

# Childhood Adversity and Adult Reports of Food Insecurity Among Households With Children



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**Introduction:** Exposure to childhood adversity, including abuse, neglect, and household dysfunction, is associated with negative long-term health and economic outcomes. Little is known about how adversity exposure in parents' early lives may be related to later food insecurity for parents and their children. This study investigated the association between female caregivers' adverse childhood experiences (ACEs) and household and child food insecurity, taking into account depressive symptoms.

**Methods:** This study used cross-sectional data from 1,255 female caregivers of children aged <4 years surveyed in an urban clinical setting from March 2012 through June 2014. Measures included sociodemographic characteristics; caregivers' ACEs, including abuse, neglect, and household dysfunction; depressive symptoms; and household and child food insecurity. Multinomial and logistic regression analyses assessed the relationship among ACEs, depressive symptoms, and household and child food security status.

**Results:** Caregiver depressive symptoms modified associations between ACEs and food insecurity level. After adjusting for covariates, caregivers reporting both depressive symptoms and four or more ACEs were 12.3 times as likely to report low food security (95% CI=6.2, 24.7); 28.8 times as likely to report very low food security (95% CI=12.8, 64.8); and 17.6 times as likely to report child food insecurity (95% CI=7.3, 42.6) compared with those reporting no depressive symptoms and no ACEs.

**Conclusions:** Depressive symptoms and ACEs were independently associated with household and child food insecurity, and depressive symptoms modified the association between ACEs and household and child food insecurity. Comprehensive policy interventions incorporating nutrition assistance and behavioral health may address intergenerational transmission of disadvantage.

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## Introduction

In 2013, 14.3% of all U.S. households reported food insecurity, whereas 19.5% of households with children and 34.4% of female-headed households

reported food insecurity. Among households with children, 5.9% reported very low household food security (VLFS), and 9.9% reported food insecurity at the child level, indicating greater severity in the household that includes reduced food intake and disrupted eating patterns among adults and children.<sup>1</sup> Household food insecurity consists of low food security (LFS), indicating food access problems and reduced diet quality, and VLFS, indicating reduced food intake and disrupted eating patterns. Regardless of whether food security is assessed at the household or “individual” level among children, food insecurity at all levels has profound associations with poor child health and development, especially among families with very young children.<sup>2–6</sup>

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Additionally, food insecurity is strongly associated with poor mental health among children and adults.<sup>7–12</sup> There is a reciprocal relationship between depressive symptoms and food insecurity. Mothers who report depressive symptoms experience more employment difficulties<sup>9</sup> that are related to financial hardship and food insecurity.<sup>13</sup> In studies of current and recent exposure to violence, intimate partner violence is associated with food insecurity among women,<sup>14</sup> and maternal depression mediates the association between intimate partner violence and household food insecurity.<sup>15</sup> However, there are little empirical data about childhood precursors of mothers' mental health in relation to food insecurity.

Evidence from studies on adversity during childhood and depression later in life provide insights into the relationship between poor mental health and food insecurity. The Adverse Childhood Experiences (ACEs) questionnaire is a widely used measure of adult reports of exposure to emotional and physical abuse and neglect and household dysfunction during childhood.<sup>16,17</sup> ACEs are associated with adult depression and attempted suicide,<sup>18,19</sup> health risk behaviors including smoking and sexual risk behavior,<sup>20,21</sup> alcohol and substance abuse,<sup>22–24</sup> congestive heart failure, obesity, and diabetes.<sup>25–27</sup> Additionally, ACEs are linked with lower educational attainment, poor employment outcomes, and economic instability.<sup>28–30</sup> Recent evidence demonstrates a potential association between caregivers' report of ACEs and current household food insecurity.<sup>31–34</sup> However, there has been no large-scale quantitative study investigating the relationship between reports of ACEs and severity of household and child food insecurity.

The purpose of this study was to investigate the relationship between female caregivers' reports of ACEs and current household and child food security in the U.S., and to evaluate the role of current depressive symptoms in such a relationship. Hypotheses were as follows:

1. A higher number of ACEs is associated with increased severity of household and child food insecurity.
2. This association is moderated by depressive symptoms.

## Methods

Data were derived from 2,130 caregivers interviewed in the emergency department of a large children's hospital in Philadelphia from March 2012 to June 2014. Trained interviewers approached primary caregivers of children aged <4 years who were not in critical condition. Over the course of the study period, nine trained interviewers employed the same protocol in administering the structured survey instrument. Questions relating to ACEs, depression, and food insecurity were taken from established

instruments designed to be self-administered. As approved by the IRB, written documentation of consent was waived, and respondents verbally agreed to participate in the initial survey and provided a second verbal consent for the ACEs survey. The Drexel University IRB approved this study.

Among eligible caregivers, the 2,130 caregivers who responded to the first interview represented an initial response rate of 86.8%. Because men were not asked about depressive symptoms, 184 male participants were excluded, and because immigrants are often barred from receiving public assistance, 298 foreign-born participants were excluded. Of U.S.-born female respondents, 1,255 (76.1%) consented to respond to the ACEs survey. Participants who did not answer ACEs were older and had younger children than those who did answer. There were no other significant differences.

## Measures

Detailed description of data collection procedures is previously published.<sup>35,36</sup> The survey contains questions regarding caregiver's demographic and economic characteristics, self-rated caregiver health, and caregiver-rated child health. Household and child food security status were assessed using the 18-item Household Food Security Survey Module.<sup>37</sup> Household food security was classified into food secure, indicating few or no food access problems; LFS; and VLFS. Child food security was classified into food secure and food insecure.

Depressive symptoms were assessed using a three-item screening tool that is validated as a proxy for a longer screener with 100% sensitivity, 88% specificity, and 66% positive predictive value.<sup>38</sup> The screener measures feelings of depression over time intervals: multiple days in the past week,  $\geq 2$  weeks in the past year, and  $\geq 2$  years over the life span. Depressive symptoms were indicated by affirmative response to at least two questions.

The ACEs Scale is a retrospective ten-question survey that inquires about an adult's experiences before age 18 years, including physical, emotional, and sexual abuse; physical and emotional neglect; and household dysfunction including parental separation or divorce, exposure to domestic violence and substance abuse, mental health conditions, and incarceration of a household member.<sup>16,17</sup> The ACE measure has been validated and shown to have good test-retest reliability with an overall kappa value of 0.64.<sup>39</sup> A cumulative score was calculated for each participant based on number of affirmative responses, each corresponding to 1 point; the score was categorized into the standard 0, 1–3, and  $\geq 4$  ACEs.<sup>19,28</sup> Trends in rates of household and child food insecurity according each individual ACEs category were also assessed.

## Statistical Analysis

In spring 2015, SAS, version 9.3, was used for all analyses. Demographic and health characteristics were compared across food security status through chi-square tests for categorical variables and Wilcoxon–Mann–Whitney tests for measurement characteristics. The Cochran–Armitage test was used to assess trends in prevalence of affirmative responses to individual ACE questions according to severity of household and child food security.<sup>40,41</sup> A multinomial regression model was applied using household food security status as an outcome, and a logistic regression model applied using child food security as an outcome.

In stratified analysis, ACEs had heterogeneous effects on household and child food security status depending on presence or absence of caregiver depressive symptoms. An interaction term between ACEs and depressive symptoms was evaluated and included in the final models. Two models were used to estimate the effect of ACEs and depressive symptoms on both household and child food security. Model 1 evaluated the association among ACEs, depressive symptoms, and food insecurity and therefore included the interaction term between depressive symptoms and ACEs. To control for potential confounders, Model 2 included all variables from Model 1 and controlled for variables known to correlate with food insecurity, including caregiver's age, race/ethnicity, marital status, employment, education, and child's health insurance.<sup>1,42</sup> Also included were caregivers' self-rated health and participation in either the Supplemental Nutrition Assistance Program (SNAP) or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).<sup>43,44</sup> Goodness of fit for adjusted models was tested through the Pearson goodness of fit for the multinomial model and the Hosmer–Lemeshow goodness of fit test for the logistic regression.

## Results

Caregiver median age was 24 years; median child age was 18.5 months (Table 1). Rates of food insecurity in the sample were similar to national rates for households with children, with 18.7% of participants reporting household food insecurity, including 11.6% reporting LFS and 7.2% reporting VLFS, as well as 7.2% reporting child food insecurity (Table 2). Participants reporting household LFS or VLFS were slightly older than those reporting household food security ( $p < 0.01$ ). In bivariate analyses, there were no statistically significant differences in food security by race/ethnicity, marital status, education, employment, and receipt of public assistance (Temporary Assistance for Needy Families, WIC, SNAP, or housing or energy assistance).

Female caregivers reporting VLFS were more likely to rate their health as fair or poor compared with those reporting food security and LFS ( $p < 0.01$ ). LFS and VLFS participants were more likely to report depressive symptoms as compared with participants who reported food security (18.4% food secure, 48.6% LFS, and 54.4% VLFS,  $p < 0.01$ ). In unadjusted regression analysis, caregivers reporting depressive symptoms were 4.2 times as likely to report LFS (95% CI=2.92, 6.03); 5.3 times as likely to report VLFS (95% CI=3.4, 8.26); and 3.0 times as likely to report child food insecurity (95% CI=1.9, 4.5). Participants reporting four or more ACEs were more likely to report LFS or VLFS compared with those reporting one to three or no ACEs ( $p_{\text{trend}} < 0.01$ ).

The ACEs correlated in an ordinal fashion with report of depressive symptoms. In an unadjusted logistic regression model, those who reported one to three ACEs were 2.7 times as likely to have depressive symptoms

compared with those who reported no ACEs (95% CI=2.0, 3.8). Those reporting four or more ACEs were 7.8 times as likely to have depressive symptoms (95% CI=5.3, 11.2) compared with those who reported no ACEs (results not shown).

There were strong, graded, statistically significant associations between ACE score and severity of household food security (Table 2). For each ACE item, there was significant positive trend by severity of household and child food security (all  $p_{\text{trend}} < 0.01$ ). Among participants reporting VLFS, 55.6% reported emotional neglect, 44.4% reported exposure to household substance abuse, 43.3% reported loss of a parent through divorce or abandonment, and 41.1% lived with household members with a mental health condition. Results were similar for child food insecurity.

Table 3 displays associations between ACEs and food security in both stratified and combined analysis. The stratified analysis uses zero ACEs as the reference group in each stratum for individuals with and without depressive symptoms; the combined analysis uses zero ACEs and no depressive symptoms as the reference group. All stratified and combined models showed adequate fit by the Pearson and Hosmer–Lemeshow goodness-of-fit tests. Results described below are from Model 2 (adjusted for covariates), which resulted in little change in associations.

In the analysis stratified by caregivers' depressive symptoms, ACE score was associated with increased likelihood of LFS and VLFS, regardless of the presence of depressive symptoms. Among participants without depressive symptoms, those who reported four or more ACEs were five times as likely to report LFS (95% CI=2.4, 10.4) and 6.5 times as likely to report VLFS compared with those who reported zero ACEs (95% CI=2.6, 16.4). Among participants with depressive symptoms, those who reported four or more ACEs were 2.3 times as likely to report LFS (95% CI=1.0–5.3) and 6.6 times as likely to report VLFS compared with those who reported zero ACEs (95% CI=2.1, 20.5). Statistically significant associations were also present but weaker for participants reporting moderate ACEs (one to three) among those without depressive symptoms. Among those reporting depressive symptoms, one to three ACEs showed non-significant associations with food insecurity.

As noted, additive and multiplicative interactions between ACEs and depressive symptoms on food security were detected in combined analysis. Among those without depressive symptoms, those reporting four or more ACEs were five times as likely to report LFS compared with those reporting no ACEs (95% CI=2.4, 10.4). Among participants who did not report ACEs, those reporting depressive symptoms were 5.3 times as likely to report LFS than those without depressive

**Table 1.** Sample Characteristics and Bivariate Association With Household and Child Food Insecurity

Variable	Household food security scale					Child's food security scale		
	Total (N=1,255)	Food secure (n=1,020)	Low food secure (n=145)	Very low food secure (n=90)	p-value	Food secure (n=1,165)	Food insecure (n=90)	p-value
Child age (months, median [IQR])	18.5 (9.3-31.2)	18.6 (9.2-31.3)	17.1 (9.7-29.6)	18.1 (9.2-32.0)	0.99 <sup>a</sup>	18.2 (9.2-30.9)	20.45 (11.0-33.7)	0.07 <sup>a</sup>
Caregiver age (years, median [IQR])	24 (22-28)	24 (21-28)	25 (22-29)	26 (23-30)	< 0.01 <sup>a</sup>	24 (21-28)	27 (23-31)	< 0.01 <sup>a</sup>
Caregiver race/ethnicity					0.06 <sup>b</sup>			0.49 <sup>b</sup>
Hispanic	598 (47.5)	487 (47.1)	75 (51.7)	40 (44.9)		553 (47.7)	40 (44.9)	
Black not Hispanic	487 (39.0)	411 (40.5)	48 (33.1)	28 (31.5)		452 (39.0)	35 (39.3)	
White not Hispanic	132 (10.6)	98 (9.7)	18 (12.4)	16 (18.0)		123 (10.6)	9 (10.1)	
Other	37 (3.0)	28 (2.8)	4 (2.8)	5 (5.6)		32 (2.8)	5 (5.6)	
Caregiver marital status					0.17 <sup>b</sup>			0.21 <sup>b</sup>
Married or partnered	321 (25.6)	258 (25.3)	33 (22.8)	30 (33.3)		293 (25.2)	28 (31.1)	
Not married or partnered	934 (74.4)	762 (74.7)	112 (77.2)	60 (66.7)		872 (74.9)	62 (68.9)	
Caregiver education					0.83 <sup>b</sup>			0.34 <sup>b</sup>
Some high school or under	300 (23.9)	243 (23.8)	37 (25.5)	20 (22.2)		279 (24.0)	21 (23.3)	
High school graduate	496 (39.5)	409 (40.1)	51 (35.2)	36 (40.0)		466 (40.0)	30 (33.3)	
Technical school/college/masters	459 (36.6)	368 (36.1)	57 (39.3)	34 (37.8)		420 (36.1)	39 (43.3)	
Caregiver employment status					0.11 <sup>b</sup>			0.80 <sup>b</sup>
Currently employed <sup>c</sup>	514 (41.0)	432 (42.4)	50 (34.5)	32 (35.6)		476 (40.9)	38 (42.2)	
Currently unemployed	741 (59.0)	588 (57.7)	95 (65.5)	58 (64.4)		689 (59.1)	52 (57.8)	
Current energy assistance					0.69 <sup>b</sup>			0.86 <sup>b</sup>
Yes	483 (45.2)	389 (44.6)	58 (48.3)	36 (47.4)		447 (45.2)	36 (46.2)	
No	585 (54.8)	483 (55.4)	62 (51.7)	40 (52.6)		543 (54.9)	42 (53.9)	
Currently receive SNAP <sup>d</sup>					0.37 <sup>b</sup>			0.29 <sup>b</sup>
Yes	968 (77.5)	796 (78.3)	108 (75.0)	64 (72.7)		903 (77.8)	65 (73.0)	
No	281 (22.5)	221 (21.7)	36 (25.0)	24 (27.3)		257 (22.2)	24 (27.0)	
Currently receive WIC <sup>e</sup>					0.29 <sup>b</sup>			0.05 <sup>b</sup>
Yes	920 (73.4)	745 (73.1)	113 (77.9)	62 (68.9)		862 (74.1)	58 (64.4)	
No	334 (26.6)	274 (26.9)	32 (22.1)	28 (31.1)		302 (26.0)	32 (35.6)	

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**Table 1.** Sample Characteristics and Bivariate Association With Household and Child Food Insecurity (*continued*)

Variable	Total (N=1,255)	Household food security scale			p-value	Child's food security scale		p-value
		Food secure (n=1,020)	Low food secure (n=145)	Very low food secure (n=90)		Food secure (n=1,165)	Food insecure (n=90)	
Current subsidized housing					0.58 <sup>b</sup>			0.21 <sup>b</sup>
Yes	109 (10.2)	89 (10.3)	10 (8.3)	10 (12.8)		98 (9.9)	11 (14.5)	
No	955 (89.8)	776 (89.7)	111 (91.7)	68 (87.2)		890 (90.1)	65 (85.5)	
Currently receive TANF <sup>f</sup>					0.28 <sup>b</sup>			0.50 <sup>b</sup>
Yes	478 (38.2)	379 (37.2)	59 (40.7)	40 (44.9)		447 (38.4)	31 (34.8)	
No	775 (61.9)	640 (62.8)	86 (59.3)	49 (55.1)		717 (61.6)	58 (65.2)	
Child health insurance					0.11 <sup>g</sup>			0.10 <sup>g</sup>
Public insurance	1157 (92.3)	940 (92.3)	136 (93.8)	81 (90.0)		1075 (92.4)	82 (91.1)	
No insurance	30 (2.4)	20 (2.0)	5 (3.5)	5 (5.6)		25 (2.2)	5 (5.6)	
Private insurance	66 (5.3)	58 (5.7)	4 (2.8)	4 (4.4)		63 (5.4)	3 (3.3)	
Caregiver health status					< 0.01 <sup>b</sup>			< 0.01 <sup>b</sup>
Excellent or good	929 (74.1)	777 (76.3)	100 (69.0)	52 (57.8)		879 (75.6)	50 (55.6)	
Fair or poor	324 (25.9)	241 (23.7)	45 (31.0)	38 (42.2)		284 (24.4)	40 (44.4)	
Caregiver depressive symptoms					< 0.01 <sup>b</sup>			< 0.01 <sup>b</sup>
Yes	306 (24.5)	187 (18.4)	70 (48.6)	49 (54.4)		264 (22.8)	42 (46.7)	
No	944 (75.5)	829 (81.6)	74 (51.4)	41 (45.6)		896 (77.2)	48 (53.3)	
Caregiver ACE score					< 0.01 <sup>h</sup>			< 0.01 <sup>h</sup>
ACEs=0	550 (43.8)	506 (49.6)	31 (21.4)	13 (14.4)		537 (46.1)	13 (14.4)	
ACEs=1–3	491 (39.1)	385 (37.8)	74 (51.0)	32 (35.6)		458 (39.3)	33 (36.7)	
ACEs QUOTE 4	214 (17.1)	129 (12.7)	40 (27.6)	45 (50.0)		170 (14.6)	44 (48.9)	

Note: Boldface indicates statistical significance ( $p < 0.05$ ). Values are  $n$  (%) unless otherwise noted.

<sup>a</sup>Tested by Wilcoxon-Mann-Whitney test.

<sup>b</sup>Tested by  $\chi^2$ .

<sup>c</sup>"Currently employed" refers to both part-time and full-time employment.

<sup>d</sup>Supplemental Nutrition Assistance Program, also known as the food stamp program, a nutrition assistance program for low-income individuals and families.

<sup>e</sup>Special Supplemental Nutrition Program for Women, Infants, and Children, a nutrition assistance program for pregnant and postpartum women, and children up to age 5.

<sup>f</sup>Temporary Assistance for Needy Families, a cash assistance program for low-income families with children.

<sup>g</sup>Tested by Fisher's exact test.

<sup>h</sup>Tested by Cochran-Armitage test for trend.

ACE, adverse childhood experience; IQR, inter-quartile range.

**Table 2.** Prevalence of Individual Adverse Childhood Experiences by Food Security Status

Category of adverse childhood experience	n (%)					
	Household food security				Child food security	
	Total (N=1,255) (100%)	Food security (n=1,020) (81.3%)	Low food security (n=145) (11.6%)	Very low food security (n=90) (7.2%)	Food security (n=1,165) (92.8%)	Food insecurity (n=90) (7.2%)
<b>Abuse</b>						
Emotional. Did a parent or other adult in the household often or very often swear at you, insult you, put you down, or humiliate you? Or act in a way that made you afraid that you might be physically hurt?	173 (13.8)	<b>111 (10.9)</b>	<b>27 (18.6)</b>	<b>35 (38.9)</b>	<b>141 (12.1)</b>	<b>32 (35.6)</b>
Physical. Did a parent or other adult in the household often or very often push, grab, slap or throw something at you? Or ever hit you so hard that you had marks or were injured?	139 (11.1)	<b>86 (8.4)</b>	<b>24 (16.6)</b>	<b>29 (32.2)</b>	<b>112 (9.6)</b>	<b>27 (30.0)</b>
Sexual. Did an adult or person at least 5 years older than you ever touch or fondle you or have you touch their body in a sexual way? Or attempt or actually have oral, anal or vaginal intercourse with you?	140 (11.2)	<b>96 (9.4)</b>	<b>23 (15.9)</b>	<b>21 (23.3)</b>	<b>121 (10.4)</b>	<b>19 (21.1)</b>
<b>Neglect</b>						
Emotional. Did you often or very often feel that...no one in your family loved you or thought you were important or special? Or your family didn't look out for each other, feel close to each other, or support each other?	299 (23.8)	<b>195 (19.1)</b>	<b>54 (37.2)</b>	<b>50 (55.6)</b>	<b>255 (21.9)</b>	<b>44 (48.9)</b>
Physical. Did you often or very often feel that...you didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? Or your parents were too drunk or high to take care of you or take you to the doctor if you needed it?	97 (7.7)	<b>40 (3.9)</b>	<b>23 (15.9)</b>	<b>34 (37.8)</b>	<b>62 (5.3)</b>	<b>35 (38.9)</b>
<b>Household dysfunction</b>						
Parental separation. Was a biological parent ever lost to you through divorce, abandonment, or other reason?	358 (28.5)	<b>256 (25.1)</b>	<b>63 (43.5)</b>	<b>39 (43.3)</b>	<b>317 (27.2)</b>	<b>41 (45.6)</b>
Domestic violence. Was your mother or stepmother: often or very often pushed, grabbed, slapped or had something thrown at her? Or sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? Or ever repeatedly hit for at least a few minutes or threatened with a gun or a knife?	136 (10.8)	<b>89 (8.7)</b>	<b>28 (19.3)</b>	<b>19 (21.1)</b>	<b>118 (10.1)</b>	<b>18 (20.0)</b>
Substance use. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?	236 (18.8)	<b>156 (15.3)</b>	<b>40 (27.6)</b>	<b>40 (44.4)</b>	<b>198 (17.0)</b>	<b>38 (42.2)</b>
Household mental illness. Was a household member depressed or mentally ill, or did a household member attempt suicide?	181 (14.4)	<b>109 (10.7)</b>	<b>35 (24.1)</b>	<b>37 (41.1)</b>	<b>147 (12.6)</b>	<b>34 (37.8)</b>
Household incarceration. Did a household member go to prison?	270 (21.5)	<b>188 (18.4)</b>	<b>47 (32.4)</b>	<b>35 (38.9)</b>	<b>229 (19.7)</b>	<b>41 (45.6)</b>

Note: Tested by Cochran-Armitage for trend. Boldface indicates statistical significance for all trends at  $p < 0.01$ . Percentages reflect the proportion of participants endorsing each adverse childhood experience, according to household and child food security status. Percentages do not add up to 100%.

**Table 3.** The Association Between Caregiver ACE Score and Household Food Security Stratified by Caregiver Depressive Symptoms

Depressive symptoms	ACE score	Low food secure compared to food secure				Very low food secure compared to food secure			
		Unadjusted <sup>a</sup> , OR (95% CI)		Adjusted <sup>b</sup> , OR (95% CI)		Unadjusted <sup>a</sup> , OR (95% CI)		Adjusted <sup>b</sup> , OR (95% CI)	
		Stratified <sup>c</sup>	Combined <sup>d</sup>	Stratified <sup>c</sup>	Combined <sup>d</sup>	Stratified <sup>c</sup>	Combined <sup>d</sup>	Stratified <sup>c</sup>	Combined <sup>d</sup>
No depressive symptoms	ACEs=0	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
	ACEs=1–3	<b>3.5</b> (2.0, 6.2)	<b>3.5</b> (2.0, 6.2)	<b>3.4</b> (1.9, 6.1)	<b>3.4</b> (1.9, 6.1)	<b>3.6</b> (1.6, 7.9)	<b>3.6</b> (1.6, 7.9)	<b>3.4</b> (1.5, 7.7)	<b>3.4</b> (1.5, 7.7)
	ACEs≥4	<b>4.8</b> (2.3, 9.9)	<b>4.8</b> (2.3, 9.9)	<b>5.0</b> (2.4, 10.4)	<b>5.0</b> (2.4, 10.4)	<b>7.0</b> (2.8, 17.5)	<b>7.0</b> (2.8, 17.5)	<b>6.5</b> (2.6, 16.4)	<b>6.5</b> (2.6, 16.4)
Depressive symptoms	ACEs=0	1 (ref)	<b>6.2</b> (2.8, 13.6)	1 (ref)	<b>5.3</b> (2.3, 11.9)	1 (ref)	<b>4.1</b> (1.2, 13.8)	1 (ref)	<b>4.4</b> (1.3, 14.9)
	ACEs=1–3	1.5 (0.7, 3.2)	<b>9.4</b> (5.1, 17.5)	1.8 (0.8, 3.9)	<b>9.5</b> (5.0, 17.8)	1.5 (0.46, 5.1)	<b>6.3</b> (2.5, 15.6)	1.1 (0.3, 3.9)	<b>4.9</b> (1.8, 12.8)
	ACEs≥4	2.0 (0.9, 4.5)	<b>12.6</b> (6.4, 24.7)	2.3 (1.0, 5.3)	<b>12.3</b> (6.2, 24.4)	<b>8.3</b> (2.8, 25.2)	<b>34.2</b> (15.5, 75.5)	<b>6.6</b> (2.1, 20.5)	<b>28.8</b> (12.8, 64.8)

Note: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>Unadjusted model variables included depressive symptoms, ACE score, and an interaction term between ACEs and depressive symptoms.

<sup>b</sup>Adjusted model variables included all variables from the unadjusted model, as well as self-reported health and demographic information (age, gender, ethnicity, marital status, employment status, child's health insurance status, education, and participation in SNAP [Supplemental Nutrition Assistance Program] or WIC [Special Supplemental Nutrition Program for Women, Infants, and Children]).

<sup>c</sup>OR for the effect of ACEs on food security status stratified by caregiver depressive symptoms.

<sup>d</sup>OR for the combined effect of ACEs and depressive symptoms on food security status.

ACE, adverse childhood experience.



symptoms (95% CI=2.3, 11.9) (Table 3). Participants reporting a combination of four or more ACEs and depressive symptoms were 12.3 times as likely to report LFS (95% CI=6.4, 24.4) compared with participants reporting no ACEs or depressive symptoms.

Given that exposure to ACEs and depressive symptoms often co-occurs, this combined effect was large enough that it warranted separate consideration. In addition to increased odds of LFS, those who reported both depressive symptoms and four or more ACEs were 28.8 times as likely to report VLFS (95% CI=12.8, 64.8) compared with participants reporting no ACEs or depressive symptoms. This increased likelihood of household food insecurity was also true for participants who reported depressive symptoms and one to three ACEs, who were 9.5 times as likely to report LFS (95% CI=5.0, 17.8) and 4.9 times as likely to report VLFS (95% CI=1.8, 12.8) compared with participants reporting neither.

Caregiver depressive symptoms and four or more ACEs were similarly associated with increased odds of child food insecurity. Table 4 shows the associations between ACEs and child food insecurity, both in stratified analysis by depressive symptoms and in a combined analysis showing the joint effects of both ACEs and depressive symptoms. Caregivers who indicated depressive symptoms and reported four or more ACEs were 17.6 times as likely to report child food insecurity compared with those who reported no depressive symptoms and zero ACEs (95% CI=7.3, 42.6).

## Discussion

Results demonstrate strong dose–response associations between number of ACEs and severity of food security at both household and child level. Female caregivers' ACEs and depressive symptoms were independent risk factors for household and child food insecurity. Together, caregiver depressive symptoms and ACEs had greater combined impacts on the risk of household food insecurity. In both models, report of four or more ACEs as well as depressive symptoms was associated with an approximately 30-fold increase in the likelihood of VLFS compared with those reporting no depressive symptoms and zero ACEs. Compared with the reference group of participants without ACEs or depressive symptoms, caregivers reporting depressive symptoms and four or more ACEs were also 17.6 times as likely to report child food insecurity. Reports of one to three ACEs also showed similar yet weaker trends. Results also demonstrate significant associations between each ACEs category and household and child food insecurity.

This study's findings corroborate previous studies identifying associations between ACEs and adult depression,<sup>18,45–48</sup> as well as studies indicating an association between maternal depressive symptoms and household food security.<sup>9</sup> This study also identified that not only are ACEs associated with food security status in combination with depression but also that ACEs are a strong predictor for food insecurity even in the absence of depressive symptoms.

**Table 4.** The Association between Caregiver's ACEs and Child Food Security Stratified by Caregivers' Depressive Symptoms

Depressive symptoms	ACE score	Food insecure compared to food secure			
		Unadjusted <sup>a</sup> , OR (95% CI)		Adjusted <sup>b</sup> , OR (95% CI)	
		Stratified <sup>c</sup>	Combined <sup>d</sup>	Stratified <sup>c</sup>	Combined <sup>d</sup>
No depressive symptoms	ACEs=0	1 (ref)	1 (ref)	1 (ref)	1 (ref)
	ACEs=1–3	<b>4.8</b> (2.06, 11.36)	<b>4.8</b> (2.1, 11.4)	<b>4.7</b> (2.0, 11.0)	<b>4.7</b> (2.0, 11.0)
	ACEs≥4	<b>13.1</b> (5.26, 32.39)	<b>13.1</b> (5.3, 32.4)	<b>12.3</b> (4.9, 30.8)	<b>12.3</b> (4.9, 30.8)
Depressive symptoms	ACEs = 0	1 (ref)	<b>6.9</b> (2.2, 21.1)	1 (ref)	<b>7.2</b> (2.3, 22.5)
	ACEs=1–3	0.7 (0.25, 2.1)	<b>4.9</b> (1.8, 13.5)	0.6 (0.18, 1.7)	<b>4.0</b> (1.4, 11.4)
	ACEs≥4	<b>3.2</b> (1.3, 8.3)	<b>22.2</b> (9.4, 52.8)	2.5 (0.93, 6.5)	<b>17.6</b> (7.3, 42.6)

Note: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>Unadjusted model variables included caregiver's depressive symptoms, caregiver's ACE score, and an interaction term between ACEs and depressive symptoms.

<sup>b</sup>Adjusted model variables included all variables from the unadjusted model, as well as caregiver self-reported health and demographic information (age, gender, ethnicity, marital status, employment status, child's health insurance status, and education, and participation in SNAP [Supplemental Nutrition Assistance Program] or WIC [Special Supplemental Nutrition Program for Women, Infants, and Children]).

<sup>c</sup>OR for the effect of ACEs on food security status stratified by caregiver depressive symptoms.

<sup>d</sup>OR for the combined effect of ACEs and depressive symptoms on food security status.

ACE, adverse childhood experiences.



There are several ways in which ACEs may be associated with severity of food security. Experiences of abuse, neglect, and family instability in childhood are related to poor educational outcomes, low wages, and social isolation in adulthood,<sup>30,49,50</sup> all of which are associated with household food insecurity.<sup>13,51–53</sup> This study contributes strong evidence that exposure to adversity or violence across the life span is associated with household and child food insecurity.<sup>15,32,54–56</sup> It shows that caregivers' childhood experiences are carried into adult household hardship and may be transferred to children in the form of food insecurity, among other stressors.

Women with ACEs and attendant mental health challenges may require additional support to protect against household and child food insecurity. Access to nutrition assistance can also be effective in reducing depressive symptoms and stress associated with food insecurity.<sup>45,57–59</sup> Research on the effects of family material supports, including housing, energy, and income assistance programs in addition to nutrition assistance, is necessary to elucidate the role of public assistance in protecting against food insecurity for all families, particularly for those exposed to childhood adversity. Although several studies found high prevalence of exposure to individual and community violence among public assistance recipients,<sup>60–63</sup> antipoverty and nutrition assistance programs have not generally participated in emerging efforts to create trauma-informed social service systems, which have included venues of health care, education, criminal and juvenile justice, child welfare, and supportive housing.<sup>64–69</sup> Incorporating services addressing trauma-related challenges, such as those identified by the U.S. Substance Abuse and Mental Health Services Administration,<sup>70</sup> into public assistance may provide additional protective effects.

In addition to providing a way forward for intervention, these results enrich evidence from neuroscience research indicating that major drivers of health disparities, including food insecurity, have roots not only in current economic deprivation but also in toxic stress (strong, frequent, or prolonged adversity).<sup>71,72</sup> Research on toxic stress demonstrates how childhood exposure to violence, abuse, neglect, or the accumulated burdens of family economic hardship can affect lifelong well-being, including both health and economic outcomes. Exposure to trauma and adversity during critical periods in development may disrupt education and other life transitions, and may result in coping strategies less suited to later environments that affect relationships and employment.<sup>64,72</sup> This study's findings suggest childhood adversity can have intergenerational consequences, affecting the life course of individuals who experience it

firsthand and that of their children. Additional research is needed to further investigate pathways between childhood adversity and later food insecurity, as well as protective factors. Two-generation interventions that address the mental health and economic stability of caregivers simultaneously with the health and development of children may offer opportunities to prevent intergenerational transmission of disadvantage.<sup>73–75</sup>

### Limitations

This study is limited by its cross-sectional design, which cannot determine causality, although there is a temporal sequence from caregivers' ACEs to current depressive symptoms and household and child food insecurity. Additionally, depressive symptoms were identified using self-report screening questions rather than diagnostic criteria, though it is a validated proxy measure.<sup>38</sup> As a retrospective measure, ACEs may introduce recall bias, although it has proven reliability and validity.<sup>39,76</sup> Child food insecurity may be under-reported, as parents may minimize reports that indicate child food insecurity.<sup>77</sup> Recruitment through a hospital emergency department may introduce selection bias toward participants with greater adversity. The 75% respondent rate for ACEs may decrease estimation precision; however, analysis indicated few differences between responders and non-responders. Small subgroup sample size contributes to wider CIs for ORs.

On the other hand, this study has several strengths. It is the first to investigate the relationship between food insecurity and caregivers' ACEs using a large quantitative data set. Additionally, it introduces the emerging ACE framework into the well-documented association between depression and food insecurity, indicating avenues for intervention. Finally, it demonstrates the intergenerational effects of ACEs not only on the life trajectory of the affected woman but also on her children. Results demonstrate that ACEs are associated with increased likelihood of household VLFS and child food insecurity, which are associated with less optimal child development,<sup>2,42</sup> poor physical and mental health,<sup>6,12,78</sup> and hospitalizations,<sup>3</sup> particularly among very young children such as those in this study.

### Conclusions

Childhood adversity is strongly associated with household and child food security. In addition to enhancing nutrition and other benefits to buffer families from food insecurity, social service providers should adopt trauma-informed practices to support families exposed to adversity. This study provides evidence that childhood adversity affects health and economic stability across

generations, and indicates need for stronger efforts to prevent and address ACEs.

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