neglect, and they also may have underestimated the true prevalence of child maltreatment in the sample (Brown, Cohen, Johnson, & Salzinger, 1998; Swahn et al., 2006). For instance, CPS records of sexual abuse are known to suffer from a high Type II error rate (Finkelhor, 1994; Pereda, Guilera, Forns, & Gómez-Benito, 2009). Unmeasured ACEs like sexual abuse, which have been shown to affect females disproportionately (Finkelhor, Hotaling, Lewis, & Smith, 1990; Walker, Carey, Mohr, Stein & Seedat, 2004), may bias our estimates downward.

Second, with the exception of the study's measure of maltreatment, ACE variables were derived from retrospective self-reports that could introduce validity threats such as recall and response biases. For example, participants who reported mental health and substance use problems may have been more disposed to remember potentially traumatic events from childhood, which could inflate associations between ACEs and study outcomes (Bernet & Stein, 1999; Green et al., 2010). Third, ACEs and outcome measures were measured cross-sectionally. Therefore, results are more safely interpreted as correlational than as causal. Fourth, because study outcomes are general indicators of health and well-being rather than specific measures of physical or psychiatric morbidity, caution should be exercised when extrapolating interpretations of clinical significance.

Despite its limitations, this study adds to a burgeoning body of research indicating that adverse outcomes in adulthood can be linked to adverse experiences in childhood. Multiple features of the investigation strengthen its contributions. Few studies have examined how ACEs impact young adults or disadvantaged, urban-dwelling minorities. Internal validity is bolstered by the study's substantial sample size and controls for many potentially confounding characteristics. External validity is enhanced by the CLS design, as participants were selected into the sample based on their public school attendance and without regard to ACE exposure or health and mental health status.

Implications

Although the evidence we present is sobering, the fact that ACEs are alterable conditions also implies that policies and programs that prevent adversity or ameliorate its effects can substantially improve public health. With this aim in mind, applying a public health framework can help to advance ACE-related research and its application in 4 areas: (a) surveillance, (b) risk assessment, (c) prevention and intervention, and (d) dissemination.

In regard to surveillance, as mentioned earlier, BRFSS data have helped to measure ACE prevalence in the general population. Cross-linking these data with CPS records and other public databases may improve the detection of ACEs and their consequences (Putnam-Hornstein, Webster, Needell, & Magruder, 2011; Schnitzer, Covington, Wirtz, Verhoek-Oftedahl, & Palusci, 2008). In practice, ACE data also can be used to augment risk assessments. By identifying children and families that are at greater risk of ACEs and their consequences, policies and services can be tailored more effectively and efficiently to populations that stand to benefit most. Given the number and heterogeneity of potentially adverse events, however, a single prescription will not suffice in preventing all ACEs or mitigating their effects.

Nevertheless, programs that reduce multiple ACEs and enhance multiple protective factors that buffer against ACEs may be particularly wise investments. For example, home visiting programs have been shown to reduce childhood injuries, promote maternal and child health, and improve parenting attitudes and behaviors (Issel, Forrestal, Slaughter, Wiencrot, & Handler, 2011; Peacock, Konrad, Watson, Nickel, & Muhajarine, 2013; Sweet & Appelbaum, 2004). The Nurse-Family Partnership program, a well-known home visiting model, also has been shown to reduce child maltreatment risk and substantiated rates of

abuse and neglect (Olds et al., 1997), though evaluations of other home visiting models have not yielded similar results (Donelan-McCall, Eckenrode, & Olds, 2009; Duggan et al., 2004; Howard & Brooks-Gunn, 2009; MacMillan et al., 2005). Parent training and family support programs such as Parent–Child Interaction Therapy (PCIT) and the Positive Parenting Program (Triple P) also appear to reduce rates of maltreatment while enhancing parenting attitudes, parent–child interactions, and child mental health (Chaffin et al., 2004; Prinz, Sanders, Shapiro, Whitaker, & Lutzker, 2009; Thomas & Zimmer-Gembeck, 2007). The Triple P model is noteworthy because it was designed explicitly for dissemination as a population-level public health intervention for parenting and family support (Prinz et al., 2009). Further research is needed to assess whether comprehensive, multilevel interventions like Triple P are able to significantly reduce diverse forms of ACEs. Likewise, translational research is needed to determine whether clinically validated models like PCIT achieve similar results when disseminated in more generalizable public service settings.

References

- Afifi TO, Enns MW, Cox BJ, Asmundson GJ, Stein MB, Sareen J. Population attributable fractions of psychiatric disorders and suicide ideation and attempts associated with adverse childhood experiences. *American Journal of Public Health*. 2008; 98:946–952. [PubMed: 18381992]
- Anda RF, Brown DW, Dube SR, Bremner JD, Felitti VJ, Giles WH. Adverse childhood experiences and chronic obstructive pulmonary disease in adult. *American Journal of Preventive Medicine*. 2008; 34:396–403. [PubMed: 18407006]
- Anda RF, Croft JB, Felitti VJ, Nordenberg D, Giles WH, Williamson DF, Giovino GA. Adverse childhood experiences and smoking during adolescence and adulthood. *The Journal of the American Medical Association*. 1999; 282:1652–1658.
- Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield C, Perry BD, Dube SR, Giles WH. The enduring effects of abuse and related adverse experiences in childhood. *European Archives of Psychiatry and Clinical Neuroscience*. 2006; 256(3):174–186. [PubMed: 16311898]
- Andersen JP, Blosnich J. Disparities in adverse childhood experiences among sexual minority and heterosexual adults: Results from a multi-state probability-based sample. *PloS One*. 2013; 8:e54691. [PubMed: 23372755]
- Bernet CZ, Stein MB. Relationship of childhood maltreatment to the onset and course of major depression in adulthood. *Depression and Anxiety*. 1999; 9:169–174. [PubMed: 10431682]
- Brookes ST, Whitely E, Egger M, Smith GD, Mulheran PA, Peters TJ. Subgroup analyses in randomized trials: Risks of subgroup-specific analyses; power and sample size for the interaction test. *Journal of Clinical Epidemiology*. 2004; 57:229–236. [PubMed: 15066682]
- Brown J, Cohen P, Johnson JG, Salzinger S. A longitudinal analysis of risk factors for child maltreatment: Findings of a 17-year prospective study of officially recorded and self-reported child abuse and neglect. *Child Abuse & Neglect*. 1998; 22:1065–1078. [PubMed: 9827312]
- 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; 35:408–413. [PubMed: 21652073]
- Centers for Disease Control and Prevention. BRFSS: Turning information into health. 2011. Retrieved from <http://www.cdc.gov/>
- Chaffin M, Silovsky JF, Funderburk B, Valle LA, Brestan EV, Balachova T, Jackson S, Lensgraf J, Bonner BL. Parent–child interaction therapy with physically abusive parents: Efficacy for reducing future abuse reports. *Journal of Consulting and Clinical Psychology*. 2004; 72:500–510. [PubMed: 15279533]
- Chapman DP, Liu Y, Presley-Cantrell LR, Edwards VJ, Wheaton AG, Perry GS, Croft JB. Adverse childhood experiences and frequent insufficient sleep in 5 US States, 2009: A retrospective cohort study. *BMC Public Health*. 2013; 13:3. [PubMed: 23286392]

- Chapman DP, Whitfield CL, Felitti VJ, Dube SR, Edwards VJ, Anda RF. Adverse childhood experiences and the risk of depressive disorders in adulthood. *Journal of Affective Disorders*. 2004; 82:217–225. [PubMed: 15488250]
- Curtis GC. Violence breeds violence—Perhaps? *American Journal of Psychiatry*. 1963; 120:386–387. [PubMed: 14069465]
- Danese A, Moffitt TE, Harrington H, Milne BJ, Polanczyk G, Pariante CM, Poulton R, Caspi A. Adverse childhood experiences and adult risk factors for age-related disease: Depression, inflammation, and clustering of metabolic risk markers. *Archives of Pediatrics & Adolescent Medicine*. 2009; 163(12):1135–1143. [PubMed: 19996051]
- de Leeuw ED. To mix or not to mix data collection modes in surveys. *Journal of Official Statistics*. 2005; 21:233–255.
- Donelan-McCall N, Eckenrode J, Olds DL. Home visiting for the prevention of child maltreatment: Lessons learned during the past 20 years. *Pediatric Clinics of North America*. 2009; 56:389–403. [PubMed: 19358923]
- Dong M, Anda RF, Felitti VJ, Dube SR, Williamson DF, Thompson TJ, Loo CM, Giles WH. The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child Abuse & Neglect*. 2004; 28(7):771–784. [PubMed: 15261471]
- Dong M, Dube SR, Felitti VJ, Giles WH, Anda RF. Adverse childhood experiences and self-reported liver disease: New insights into the causal pathway. *Archives of Internal Medicine*. 2003; 163:1949–1956. [PubMed: 12963569]
- Dong M, Giles WH, Felitti VJ, Dube SR, Williams JE, Chapman DP, Anda RF. Insights into causal pathways for ischemic heart disease. *Circulation*. 2004; 110:1761–1766. [PubMed: 15381652]
- Dube SR, Anda RF, Felitti VJ, Edwards VJ, Croft JB. Adverse childhood experiences and personal alcohol abuse as an adult. *Addictive Behaviors*. 2002; 27:713–725. [PubMed: 12201379]
- Dube SR, Anda RF, Whitfield CL, Brown DW, Felitti VJ, Dong M, Giles WH. Long-term consequences of childhood sexual abuse by gender of victim. *American Journal of Preventive Medicine*. 2005; 28:430–438. [PubMed: 15894146]
- Dube SR, Fairweather D, Pearson WS, Felitti VJ, Anda RF, Croft JB. Cumulative childhood stress and autoimmune diseases in adults. *Psychosomatic Medicine*. 2009; 71:243–250. [PubMed: 19188532]
- Dube SR, Felitti VJ, Dong M, Chapman DP, Giles WH, Anda RF. Childhood abuse, neglect, and household dysfunction and the risk of illicit drug use: The adverse childhood experiences study. *Pediatrics*. 2003; 111:564–572. [PubMed: 12612237]
- Duggan A, Fuddy L, Burrell L, Higman SM, McFarlane E, Windham A, Sia C. Randomized trial of a statewide home visiting program to prevent child abuse: Impact in reducing parental risk factors. *Child Abuse & Neglect*. 2004; 28:625–645.
- Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *American Journal of Preventive Medicine*. 1998; 14(4):245–258. [PubMed: 9635069]
- Finkelhor D. The international epidemiology of child sexual abuse. *Child Abuse & Neglect*. 1994; 18:409–417. [PubMed: 8032971]
- Finkelhor D, Hotaling G, Lewis I, Smith C. Sexual abuse in a national survey of adult men and women: Prevalence, characteristics, and risk factors. *Child Abuse & Neglect*. 1990; 14:19–28. [PubMed: 2310970]
- Grant BF, Stinson FS, Dawson DA, Chou SP, Dufour MC, Compton W, Pickering RP, Kaplan K. Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry*. 2004; 61(8):807–816. [PubMed: 15289279]
- Green JG, McLaughlin KA, Berglund PA, Gruber MJ, Sampson NA, Zaslavsky AM, Kessler RC. Childhood adversities and adult psychiatric disorders in the National Comorbidity Survey Replication I: Associations with first onset of DSM-IV disorders. *Archives of General Psychiatry*. 2010; 67:113–123. [PubMed: 20124111]
- Herman DB, Susser ES, Struening EL, Link BL. Adverse childhood experiences: Are they risk factors for adult homelessness? *American Journal of Public Health*. 1997; 87:249–255. [PubMed: 9103105]

- Howard KS, Brooks-Gunn J. The role of home-visiting programs in preventing child abuse and neglect. *The Future of Children*. 2009; 19:119–146. [PubMed: 19719025]
- Issel LM, Forrestal SG, Slaughter J, Wiencrot A, Handler A. A review of prenatal home-visiting effectiveness for improving birth outcomes. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*. 2011; 40:157–165.
- Johnson, JH.; McCutcheon, SM. Assessing life stress in older children and adolescents: Preliminary findings with the Life Events Checklist. In: Sarason, IG.; Spielberger, CD., editors. *Stress and anxiety*. Hemisphere; Washington, DC: 1980. p. 111-125.
- Kempe CH, Silverman FN, Steele BF, Droegemueller W, Silver HK. The battered child syndrome. *Journal of the American Medical Association*. 1962; 181:17–24. [PubMed: 14455086]
- Kessler RC, Avenevoli S, McLaughlin KA, Green JG, Lakoma MD, Petukhova M, Pine DS, Sampson NA, Zaslavsky AM, Merikangas KR. Lifetime co-morbidity of DSM-IV disorders in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *Psychological Medicine*. 2012; 42(9):1997–2010. [PubMed: 22273480]
- Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*. 2005; 62:617–627. [PubMed: 15939839]
- MacMillan HL, Thomas BH, Jamieson E, Walsh CA, Boyle MH, Shannon HS, Gafni A. Effectiveness of home visitation by public-health nurses in prevention of the recurrence of child physical abuse and neglect: A randomised controlled trial. *The Lancet*. 2005; 365:1786–1793.
- Merikangas KR, He MJP, Burstein M, Swanson MSA, Avenevoli S, Cui ML, Benjet C, Georgiades K, Swendsen J. Lifetime prevalence of mental disorders in US adolescents: Results from the National Comorbidity Study-Adolescent Supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry*. 2010; 49(10):980–989. [PubMed: 20855043]
- Nurius PS, Logan-Greene P, Green S. Adverse Childhood Experiences (ACE) within a social disadvantage framework: Distinguishing unique, cumulative, and moderated contributions to adult mental health. *Journal of Prevention & Intervention in the Community*. 2012; 40:278–290. [PubMed: 22970781]
- Olds DL, Eckenrode J, Henderson CR, Kitzman H, Powers J, Cole R, Sidora K, Morris P, Pettitt LM, Luckey D. Long-term effects of home visitation on maternal life course and child abuse and neglect. *The Journal of the American Medical Association*. 1997; 278(8):637–643.
- Olf M, Langeland W, Draijer N, Gersons BP. Gender differences in posttraumatic stress disorder. *Psychological Bulletin*. 2007; 133:183–204. [PubMed: 17338596]
- Peacock S, Konrad S, Watson E, Nickel D, Muhajarine N. Effectiveness of home visiting programs on child outcomes: A systematic review. *BMC Public Health*. 2013; 13:17. [PubMed: 23302300]
- Pereda N, Guilera G, Forns M, Gómez-Benito J. The prevalence of child sexual abuse in community and student samples: A meta-analysis. *Clinical Psychology Review*. 2009; 29:328–338. [PubMed: 19371992]
- Prince M, Patel V, Saxena S, Maj M, Maselko J, Phillips MR, Rahman A. No health without mental health. *The Lancet*. 2007; 370:859–877.
- Prinz RJ, Sanders MR, Shapiro CJ, Whitaker DJ, Lutzker JR. Population-based prevention of child maltreatment: The US Triple P system population trial. *Prevention Science*. 2009; 10:1–12. [PubMed: 19160053]
- Putnam-Hornstein E, Webster D, Needell B, Magruder J. A public health approach to child maltreatment surveillance: Evidence from a data linkage project in the United States. *Child Abuse Review*. 2011; 20:256–273.
- Repetti RL, Taylor SE, Seeman TE. Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin*. 2002; 128:330–366. [PubMed: 11931522]
- Reynolds, AJ. *Success in early intervention: The Chicago Child-Parent Centers*. University of Nebraska Press; Lincoln: 2000.
- Reynolds AJ, Robertson DL. School-based early intervention and later child maltreatment in the Chicago Longitudinal Study. *Child Development*. 2003; 74:3–26. [PubMed: 12625433]
- Reynolds AJ, Temple JA, Ou SR, Robertson DL, Mersky JP, Topitzes JW, Niles MD. Effects of a school-based, early childhood intervention on adult health and well-being: A 19-year follow-up of

- low-income families. *Archives of Pediatrics & Adolescent Medicine*. 2007; 161:730–739. [PubMed: 17679653]
- Schafer, JL. *Analysis of incomplete multivariate data*. Chapman & Hall; London, England: 1997.
- Schilling EA, Aseltine RH, Gore S. Adverse childhood experiences and mental health in young adults: A longitudinal survey. *BMC Public Health*. 2007; 7:30. [PubMed: 17343754]
- Schnitzer PG, Covington TM, Wirtz SJ, Verhoek-Oftedahl W, Palusci VJ. Public health surveillance of fatal child maltreatment: Analysis of 3 state programs. *American Journal of Public Health*. 2008; 98:296–303. [PubMed: 17538060]
- StataCorp. *Stata Statistical Software: Release 12.1*. StataCorp; College Station, TX: 2011.
- Swahn MH, Whitaker DJ, Phippen CB, Leeb RT, Teplin LA, Abram KM, McClelland GM. Concordance between self-reported maltreatment and court records of abuse or neglect among high-risk youths. *American Journal of Public Health*. 2006; 96:1849–1853. [PubMed: 17008582]
- Sweet MA, Appelbaum MI. Is home visiting an effective strategy? A meta-analytic review of home visiting programs for families with young children. *Child Development*. 2004; 75:1435–1456. [PubMed: 15369524]
- Thomas R, Zimmer-Gembeck MJ. Behavioral outcomes of Parent–Child Interaction Therapy and Triple P—Positive Parenting Program: A review and meta-analysis. *Journal of Abnormal Child Psychology*. 2007; 35:475–495. [PubMed: 17333363]
- Walker JL, Carey PD, Mohr N, Stein DJ, Seedat S. Gender differences in the prevalence of childhood sexual abuse and in the development of pediatric PTSD. *Archives of Women's Mental Health*. 2004; 7:111–121.

Table 1

Descriptive statistics: adverse childhood experiences and health-related outcomes.

	<u>Total sample</u>		<u>Female</u>		<u>Male</u>	
	<i>N</i>	Mean	<i>N</i>	Mean	<i>N</i>	Mean
Number of ACEs						
Cumulative ACE index	1,129	1.81	620	1.55	522	2.12
0 ACEs	1,129	20.5%	620	25.2%	522	14.8%
1 ACE	1,129	31.6%	620	32.4%	522	30.7%
2 ACEs	1,129	20.8%	620	21.6%	522	19.8%
3–4 ACEs	1,129	18.8%	620	15.8%	522	22.4%
5 ACEs	1,129	8.3%	620	5.0%	522	12.3%
Discrete outcomes						
Overall health	1,138	71.3%	619	68.2%	519	75.5%
Overall life satisfaction	1,141	63.7%	620	68.4%	521	58.2%
Frequent depressive symptoms, previous month	1,134	24.9%	617	25.1%	517	24.6%
Frequent anxiety, previous month	1,126	24.1%	614	16.5%	512	33.2%
Frequent tobacco use	1,125	28.0%	613	20.1%	512	38.5%
Frequent alcohol use	1,123	16.9%	612	7.0%	511	29.4%
Frequent marijuana use	1,120	16.6%	613	8.0%	507	27.8%
Aggregate outcomes						
7-item outcome index	1,119	1.76	613	1.38	506	2.20
3 poor outcomes	1,127	28.8%	614	21.0%	513	38.2%
4 poor outcomes	1,127	15.6%	614	8.3%	513	24.4%

Note: Cumulative ACE index and cumulative outcome index range from 0 to 7. All other measures are dichotomous.

ACE: adverse childhood experiences.

Table 2

Estimated effects of ACEs on health, mental health, and substance use.

	<i>N</i> of ACEs	Adj. mean	OR (95% CI)
Overall health (<i>N</i> = 1,127)	0	79.2	– (Referent)
	1	72.8	.73 (.49–1.09)
	2	64.2**	.50 (.33–.77)
	3–4	67.0*	.57 (.37–.88)
	5	61.0**	.45 (.26–.77)
Overall life satisfaction (<i>N</i> = 1,128)	0	76.8	– (Referent)
	1	69.9	.74 (.50–1.10)
	2	61.4**	.52 (.35–.79)
	3–4	46.4***	.28 (.18–.43)
	5	41.0***	.22 (.13–.38)
Frequent depressive symptom, previous month (<i>N</i> = 1,125)	0	13.5	– (Referent)
	1	20.6	1.47 (.92–2.35)
	2	27.2**	2.01 (1.24–3.28)
	3–4	40.0***	3.56 (2.20–5.75)
	5	60.5***	8.09 (4.56–14.37)
Frequent anxiety, previous month (<i>N</i> = 1,118)	0	16.1	– (Referent)
	1	15.7	.98 (.61–1.56)
	2	32.2***	2.29 (1.44–3.65)
	3–4	26.8*	1.77 (1.09–2.86)
	5	47.3***	4.19 (2.39–7.34)
Frequent tobacco use (<i>N</i> = 1,125)	0	17.4	– (Referent)
	1	20.0	1.14 (.73–1.78)
	2	35.1***	2.31 (1.47–3.63)
	3–4	37.3***	2.52 (1.60–3.98)
	5	53.0***	4.70 (2.69–8.21)
Frequent alcohol use (<i>N</i> = 1,120)	0	9.4	– (Referent)
	1	14.5	1.51 (.88–2.59)
	2	15.4	1.59 (.89–2.83)
	3–4	15.8	1.63 (.92–2.89)
	5	27.4***	3.08 (1.62–5.89)
Frequent marijuana use (<i>N</i> = 1,117)	0	7.7	– (Referent)
	1	13.3	1.57 (.88–2.83)
	2	17.6*	2.08 (1.13–3.82)
	3–4	19.6**	2.34 (1.28–4.28)
	5	43.1***	6.75 (3.48–13.10)

CI: confidence interval; OR: odds ratio; ACE: adverse childhood experiences; Adj. mean: adjusted mean controlling for covariates.

*
 $p < .05$.

**
 $p < .01$.

 $p < .001$.

Table 3

Estimated effects of ACEs on aggregate health-related outcomes.

<i>N</i> of ACEs	7-item outcome index (<i>N</i> = 1,116)		3 poor outcomes (<i>N</i> = 1,124)		4 poor outcomes (<i>N</i> = 1,124)	
	Adj. mean	<i>B</i> (95%, CI)	Adj. mean	<i>OR</i> (95%, CI)	Adj. mean	<i>OR</i> (95%, CI)
0 ACEs	1.18	– (Referent)	14.2	– (Referent)	4.8	– (Referent)
1 ACE	1.41 [*]	.23 (.02–.45)	23.0	1.55 (.98–2.46)	10.7	1.72 (.84–3.51)
2 ACEs	1.94 [*]	.76 (.50–1.03)	36.1 [*]	2.75 (1.71–4.43)	23.6 [*]	3.93 (1.95–7.93)
3–4 ACEs	2.16 [*]	.98 (.72–1.25)	42.1 [*]	3.54 (2.20–5.70)	23.8 [*]	3.90 (1.93–7.91)
5 ACEs	3.16 [*]	1.98 (1.59–2.36)	66.4 [*]	10.15 (5.67–18.18)	56.4 [*]	15.18 (7.17–32.17)

CI: confidence interval; *B*: standardized beta; *OR*: odds ratio; ACEs: adverse childhood experiences. Adj. mean: adjusted mean controlling for covariates.

*
 $p < .05$.

**
 $p < .01$.

 $p < .001$.

Table 4

Associations between ACEs and study outcomes: stratified analysis of males and females.

	Overall health, females (<i>N</i> = 614)		Overall health, males (<i>N</i> = 513)		Life satisfaction, females (<i>N</i> = 615)		Life satisfaction, males (<i>N</i> = 513)	
	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI
ACE Index	.87*	.77–.97	.91	.81–1.02	.72***	.64–.81	.73***	.65–.82
	Frequent depressive symptoms, females (<i>N</i> = 613)		Frequent depressive symptoms, males (<i>N</i> = 512)		Frequent anxiety, females (<i>N</i> = 610)		Frequent anxiety, males (<i>N</i> = 508)	
	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI
ACE Index	1.39***	1.23–1.57	1.59***	1.39–1.81	1.25**	1.09–1.44	1.33***	1.19–1.49
	Frequent tobacco use, females (<i>N</i> = 613)		Frequent tobacco use, males (<i>N</i> = 512)		Frequent alcohol use, females (<i>N</i> = 612)		Frequent alcohol use, males (<i>N</i> = 508)	
	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI
ACE Index	1.26**	1.11–1.44	1.41***	1.25–1.58	1.39***	1.16–1.67	1.11	.99–1.24
	Frequent marijuana use, females (<i>N</i> = 613)		Frequent marijuana use, males (<i>N</i> = 504)		7-Item Outcome Index, females (<i>N</i> = 613)		7-Item Outcome Index, males (<i>N</i> = 503)	
	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
ACE Index	1.42***	1.20–1.70	1.30***	1.15–1.46	.30***	.22–.37	.39***	.30–.48
	3 poor outcomes, females (<i>N</i> = 614)		3 poor outcomes, males (<i>N</i> = 510)		4 poor outcomes, females (<i>N</i> = 614)		4 poor outcomes, males (<i>N</i> = 510)	
	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI	<i>OR</i>	95% CI
ACE Index	1.50***	1.31–1.71	1.49***	1.33–1.68	1.59***	1.34–1.89	1.58***	1.39–1.80

ACEs: adverse childhood experiences; *B*: standardized beta; *OR*: odds ratio; CI: confidence interval; Adj. mean: adjusted mean controlling for covariates.

* $p < .05$.

** $p < .01$.

*** $p < .001$.