

## Adverse Childhood Experiences and Household Out-of-Pocket Healthcare Costs



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**Introduction:** Adverse childhood experiences are associated with higher risk of common chronic mental and physical illnesses in adulthood, but little evidence exists on whether this influences medical costs or expenses. This study estimated increases in household medical expenses associated with adults' reported adverse childhood experience scores.

**Methods:** Household out-of-pocket medical cost and adverse childhood experience information was collected in the 2011 and 2013 waves of the Panel Study of Income Dynamics and its linked 2014–2015 Panel Study of Income Dynamics Childhood Retrospective Circumstances Study supplement and analyzed in 2017. Generalized linear regression models estimated adjusted annual household out-of-pocket medical cost differences by retrospective adverse childhood experience count and compared costs by family type and size. Logistic models estimated odds of out-of-pocket costs that were >10% of household income or >100% of savings, as well as odds of household debt.

**Results:** Adverse childhood experience scores were associated with higher out-of-pocket costs. Annual household total out-of-pocket medical costs were \$184 (95% CI=\$90, \$278) or 1.18-fold higher when respondents reported one to two adverse childhood experiences and \$311 (95% CI=\$196, \$426) or 1.30-fold higher when three or more adverse childhood experiences were reported by an adult in the household. Odds of household medical costs >10% of income, >100% of savings, and the presence of household medical debt were 2.48-fold (95% CI=1.40, 4.38), 2.25-fold (95% CI=1.69, 2.99), and 2.29-fold (95% CI=1.56, 3.34) higher when an adult in the household reported three or more adverse childhood experiences compared with none.

**Conclusions:** Greater exposure to adverse childhood experiences is associated with higher household out-of-pocket medical costs and financial burden in adulthood.

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### INTRODUCTION

Adverse childhood experiences (ACEs) are stressful and potentially traumatic events, including abuse, neglect, and household dysfunction, that occur any time before age 18 years.<sup>1</sup> Numerous studies have linked a higher number of reported ACEs with poorer adult mental and physical health, chronic disease, and premature mortality.<sup>2,3</sup> Worse adult health associated with higher numbers of ACEs is also associated with higher healthcare utilization,<sup>4</sup> which likely increases overall costs of care and, in turn, the out-of-pocket (OOP) medical expenses incurred. Although a few studies have examined the costs

attributable to specific forms of childhood maltreatment, none have examined how overall ACE scores impact costs, or OOP costs specifically. OOP costs—defined as

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direct spending by consumers for all healthcare goods and services, including co-insurance, deductibles, and any amount not covered by insurance—are often used as a measure of the economic burden of health care to patients.<sup>5–7</sup> Nationally, OOP costs represent just over 10% of total healthcare expenditure, though the proportion varies by insurance plan.<sup>8</sup> High OOP costs are associated with medical nonadherence and other health inequities, especially among low-income individuals at higher risk for ACEs and their health consequences throughout the lifecourse.<sup>9,10</sup>

Previous studies estimating the costs of childhood adversity have focused on long-term health system costs attributable to childhood abuse in women, as well as short-term total Medicaid costs and long-term societal costs for children specifically after reportable maltreatment.<sup>11–14</sup> One study found that ambulatory, inpatient, and mental health services costs in a managed care system were more than a third higher for women with histories of childhood sexual and physical abuse.<sup>15</sup> Two other studies found higher self-reported ambulatory care costs for women who were childhood physical or sexual abuse survivors up to nearly twice the costs of women with no abuse history.<sup>16,17</sup>

Given growing awareness of the impact of ACEs, estimates of the OOP costs associated with ACEs could quantify the long-term economic burden childhood adversity places directly on individuals and households. Such information might also be useful in estimating returns to households on upstream investments in ACE prevention strategies.

This study assesses the association between ACE scores and overall household OOP medical costs, as well as high OOP cost burden and likelihood of medical debt, while controlling for sociodemographic factors and insurance type. Patterns of association stratified by household structure are explored, as well as associations between ACEs. To determine whether any associations found are likely mediated by worse adult health as a consequence of higher ACEs, the study examines mediation by health condition count and mental illness burden.

## METHODS

### Study Sample

Data were from the Panel Study of Income Dynamics (PSID), a national panel survey of household economic well-being containing a host of health and demographic information, comprising main individual and family files plus linked subsample supplements. Data collected by phone from the 2011 and 2013 PSID main interview included information on health, education, income, health insurance, family structure, OOP healthcare expenditures, and demographic characteristics for adult heads of household and, if

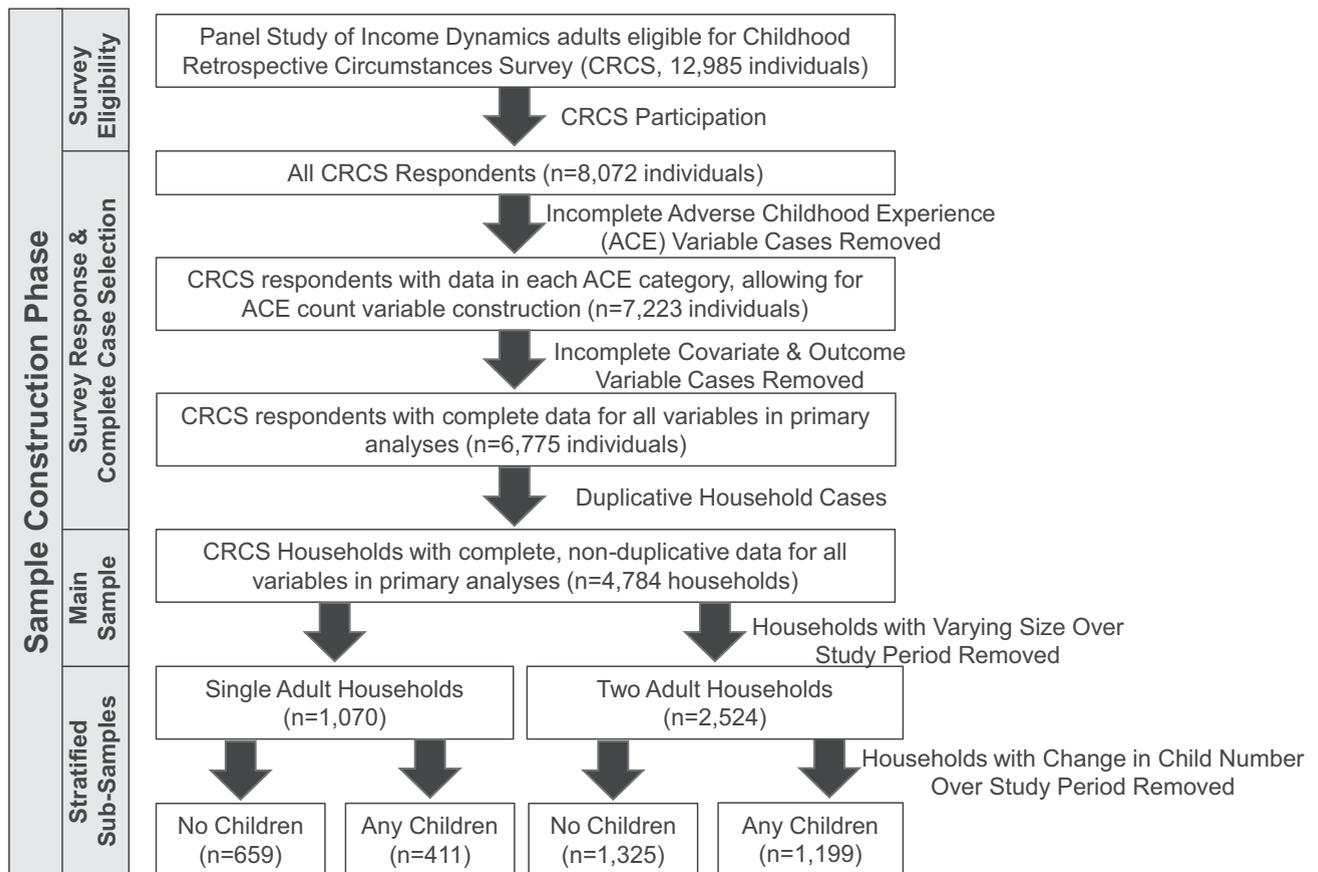
present, their spouses or partners and their children and other family members. English-speaking adult heads of household and their spouses were eligible for the PSID Childhood Retrospective Circumstances Study (CRCS) supplement, which retrospectively assessed childhood experiences including nine ACEs via web-based or mailed survey between 2014 and 2015 with an unweighted response rate of 62% (weighted rate 67%), similar to web-based supplements to other national panel studies.<sup>18</sup> Household-level associations between adults' ACE counts and household OOP costs were assessed for (1) the entire sample of households in which complete data were available for either or both adults, (2) households consisting of one adult over the entire study period (with and without children), and (3) households with two adults over the entire study period (with and without children). Because the PSID OOP medical cost information is collected at the household level, this approach of analyzing the two subgroups within the overall sample was chosen to disaggregate individual from household costs and understand whether the ACE scores of male and female adults within households have joint influence. [Figure 1](#) displays the study sample and subsample construction.

### Measures

Complete data on all nine categories of ACEs assessed through the CRCS was provided by 7,223 respondents. Binary indicator measures of parent mental illness, parent substance use disorder, parent intimate partner violence, parental divorce or separation, deceased or absent parent, physical abuse, sexual abuse, emotional abuse, and neglect experienced by the respondent were constructed from CRCS items ([Appendix Table 1](#)). [Appendix Tables 2 and 3](#) provide the CRCS source item language from which ACE measures were created. ACE counts were constructed for each adult in a household and binned into three categories—zero, one to two, and three or more ACEs—similar to prior studies.<sup>19,20</sup> The authors confirmed that retrospective ACE counts were associated with adult health outcomes and, in a subset of participants raised in PSID households during the 1997–2002 waves of its Child Development Supplement, early life measures of childhood stress including their parents' Kessler-6 emotional distress and parental aggravation scale scores.

A total OOP healthcare cost outcome was constructed from responses to three component OOP healthcare cost items in the 2011 and 2013 PSID: (1) inpatient visit OOP costs, (2) ambulatory visit OOP costs, and (3) prescription and other OOP healthcare costs ([Appendix Tables 2 and 3](#) list source survey items). The PSID OOP cost measures track closely with averages reported in the Consumer Expenditure Survey<sup>21,22</sup> and were inflated in this study to 2013 dollars using the Consumer Price Index and annualized to yield average yearly costs from 2009 to 2012. Total annual OOP medical costs were confirmed to show an average linear increase of \$241.82 for each additional chronic condition an individual reported, adjusted for covariates described in the next section.

To determine whether any increases in ACE count category also put households at greater risk for high financial burden, the authors examined secondary outcomes of whether household OOP medical costs exceeded the frequently cited threshold for burdensome financial hardship because of medical expenses: 10% of annual income spent on OOP medical costs.<sup>23–25</sup> A threshold of 100% of average annual household



**Figure 1.** Sample construction flowchart – main study samples and stratified subsamples.

ACE, adverse childhood experience; CRCS, Childhood Retrospective Circumstances Survey.

savings was also used. In another secondary analysis, an outcome indicator of households carrying any medical debt in the last year of the study was assessed to understand whether the increases in OOP costs might contribute to debt.

Covariates for each adult in sample households included educational attainment, continuous years of age, race, Latino/Hispanic ethnicity, sex, marital status, income level, number of household members and children, smoking, and alcohol consumption. A categorical health insurance coverage variable included six categories: uninsured, employer sponsored, privately purchased, Medicare/Medi-Gap/Supplemental, Medicaid, and Veterans and other government coverage types.

### Statistical Analysis

In the main analytic model with primary outcome of OOP costs, average annual total, inpatient, ambulatory, and prescription/other household OOP healthcare costs were regressed on ACE count using multivariable generalized linear models, adjusted for covariates (Stata, glm family[poisson] link[log]). Model fit was assessed using the Modified Park Test according to published methods,<sup>26</sup> which indicated that generalized linear models with Poisson family and log link was the preferred model. Alternate covariate specifications tested individually in the model had minimal effect on estimates, similar to models with premium costs or respondent report of

relative childhood SES included as covariates, and therefore covariates listed in the section above were used. Covariate-adjusted dollar value OOP cost predictions by ACE count were estimated using the delta method (Stata, margins program). These primary analyses were then stratified by household structure. For each of these stratifications, predictors of either (1) the single highest of all ACE counts available among any adults in a household or (2) ACE count predictors for each adult respondent in sample households by gender (male and female ACE counts) were used. For the subset of households with two adults who both provided complete data, the model interacted the ACE counts of the two adults and, though the interaction terms were not statistically significant, this model was used to estimate average OOP costs at each combination of male and female adults' ACE counts. Associations between ACEs and secondary binary outcomes were examined using logistic regression models with identical covariate specifications as the main model. All models were weighted to accommodate the complex survey design, achieve population representation, and adjust for nonresponse using the PSID 2013 survey base weights; models were further adjusted for CRCS differential nonresponse using age, education, gender, and race/ethnicity variables. All estimates employed survey-robust SEs.

Sobel–Goodman tests of mediation (Stata, sgmediation program) were used to estimate the proportion of the ACE score effect on total OOP medical costs mediated by worse adult health, measured using individuals' mental illness symptom scores on the

Kessler-6 emotional distress<sup>27</sup> 24-point scale and separately by individuals' chronic condition counts. The constructed chronic condition count variable included participant report of a clinician giving him/her a diagnosis of diabetes, hypertension, heart disease, arthritis, lung disease, cancer, asthma, or other chronic conditions.

For all models, to assess for selection bias in the primary analyses, the authors confirmed regression results were substantially similar when missing ACE data was imputed and using an inverse probability of treatment weighted model with regression adjustment, in which the propensity weights for adults' ACE scores predictor category were estimated on the basis of their parents' education level, SES, race, ethnicity, and family structures (results available upon request).

The data were housed at the University of Michigan's Institute for Social Research. All analyses were carried out in 2017 using Stata, version 14, via an online data enclave. The University of California, Los Angeles IRB approved this study.

## RESULTS

The study sample included 4,784 households (6,775 adults) with complete data, of which 2,738 households had two adults, 659 were single-person households, and the remainder included other arrangements such as single-parent households with children. One fifth of adults in the sample reported having experienced three or more ACEs. Just more than half were female, just under one sixth were non-white, one in 16 was Latino, a third had a high school education or less, and <15% lived in poverty (Tables 1 and 2).

A positive association between OOP costs and higher reported ACEs was seen in the sample overall (Table 3, detailed regression coefficient findings and costs by category of medical spending in Appendix Tables 4 and 5, respectively). Households in which adult respondents reported three or more ACEs had higher annual household OOP costs in total, inpatient care, and ambulatory care. Across all households in the sample, total OOP medical costs were \$184 (95% CI=\$90, \$278) and 1.18-fold higher when adult respondents in those households reported one to two ACEs, and \$311 (95% CI=\$196, \$426) and 1.30-fold higher when reporting three or more ACEs, respectively, compared with none (baseline annual OOP costs \$1,042; Table 3). Predicted OOP cost estimates showed single, childless adults reporting three or more ACEs spent an average of \$505 (95% CI=\$255, \$754; Table 3) more per year overall compared with those with none, a 1.83-fold increase. When examined individually, predicted annual OOP inpatient, ambulatory care, and prescription/other medical services costs were on average \$119 (95% CI= -\$5, \$243), \$251 (95% CI=\$101, \$401), and \$116 (95% CI=\$47, \$185) higher, respectively, for single adults with three or more ACEs compared with none (Appendix Table 5). Female

respondents' ACE counts were more strongly associated with OOP costs than their male counterparts' (Table 3).

In models examining two-adult households and including interaction terms for male and female respondents' ACE scores, increases in female ACE scores were associated with stepwise increases in total OOP healthcare costs compared with households in which neither adult reported an ACE, whereas male ACE scores only showed a positive association with OOP cost in the absence of ACEs reported by the female household partner (Figure 2).

Households with adults reporting three or more ACEs had more than twice the odds of annual medical costs >10% of household income or exceeding the entirety of household liquid assets, on average. Odds of carrying any household medical debt were 2-fold higher when three or more ACEs were reported. A history of one to two ACEs was associated with a roughly 1.5-fold higher odds of OOP healthcare costs outpacing all of one's household savings and higher odds of carrying medical debt. These associations were stronger for adult women's ACEs but were observed among men as well (Table 3).

Sobel–Goodman mediation analyses found that 41.3% of the association between total OOP costs X highest household adults' ACE count was mediated by chronic condition count and 27.4% was mediated by emotional distress.

## DISCUSSION

In a national study of households, adults with a higher number of ACEs showed higher household OOP medical costs. This association is seen among single adults and among couples jointly contributing to their household medical expenses. Differences in estimated costs revealed that medical expenses were more than 50% more for single individuals with a history of three or more ACEs and 30% more for two-adult households in which the higher of the two adult's ACEs count was three or more, compared with no ACEs. Women's ACE counts showed a much stronger association with OOP costs than men's. A sizeable proportion of the additional costs associated with higher ACE counts was mediated by chronic illness burden and emotional distress (a proxy for mental illness burden).

Given the existing literature linking ACEs and chronic disease in adulthood, the finding that ACEs correlate with OOP medical costs is not unexpected. OOP costs are driven by many factors including mental and physical ailments that require health care, healthcare seeking behavior determining the extent of discretionary care sought, and health insurance coverage for healthcare services rendered. The analyses controlled for insurance

**Table 1.** Sample Characteristics of Full Sample, Single Adults, and Married/Partnered Adults, Panel Study of Income Dynamics and Childhood Retrospective Circumstances Survey Data, 2013–2015

<b>Individual-level variables</b>	<b>All individual adults with complete data, % (n=6,775)</b>	<b>Single adults with complete data, % (n=659)</b>	<b>Married/partnered adults with complete data, % (n=4,680)</b>
<b>Adverse childhood experiences</b>			
0	36.5	33.7	39.3
1–2	43.1	43.3	41.8
≥3	20.3	23.0	18.8
<b>Race</b>			
White	84.9	83.0	88.0
African American	10.0	13.6	6.4
Asian/Pacific Islander	2.6	1.8	2.9
<b>Ethnicity</b>			
Latino/Hispanic	6.2	2.6	6.6
Male	46.9	45.1	50.8
<b>Health insurance</b>			
Uninsured	12.2	20.0	7.8
Employer sponsored	59.0	42.8	66.3
Privately purchased individual	6.6	6.9	6.8
Medicare	14.6	24.7	12.7
Medicaid	4.2	3.6	2.5
Tricare/Veterans Administration/Other	3.4	2.1	3.9
<b>Education</b>			
< High school	7.5	7.2	6.7
High school graduate/GED	24.7	25.7	24.3
Any college/vocational/graduate school	67.9	67.0	69.0
Age, years, mean (SD)	48.3 (15.7)	52.3 (16.6)	48.8 (14.7)
Years of education, mean (SD)	14.2 (2.2)	14.1 (2.2)	14.3 (2.3)
<b>Self-rated health status</b>			
Excellent	17.6	12.8	19.2
Very good	39.9	32.6	42.3
Good	29.6	34.4	28.1
Fair	10.0	15.1	8.2
Poor	3.0	5.1	2.3
<b>Chronic condition count</b>			
0	43.4	33.6	45.6
1	28.7	27.1	29.7
≥2	27.9	40.4	24.7
<b>Mental illness symptom burden</b>			
None/mild	81.7	74.0	85.3
Moderate	14.9	19.7	12.8
Severe	3.4	6.3	1.9

coverage and showed that the main effects were largely mediated by the greater burden of chronic mental and physical illness. Measures of care seeking behavior were not available, but might mediate the remaining fraction of the association.

The magnitude of the difference in average OOP costs between no ACEs and highest ACE levels demonstrates how sizeable a difference in costs may be

associated with childhood adversity. These cost differences have the potential to impact family finances, with the largest increases in costs to households of single individuals. This difference between single and married households in the proportional change in OOP costs across ACE scores could be because social connection is protective against OOP costs or because individuals with high numbers of ACEs and their behavioral

**Table 2.** Sample Characteristics of Full Sample, Single Member Households, and Two Adult Households, Panel Study of Income Dynamics and Childhood Retrospective Circumstances Survey Data, 2013–2015

Household-level variables	All households with complete data, % (n=4,784)	Single member households, % (n=659)	Two adult households, % (n=2,524)
Income level			
>400% FPL	40.8	30.8	54.6
300%–400% FPL	13.2	11.9	14.8
200%–299% FPL	16.0	18.1	14.5
100%–199% FPL	16.6	19.6	11.1
<100% FPL	13.3	19.7	4.9
Annual household income, \$, mean (SD)	79,701 (144,121)	40,860 (36,202)	111,405 (181,094)
Annual out-of-pocket medical costs, \$			
Total	1,055	686	1,359
Inpatient	294	154	381
Outpatient	471	318	614
Prescription and in-home care	304	212	386
Annual total out-of-pocket medical costs exceeding 10% of income	3.7	6.5	2.0
Annual total out-of-pocket medical costs exceeding 100% of liquid assets	23.3	25.6	19.4
Currently carrying medical debt	10.0	9.6	9.5

Note: Data shown are %, unless otherwise noted.  
FPL, federal poverty level.

consequences could more often remain unmarried. This possible effect of childhood adversity on likelihood of family formation may be because of smaller social networks and poorer quality social relationships found among survivors of child maltreatment.<sup>28,29</sup> Future work to examine the impact of ACEs on one's social development and future pair bonding could help sort out these possible explanations.

Although prior literature has shown that women have greater healthcare utilization and costs than men<sup>30</sup> and healthcare utilization among women with a history of childhood maltreatment is known to be higher than women without such histories,<sup>12</sup> the finding that the relationship between ACEs and women's OOP medical expenses is stronger than that for men has not been previously reported. This stronger ACE–OOP cost relationship could be the product of women reporting a higher average number of ACEs combined with their already higher healthcare costs, but other mechanisms are also worth considering. For instance, the ACEs reported by women in this study may function as surrogates for lifelong risk of abuse,<sup>31</sup> and women with ongoing abuse and victimization from intimate partner violence have considerably higher healthcare utilization and costs than women without such exposures.<sup>32</sup> Because men are less likely to be victims of domestic abuse, this may be why they do not display the same strong ACE–OOP cost relationship.

Future studies should examine whether ongoing abuse mediates the relationship between women's ACEs and their medical expenses.

Greater exposure to ACEs was associated with higher likelihood of OOP costs exceeding household savings and 10% of income, as well as likelihood of carrying medical debt. This confluence of financial burden and debt combined with the higher prevalence of chronic physical and mental health conditions suggest that the health and financial tolls of early childhood adversity are compounding, with the worsening of financial health likely to imperil physical health, and vice versa, in a self-perpetuating spiral.

The results provide further evidence supporting the notion that upstream, early childhood trauma and toxic stress have lifelong economic consequences<sup>33</sup> and contribute to a growing literature suggesting that evidence-based approaches to reduce ACEs may yield significant cost savings for families over the long term.<sup>34–36</sup> Preventing ACEs may not only reduce trauma within families but also improve later financial outlook.

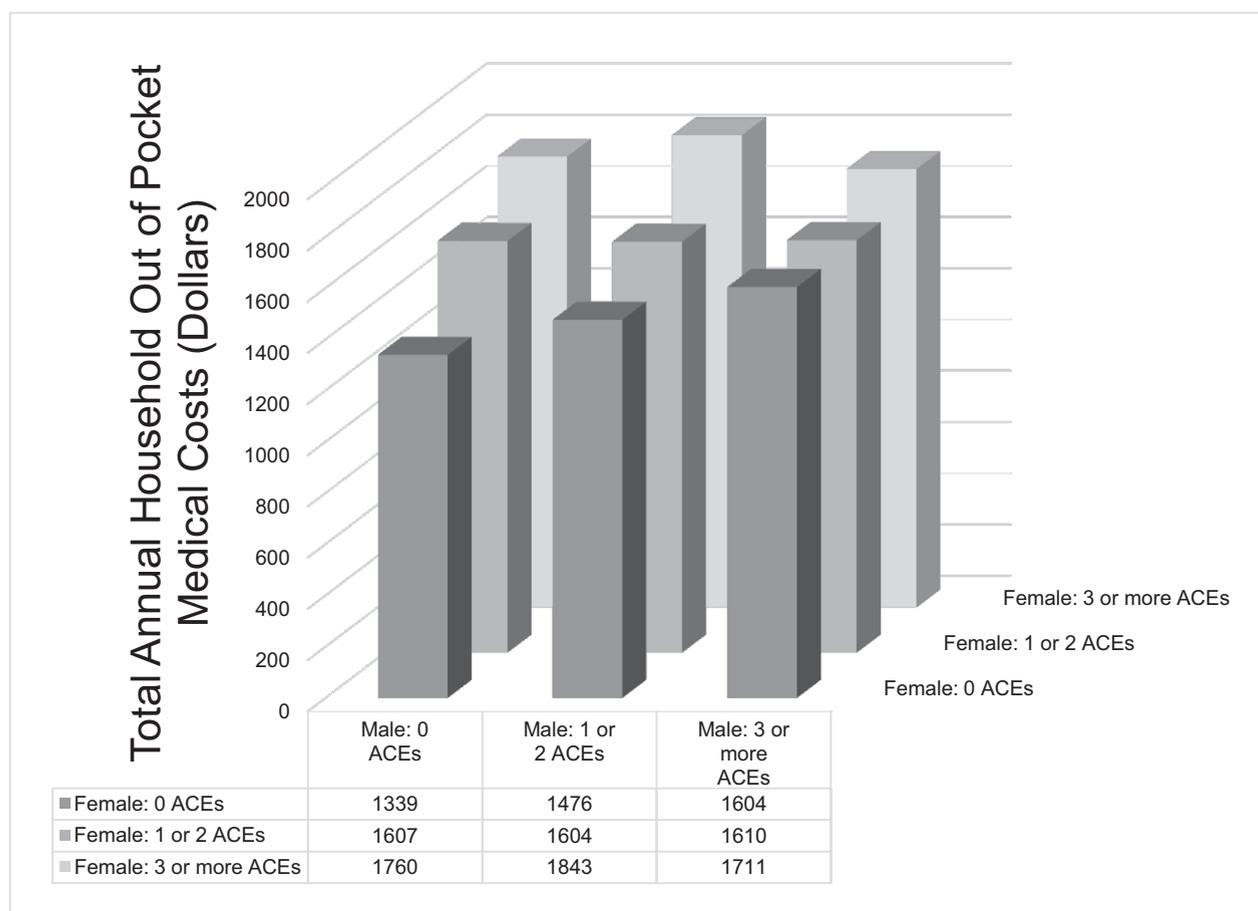
### Limitations

As in most ACE studies, this study's ACE score is retrospective and recall bias is a potential threat, although the possibility that higher or lower OOP expenses would prompt participants to misremember or misreport childhood trauma seems unlikely.

**Table 3.** Associations Between Adverse Childhood Experience Count and Annual Out-of-Pocket Medical Expenses, Measures of Burdensome Medical Costs, and Presence of Medical Debt, Overall and Stratified by Household Size (2011–2013 PSID Waves)

Outcome measure	Highest ACE score of household adult respondent, Adjusted dollar values and OR (95% CI)			Adult household respondent ACE score by gender, Adjusted dollar values and OR (95% CI)					
	0 (ref)	1–2	≥3	Female 0 (ref)	Female 1–2	Female ≥3	Male 0 (ref)	Male 1–2	Male ≥3
All households (n=4,784)									
Overall household OOP medical costs	1,042 (936, 1,148)	<b>1,226</b> <b>(1,132, 1,320)</b>	<b>1,353</b> <b>(1,238, 1,468)</b>	1,083 (1,003, 1,163)	<b>1,284</b> <b>(1,172, 1,395)</b>	<b>1,441</b> <b>(1,287, 1,594)</b>	1,191 (1,114, 1,270)	1,231 (1,115, 1,347)	1,231 (1,089, 1,372)
Total OOP costs over 10% of income (%; 95% CI)	–	1.36 (0.81, 2.29)	<b>2.48</b> <b>(1.40, 4.38)**</b>	–	1.32 (0.76, 2.29)	<b>2.50</b> <b>(1.38, 4.53)**</b>	–	1.09 (0.58, 2.07)	1.48 (0.64, 3.40)
Total OOP costs over 100% of liquid asset wealth (%; 95% CI)	–	<b>1.73</b> <b>(1.32, 2.26)***</b>	<b>2.25</b> <b>(1.69, 2.99)***</b>	–	<b>1.54</b> <b>(1.19, 2.01)***</b>	<b>1.78</b> <b>(1.32, 2.39)***</b>	–	<b>1.65</b> <b>(1.22, 2.23)***</b>	<b>2.22</b> <b>(1.54, 3.18)***</b>
Any household medical debt (%; 95% CI)	–	<b>1.73</b> <b>(1.20, 2.49)**</b>	<b>2.29</b> <b>(1.56, 3.34)***</b>	–	<b>1.86</b> <b>(1.30, 2.67)***</b>	<b>2.07</b> <b>(1.40, 3.06)***</b>	–	1.37 (0.90, 2.08)	<b>2.08</b> <b>(1.26, 3.41)**</b>
Overall household OOP medical costs									
Single member households (n=659)	607 (474, 740)	702 (543, 860)	<b>1,112</b> <b>(862, 1361)</b>	612 (505, 719)	799 (541, 1,056)	<b>1,330</b> <b>(980, 1,680)</b>	765 (655, 875)	686 (467, 906)	957 (451, 1,462)
Single adult households with children (n=411)	506 (340, 673)	635 (475, 796)	<b>856</b> <b>(655, 1,057)</b>	551 (385, 717)	654 (458, 849)	<b>872</b> <b>(633, 1,112)</b>	623 (517, 729)	900 (323, 1,479)	1,304 (331, 2,277)
Households with two adults and no children (n=1,325)	1,408 (1,219, 1,596)	<b>1,717</b> <b>(1,536, 1,897)</b>	<b>1,823</b> <b>(1,589, 2,056)</b>	1,506 (1,359, 1,653)	<b>1,779</b> <b>(1,549, 2,010)</b>	<b>1,911</b> <b>(1,589, 2,232)</b>	1,581 (1,425, 1,737)	1,757 (1,557, 1,957)	1,770 (1,499, 2,041)
Households with two adults and any children (n=1,199)	1,240 (1,065, 1,415)	1,347 (1,201, 1,493)	<b>1,571</b> <b>(1,330, 1,812)</b>	1,274 (1,142, 1,406)	1,401 (1,229, 1,573)	<b>1,635</b> <b>(1,296, 1,974)</b>	1,417 (1,257, 1,578)	1,334 (1,159, 1,508)	1,390 (1,152, 1,626)

Note: Data shown are adjusted dollar values OR (95% CI), unless otherwise noted. Results from the main analytic model shown are dollar values from post-estimation from regression models using a generalized linear model with Poisson family and log link (Stata glm, family(poisson) link(log), post-estimation using margins command), stratified by family structure and gender. Covariates in the model include household income level, race, ethnicity, age, education, health insurance, whether smokes tobacco, and whether drinks alcohol for each household adult if present. The main model also includes indicators of gender, married/partnered household status, and number of children in the household, whereas the models stratified by gender, number of household adults, or number of household children omit these covariates, respectively, when they do not apply to the analytic strata. Results from the secondary outcome analyses shown are ORs from logistic regression models with the same covariates included as in the main analytic model. Boldface indicates statistical significance of regression model results, including regression model results underlying OOP medical cost post-estimates (\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ). Reported results are in 2013 USD or are based on cost data in 2013 USD. ACE, adverse childhood experience(s); OOP, out-of-pocket; PSID, Panel Study of Income Dynamics.



**Figure 2.** Two-adult household total annual out-of-pocket medical costs, accounting for both male and female respondents' adverse childhood experience (ACE) scores in the Panel Study of Income Dynamics National Sample (Data from 2011–2013;  $n=2,524$  households).

Note: Results shown are dollar values estimated using the delta method from regression models using a generalized linear model with Poisson family and log link (Stata glm, family(poisson) link(log), post-estimation using margins command) and interacting number of ACEs for each household adult in two-adult households. Covariates in the model include household income level, race, ethnicity, age, education, health insurance, whether smokes tobacco, whether drinks alcohol for each household adult if present, and number of children in the household. Reported results are in 2013 USD.

Unmeasured confounding factors could play a role in linking the predictors and outcomes in this study, though the analyses have attempted to account for likely individual and household confounders. Selection could affect the results if the CRCS web-based data collection approach excluded participants less likely to have technological literacy (i.e., those with lower education or income, or those older in age).

## CONCLUSIONS

This is the first study to find that overall ACE score—a measure of greater reported exposure to adversity in childhood—is associated with adults' OOP medical expenses, as well as greater financial strain owing to medical costs and higher likelihood of medical debt. The association between ACE score and OOP costs was

partially mediated by the number of chronic medical and mental health conditions, suggesting a lifecourse cascade beginning with adverse events during childhood that predispose adults to chronic disease and lead to more healthcare spending and greater financial burden. Interventions designed to reduce the OOP cost burden of medical care, and perhaps even those designed to reduce the overall costs of care, should consider preventive approaches to reducing the occurrence of ACEs and minimizing their health impact.

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## SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at <https://doi.org/10.1016/j.amepre.2018.11.019>.

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