



# Childhood Trauma, Social Networks, and the Mental Health of Adult Survivors

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## Abstract

The purpose of this study was to investigate the relationship of childhood trauma to the quality of social networks and health outcomes later in adulthood. Data were obtained from a convenience sample of 254 adults seen in one of 10 primary care clinics in the state of Texas. Standardized measures of adverse childhood experiences (ACEs), stressful and supportive social relationships, medical conditions, anxiety, depression, and health-related quality of life were administered. Using latent class analysis, subjects were assigned to one of four ACE classes: (a) minimal childhood abuse (56%), (b) physical/verbal abuse of both child and mother with household alcohol abuse (13%), (c) verbal and physical abuse of child with household mental illness (12%), and (d) verbal abuse only (19%). Statistically significant differences across the four ACE classes were found for mental health outcomes in adulthood. Although respondents who were physically and verbally abused as children reported compromised mental health, this was particularly true for those who

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witnessed physical abuse of their mother. A similar relationship between ACE class and physical health was not found. The quality of adult social networks partly accounted for the relationship between ACE classes and mental health outcomes. Respondents exposed to ACEs with more supportive social networks as adults had diminished odds of reporting poor mental health. Conversely, increasing numbers of stressful social relationships contributed to adverse mental health outcomes. Although efforts to prevent childhood trauma remain a critical priority, the treatment of adult survivors needs to expand its focus on both strengthening social networks and decreasing the negative effects of stressful ones.

**Keywords**

childhood trauma, social networks, mental health

**Introduction**

Traumatic experiences in childhood can have long-term consequences on the health and mental health of adults later in life (Brodsky & Stanley, 2008; Danese et al., 2009; Dong et al., 2004; Dube et al., 2009; Felitti et al., 1998; Leeners, Rath, Block, Görres, & Tschudin, 2014; Roos et al., 2013; Su et al., 2014). In a study of 9,508 adult health maintenance organization patients, Felitti et al. (1998) originally found significant relationships between adverse childhood experiences (ACEs) and numerous medical (ischemic heart disease, cancer, chronic lung disease, skeletal fractures, liver disease) and mental health conditions (alcoholism, drug abuse, depression, suicide attempts) in adulthood.

ACEs are defined as stressful or traumatic experiences in childhood that include physical, sexual, and verbal abuse; neglect; and growing up in a dysfunctional household. Most research has focused exclusively on one adverse childhood event or used additive indices of ACEs to measure trauma severity, which erroneously assumes that each ACE is equally traumatic (Edwards, Holden, Felitti, & Anda, 2003; Weisberg, Krosnick, & Bowen, 1996). In reality, children are likely to experience different combinations of ACEs with different levels of distress (Felitti et al., 1998). Childhood trauma is known to compromise early social, emotional, and cognitive development (Edwards et al., 2005; Kendall-Tackett, 2002; Roman, Belaise, Martin, Morris, & Raffi, 2002; Taylor, 2010; van der Kolk, 2003), making it likely that disruptions in psychosocial development have a long-lasting effect on social relationships in adulthood. Research documents the damaging effect

of childhood trauma on social relationships throughout life (Gilbert et al., 2009; Lampe et al., 2003). There also is evidence that supportive relationships have a positive impact on health (Ibarra-Rovillard & Kuiper, 2011; Scarpa, Haden, & Hurley, 2006; Strine, Chapman, Balluz, & Mokdad, 2008). Supportive social networks may play an important role in decreasing adverse physiological regulation processes and promoting healthy behaviors, including adherence to medical treatment (Emmons, Barbeau, Gutheil, Stryker, & Stoddard, 2007; House, Landis, & Umberson, 1988; Reblin & Uchino, 2008; Uchino, 2006). Less attention has been paid to social network members who are sources of stress or who offer no support at all (Golding, Wilsnack, & Cooper, 2002; Ibarra-Rovillard & Kuiper, 2011; Scarpa et al., 2006). Nevertheless, there is some evidence that stressful relationships with family and friends are negatively associated with health outcomes (Burg & Seeman, 1994; Murphy, Slavich, Rohleder, & Miller, 2013; Parkerson et al., 1989; Rook, August, & Sorkin, 2011).

The purpose of this study was to investigate the relationship of two key factors in the health and mental health of adult survivors of childhood trauma, specifically the combinations of different ACEs experienced in childhood and the quality of social relationships in adulthood. In a chronic pain, primary care patient population seeking treatment, the specific objectives are to (a) identify groups/classes of ACEs experienced in childhood, (b) determine the degree these different ACE classes are associated with health and mental health outcomes in adulthood, and (c) determine whether supportive and stressful social relationships moderate this association.

## Method

### *Patient Recruitment and Enrollment*

To measure the study objectives, data were used from an earlier cross-sectional study that investigated risk factors associated with chronic low back pain (CLBP; Young, Benold, Whitham, & Burge, 2011). The sample included 254 adults seen in 10 geographically diverse primary care clinics throughout Texas as part of the Residency Research Network of Texas (RRNeT), a collaboration between 10 Accreditation Council for Graduate Medical Education (ACGME)-accredited family medicine residency programs (<http://iims.uthscsa.edu/RRNeT/home>). On average, the clinics were staffed by 29 resident physicians and 10 faculty members with an annual visit rate of 29,000. Patients seen in the RRNeT clinics tended to be economically disadvantaged with a large proportion being Latinos and African Americans (Young et al., 2011).

Institutional review board (IRB) approval was obtained from each participating clinic, as well as from The University of Texas Health Science Center at San Antonio where the RRNeT is located. The data analysis performed in this study was exempted from the Saint Louis University School of Medicine IRB. Inclusion criteria for the sample included primary care patients who could speak English or Spanish and who had a diagnosis of CLBP. Patients were excluded if they had a cancer diagnosis, were pregnant, or were new to the primary care clinic. Approximately 15 to 50 respondents were recruited from each clinic with a total of 254 enrolled by medical or undergraduate students hired as summer research assistants under the supervision of family medicine faculty members. No incentives for participating in the study were provided. Only 18 potential respondents refused to participate.

## *Measures*

During their primary care clinic visit, the respondents completed a 106-item paper-and-pencil questionnaire that measured ACEs, quality of social networks, current health and mental health status, and sociodemographic characteristics. Informed consent was obtained prior to administering the questionnaire. For those respondents with reading, eyesight, or language difficulties, the research assistants read the questions to them and recorded their responses.

**ACEs.** A 17-item version of the Centers for Disease Control and Prevention ACE questionnaire (<http://www.cdc.gov/ace/>) was used to measure multiple ACEs, including abuse (emotional, physical, and sexual), violence toward mother, and household dysfunction (household substance abuse, mental illness, suicide, and incarceration). Several items in the original ACE questionnaire were adapted from other measures, including the Conflict Tactics Scale for physical abuse, emotional abuse, and witnessing violence toward mother and Wyatt's questions on sexual abuse (Straus & Gelles, 1990; Wyatt, 1985). Acceptable reliability and validity of the ACE questionnaire have been established, including test-retest reliability (kappa coefficient = 0.61-0.80) and construct validity (Dube, Williamson, Thompson, Felitti, & Anda, 2004; Felitti et al., 1998).

**Quality of social networks.** An adapted version of the Duke Social Support and Stress Scale (DUSOCS) measured the supportive and stressful nature of interpersonal relationships for different categories of family and nonfamily members. Supportive relationships were defined as those that offer help, listen to you, or back you up when you are in trouble. Stressful relationships, on the contrary, are those that cause problems or that make life more difficult.

Respondents were asked to identify the supportive or stressful nature of relationships in six different categories of family networks (spouse, children, parents, siblings, other blood relatives, relatives by marriage) and four categories of nonfamily networks (neighbors, coworkers, church members or religious groups, other friends). In this study, respondents were asked which categories of relationship were supportive and which were stressful, whereas the original DUSOCS used a 1 to 3 scale describing the degree to which the relationships were supportive or stressful. The psychometric properties of the DUSOCS were acceptable with test-retest reliability scores ranging from  $r = .40$  to  $.76$  and evidence of convergent validity (Parkerson, Broadhead, & Tse, 1991; Parkerson et al., 1989). Because people can have both supportive and stressful relationships in their social networks, a social network index (SNI) was created by computing the difference between the total number of supportive and stressful social relationships in the network. The three levels of the SNI were (a) more stressful than supportive network (difference  $\leq -1$ ), (b) equal number of stressful to supportive relationships in network, and (c) more supportive than stressful network (difference  $\geq 1$ ). Due to small cell sizes in this three-level variable, a binary SNI was used that designated either a stressful/equal versus supportive social network. Respondents with no social network were assigned to the stressful/equal level of the binary variable.

**Adult health and mental health.** Health-related quality of life (HRQL) was measured using several subscales from the RAND Short Form Health Survey-36 (SF-36) (Stewart, Hays, & Ware, 1988). The SF-36 is the long form assessment for HRQL and contains eight subscales, four measuring mental HRQL and four measuring physical HRQL. The questionnaire asked only about the physical HRQL subscales. These included Bodily Pain, Limitations in Physical Activities, Perceived Quality of General Health, and Limitations in Usual Role Activities Due to Physical (Role-P) and to Emotional Problems (Role-E). The validity of these SF-36 subscales is well established, as well as their test-retest (.73-.96) and internal consistency reliabilities (equals or exceeds .80; McHorney, Koslinski, & Ware, 1994).

Depression was measured using the PHQ-8, a valid and widely used measure of *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994) depression severity (Beck, Steer, Ball, Cievo, & Kabat, 1997). The Patient Health Questionnaire-8 (PHQ-8) queries symptoms of major depression and has excellent agreement with the more commonly used PHQ-9. The positive predictive values for diagnosing depression at a threshold score of 15 are 94 and 93 for PHQ-8 and PHQ-9, respectively (Kroenke & Spitzer, 2002). Anxiety was measured using the Beck Anxiety Inventory-Primary Care (BAI-PC) which is a seven-item,

self-report, primary care screening instrument to detect anxiety disorders (Mori et al., 2003). The BAI-PC has good internal consistency reliability ( $\alpha = .90$ ) and construct validity, as well as good sensitivity and specificity in primary care settings. Based on recommended thresholds used in other research, binary variables for depression and anxiety were used in this study that support the clinical relevance of findings in this study (Beck et al., 1997; Kroenke et al., 2009). The threshold for clinical depression was PHQ  $\geq 10$ , and the threshold for clinical anxiety was BAI-PC  $\geq 5$ .

**Covariates.** Potential confounders of the association between ACEs and health outcomes were pain severity, comorbid health conditions, and sociodemographic characteristics. Pain severity was measured by self-report at the time of the interview using a visual analog scale ranging from 0 = *no pain* to 10 = *severe pain*. Data on comorbid health conditions were collected by asking respondents to check boxes for up to 18 health conditions commonly seen in primary care settings (e.g., diabetes, hypertension). We modeled a count of health conditions in our analysis. Sociodemographic covariates included age, gender, race, marital status, education, employment, and monthly income.

### Statistical Analysis

Latent class analysis (LCA) was used to first, empirically, identify mutually exclusive subgroups of trauma. Comparable with using factor analysis in continuous data, LCA is a statistical method used to derive mutually exclusive classes based on responses to a set of categorical variables (McCutcheon, 1987). Applied to this study, the underlying assumption is that the observed association among the 17 ACEs is due to an unobserved latent variable with a finite number of mutually exclusive classes. LCA models include the prevalence of each latent class, the probability that an individual is a member of a given class, and the probabilities of endorsing an individual ACE (item endorsement probabilities, given membership in a class). The best fitting latent class model was determined by the Bayesian information criterion (BIC). Models were computed using Latent Gold v.4.0 (Vermunt & Magidson, 2005). Model fitting began with a one-class solution, and additional models were computed up to a five-class solution. Respondents with missing data on any ACE item ( $n = 37$ ; 14.6%) were excluded from the LCA analysis, resulting in a final cohort of 217 respondents.

For the remaining statistical analyses, SPSS Version 20.0 was used to first calculate the frequency distributions and means (standard deviations [*SDs*]) of the quality of social networks, adult health and mental health, sociodemographic characteristics, and covariates. Crosstabulations were then computed

for these variables by ACE class. Statistical significance was determined using chi-square and ANOVA tests.

Multivariate logistic regression models were computed with depression and anxiety as outcomes, and multivariate linear regression models were computed for Role-E as an outcome. Results were expressed as odds ratios (ORs) and standardized beta coefficients with 95% confidence intervals (CIs).

To evaluate the effect of the SNI on the association between ACEs and health outcomes, unadjusted models were computed for ACEs and each outcome. Adjusted models for each outcome were then computed by first adding those variables significantly associated with both ACEs and the outcome at the bivariate level. Then, the effect of the SNI was forced into each model. ORs and beta coefficients were evaluated before and after adjusting for SNI to evaluate evidence (i.e.,  $\geq 10\%$  change in point estimates) that social relationships partly accounted for the association between ACEs and each health outcome. Two-tailed tests were used in all analysis conducted in this study.

## Results

As shown in Table 1, the mean age of respondents was  $53.5 \pm 14.4$  years, most were female (65.9%), and nearly one half were Caucasian (49.3%), were married (45%), and had a monthly income of US\$1,000 or less (44.7%). The majority had high school or more education (68.4%) and were unemployed (80.6%). Respondents reported an average of  $4.8 \pm 2.4$  comorbid medical conditions and a current mean pain score of  $6.1 \pm 2.7$ . The highest average scores on the HRQL subscales were Role-E ( $62.5 \pm 43.9$ ) and Perceived Quality of General Health ( $43.5 \pm 21.8$ ). Using clinically significant thresholds, anxiety and depression were common (47.0% and 43.3%, respectively).

Most respondents (70.5%) reported having more supportive categories of social networks than either stressful ones or those with equal numbers of both.

Nearly three out of four respondents reported experiencing at least one ACE in childhood (72.8%), and more than one half (51.3%) experienced three or more. The mean number of ACEs reported was 3.9 ( $SD = 4.1$ ). The most common ACE was having a parent or adult in the household swear, insult, or put them down as children (47.6%). Being pushed, grabbed, shoved, or slapped was the second most common (38.2%) followed by living in the same household with someone who was a problem drinker or alcoholic (31.1%). Least common was having a parent or adult in the household touch them in a sexual way (7.5%), try to have sex with them (7.9%), and actually have sex with them (5.5%).

**Table 1.** Sociodemographic and Medical Characteristics, Quality of Social Network, and Health and Mental Health Outcomes by ACE Classes<sup>a</sup> (N = 217).

		ACE Class 1 (n = 124)	ACE Class 2 (n = 41)	ACE Class 3 (n = 27)	ACE Class 4 (n = 25)	$\chi^2$ ANOVA p Value
Sociodemographic characteristics		Total %				
Age (years)	M, SD	53.5 ± 14.4	56.2 ± 15.3	51.4 ± 14.0	49.4 ± 10.2	48.1 ± 11.8
Gender						
	Male	34.1	34.7	36.6	37.0	24.0
	Female	65.9	65.3	63.4	63.0	76.0
Race						
	White	49.3	45.5	48.8	59.3	58.3
	Other	50.7	54.5	51.2	40.7	41.7
Marital status						
	Married	45.0	50.0	31.7	44.4	44.0
	Other	55.0	50.0	68.3	55.6	56.0
Education						
	<12th grade	31.6	35.0	33.3	12.0	32.0
	≥12th grade	68.4	65.0	66.7	88.0	68.0
Employment						
	Full/part-time	19.4	18.7	19.5	22.2	20.0
	Unemployed	80.6	81.3	80.5	77.8	80.0

(continued)



**Table 1. (continued)**

	Total %	ACE Class 1 (n = 124)	ACE Class 2 (n = 41)	ACE Class 3 (n = 27)	ACE Class 4 (n = 25)	$\chi^2$ ANOVA p Value
Monthly income						.35
<US\$1,000	44.7	42.7	55.3	48.1	33.3	
≥US\$1,000	55.3	57.3	44.7	51.9	66.7	
Stressful and supportive social networks						
Social network						
Negative/equal <sup>b</sup>	29.5	21.0	43.9	51.9	24.0	
Positive	70.5	79.0	56.1	48.1	76.0	.002
Adult health and mental Health						
Severity of low back pain	6.1 ± 2.7	5.9 ± 2.8	6.4 ± 2.7	6.5 ± 2.1	6.3 ± 2.7	.60
No. of comorbid conditions						
M, SD	4.8 ± 2.4	4.5 ± 2.5	5.4 ± 2.1	5.3 ± 2.0	4.5 ± 2.7	.13
Any anxiety						
BAI-PC < 12	53.0	69.4	22.0	33.3	44.0	
BAI-PC ≥ 12	47.0	30.6	78.0	66.7	56.0	<.0001
Any depression						
PHQ-8 < 10	56.7	73.4	29.3	37.0	40.0	
PHQ-8 ≥ 10	43.3	26.6	70.7	63.0	60.0	<.0001
SF General Pain						
M, SD	29.8 ± 26.5	32.0 ± 26.9	27.5 ± 25.2	24.1 ± 26.4	29.0 ± 26.7	.49

(continued)

Table 1. (continued)

	Total %	ACE Class 1 (n = 124)	ACE Class 2 (n = 41)	ACE Class 3 (n = 27)	ACE Class 4 (n = 25)	$\chi^2$ ANOVA p Value
SF General Health						
M, SD	43.5 ± 21.8	45.5 ± 21.9	37.7 ± 20.4	38.3 ± 20.4	48.6 ± 23.2	.08
SF Role-E						
M, SD	62.5 ± 43.9	76.1 ± 38.6	38.3 ± 41.7	40.7 ± 47.4	57.3 ± 43.6	<.0001
SF Physical Function						
M, SD	33.5 ± 26.7	36.4 ± 27.5	30.1 ± 23.5	57.3 ± 43.6	33.0 ± 28.9	.26
SF Role-P						
M, SD	16.1 ± 29.1	19.1 ± 31.7	12.8 ± 26.2	11.1 ± 22.3	12.0 ± 26.1	.39

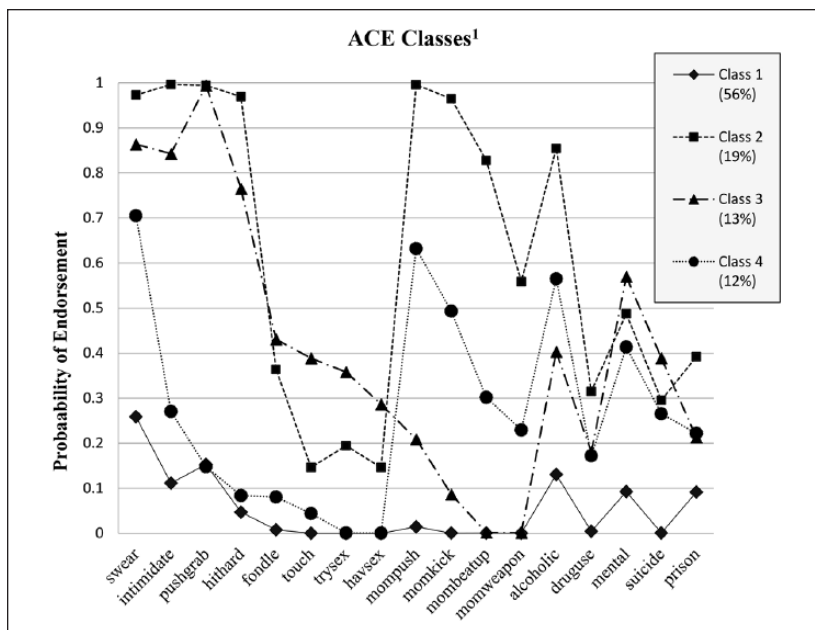
Note. ACE = adverse childhood experience; BAI-PC = Beck Anxiety Inventory-Primary Care.

<sup>a</sup>ACE classes: 1 = minimal, 2 = physical/verbal abuse of child who witnessed physical abuse of mother, 3 = physical/verbal abuse of child, and 4 = verbal abuse of child.

<sup>b</sup>aa-PHQ-8 = Patient Health Questionnaire-8<sup>10</sup>.

<sup>c</sup>Equal is defined as having identical numbers of supportive and stressful categories of social relationships.

<sup>d</sup>Short Form Health Survey (SF) Role-E = Limitations in Usual Role Activities Due to Emotional Problems and SF Role-P = Limitations in Usual Role Activities Due to Physical Problems.



**Figure 1.** Latent class analysis ACEs: Best fitting four-class solution ( $N = 217$ ).

Note. ACE = adverse childhood experience.

<sup>a</sup>ACE classes: 1 = minimal, 2 = physical/verbal abuse of child who witnessed physical abuse of mother, 3 = physical/verbal abuse of child, and 4 = verbal abuse of child.

The LCA identified a four-class solution as best fitting the ACE data (see Figure 1). The lowest BIC value was obtained for this four-class solution ( $BIC = 2,875.43$ ) which indicates a better fit than the larger BIC values for either the three-class ( $BIC = 2,889.30$ ) or five-class ( $BIC = 2,890.64$ ) solutions. Respondents in Class 1 (56%) are characterized by low endorsement probabilities for all ACEs. Class 2 respondents (19%) have high endorsement probabilities ( $>.90$ ) for experiencing verbal and physical abuse (i.e., sworn at, intimidated, pushed, and hit) and witnessing their mother being pushed, slapped, and kicked. High endorsement probabilities ( $>.80$ ) were also found for witnessing their mother being beat up and living in a household with a problem drinker or alcoholic. Respondents in Class 3 (13%) had high endorsement probabilities ( $>.90$ ) for both verbal and physical abuse as a child and a moderate probability endorsement ( $>.50$ ) for living with someone who was mentally ill. Unlike Class 2 respondents, they had minimal endorsement probabilities for witnessing the physical abuse of their mother. Finally,

respondents in Class 4 (12%) had relatively high endorsement ( $>.70$ ) for only one type of verbal abuse (swearing) with very moderate ( $>.50$ ) probabilities for seeing their mother being pushed. Few respondents reported any type of sexual abuse, although very moderate probabilities were found in Classes 2 and 3. The endorsement probability of living in households with persons who were drug users, suicidal, and in prison did not distinguish respondents assigned to Classes 2, 3, and 4. Based on the type of endorsed ACEs in each class, they were labeled as (a) Class 1 = minimal abuse, (b) Class 2 = physical/verbal abuse of child and mother with problem drinker or alcoholic in household, (c) Class 3 = physical/verbal abuse of child with mental illness in the household, and (d) Class 4 = verbal abuse of child.

The distribution of sociodemographic characteristics across the four ACE classes is shown in Table 1. With the exception of age, there are no significant differences in sociodemographic characteristics between the ACE classes. However, respondents in Class 1 (minimal abuse) were significantly older on average than respondents in the other ACE classes ( $p < .05$ ).

For health outcomes, highly significant differences were found across classes for both anxiety and depression ( $p < .0001$ ). Clinical anxiety was disproportionately more common among members of Class 2 and Class 3 (78.0% and 66.7%, respectively) than those in Class 1 and Class 4 (30.6% and 56.0%, respectively). Similarly, depression was significantly higher in Classes 2, 3, and 4 compared with Class 1 (70.7%, 63.0%, 60.0%, and 26.6%, respectively). There were no significant differences across groups on either severity of low back pain or number of medical conditions. For HRQL, statistically significant differences across ACE classes were found for Role-E ( $p < .0001$ ). With higher scores indicating better functioning, respondents in both Classes 2 and 3 were the most impaired. A similar but nonsignificant trend was also found for general health perceptions.

The next analysis focused on the relationship of social network characteristics to ACE classes and mental health outcomes. The SNI was significantly associated with ACE classes ( $p < .01$ ). Respondents in Classes 1 and 4 reported having more supportive than stressful categories of social networks (79.0% and 76.0%, respectively) compared with only 56.1% of respondents in Class 2 and 48.1% in Class 3. The association of mental health outcomes with sociodemographic and physical health characteristics was then determined. As shown in Table 2, each additional year of age was significantly and inversely associated with depression (OR = 0.98; 95% CI = [0.96, 0.99]) and anxiety (OR = 0.97; 95% CI = [0.95, 0.99]) and was positively associated with Role-E ( $\beta = .16, p < .05$ ). Having larger numbers of medical conditions was positively associated with depression and anxiety and was negatively associated with Role-E. The remaining HRQL subscales were significantly

**Table 2.** Bivariate Associations of Sociodemographic and Medical Characteristics, Social Networks, and Physical Health to Mental Health Outcomes ( $N = 217$ ).

	Any Clinical Depression	Any Clinical Anxiety	SF Role-E <sup>a</sup>
	OR (95% CI)	OR (95% CI)	Standardized Beta Coefficient
Age (years)	<b>0.98 [0.96, 0.99]</b>	<b>0.97 [0.95, 0.99]</b>	0.16 [0.03, 0.29]
Gender			
Female	1.00	1.00	—
Male	1.08 [0.62, 1.91]	1.11 [0.63, 1.94]	-0.01 [-0.15, 0.12]
Race			
Other	1.00	1.00	—
White	1.01 [0.59, 1.74]	0.65 [0.38, 1.11]	0.049 [-0.09, 0.18]
Marital status			
Other	1.00	1.00	—
Married	0.74 [0.43, 1.28]	0.69 [0.40, 1.18]	0.17 [0.03, 0.30]
Education			
<12th grade	1.00	1.00	—
≥12th grade	1.64 [0.90, 2.99]	1.60 [0.89, 2.88]	-0.05 [-0.19, 0.08]
Employment			
Unemployed	1.00	1.00	—
Full/part-time	0.52 [0.25, 1.06]	0.80 [0.41, 1.59]	0.17 [0.04, 0.31]

(continued)

Table 2. (continued)

	Any Clinical Depression	Any Clinical Anxiety	SF Role-E <sup>a</sup>
	OR (95% CI)	OR (95% CI)	Standardized Beta Coefficient
Monthly income			
<US\$1,000	1.00	1.00	
>US\$1,000	0.91 [0.52, 1.58]	0.72 [0.41, 1.24]	0.16 [0.03, 0.30]
No. of comorbid conditions	1.13 [1.01, 1.27]	1.17 [1.04, 1.32]	-0.17 [-0.30, -0.04]
Severity of low back pain	1.23 [1.10, 1.38]	1.19 [1.07, 1.33]	-0.26 [-0.39, -0.13]
Social network			
Stressful/equal	1.00	1.00	
Supportive	0.36 [0.20, 0.66]	0.41 [0.22, 0.75]	0.26 [0.13, 0.39]
SF General Pain	0.97 [0.96, 0.99]	0.98 [0.97, 0.99]	0.31 [0.18, 0.44]
SF General Health	0.96 [0.95, 0.98]	0.97 [0.96, 0.98]	0.27 [0.14, 0.41]
SF Physical Function	0.97 [0.96, 0.98]	0.98 [0.97, 0.99]	0.24 [0.11, 0.37]
SF Role-P <sup>a</sup>	0.98 [0.96, 0.99]	0.98 [0.97, 0.99]	0.28 [0.15, 0.40]

Note. Bold text indicates significant point estimates. OR = odds ratio; CI = confidence interval.

<sup>a</sup>Short Form Health Survey (SF) Role-E = Limitations in Usual Role Activities Due to Emotional Problems and SF Role-P = Limitations in Usual Role Activities Due to Physical Problems.

and inversely associated with depression and anxiety, indicating that higher levels of functioning were less common among those with depression and anxiety. Respondents who were married, employed, and earning US\$1,000 or more per month had significantly higher Role-E scores ( $p < .05$ ). Finally, higher levels of low back pain and number of medical conditions were associated with lower levels of Role-E scores (both  $p < .05$ ).

Age was the only variable significantly associated with both ACE class and mental health outcomes. As shown in Table 3, the association between ACE class and mental health outcomes was determined before and after adjusting for age and then after adjusting for both age and the SNI. Compared with Class 1 in unadjusted Model 1, the other 3 classes of ACEs were significantly associated with depression (OR range = 4.05-6.52), anxiety (OR range = 3.04-8.49), and Role-E ( $\beta$  range =  $-.14$  to  $-.34$ ;  $p < .05$ ). After adjusting for age in Model 2, the ORs and beta coefficients remained nearly identical, except the association between Class 4 and Role-E was no longer significant.

The SNI was significantly associated with depression, in that respondents with more supportive network categories were less likely to experience clinical depression (OR = 0.48; 95% CI = [0.25, 0.92]) and were more likely to report higher Role-E limitations ( $\beta = .17$ ,  $p < .05$ ). Using a threshold of  $\geq 10\%$  change in point estimates, supportive social networks partly accounted for the association between ACE Classes 2 and 3 and depression. They also partly explained the association between ACE Class 3 and anxiety and between ACE Class 3 and Role-E scores. Supportive networks did not account for the association between ACE Class 4 and any mental health outcome. Similarly, they did not account for the association between ACE Class 2 and anxiety or the association between ACE Class 2 and Role-E scores.

The relationship of social networks and mental health outcomes was also analyzed by computing the difference between the number of supportive and stressful people in participants' lives. Out of a list of 10 people, participants indicated if each individual was stressful, supportive or both. Differences in counts ranged from -6.0 (more stressful than supportive) to 10.0 (more supportive than stressful), and were dichotomized to supportive (positive) or stressful (negative) difference. The probability of depression and anxiety decreased markedly when there were more supportive than stressful social networks. When the number of supportive versus stressful networks was large ( $> 8.0$ ), there was an additional drop in the probability of depression and anxiety. Similarly, Role-E scores substantially improved with equal or higher numbers of supportive to stressful categories, particularly for those with a score  $\geq 8$ .

**Table 3.** Multivariate Regression (Logistic and OLS) of ACE Class Models by ACE Class and Mental Health Outcomes, Adjusting for Age and Social Network Index (*N* = 217).

	Any Depression	Any Anxiety	SF Role-E <sup>a</sup>
	OR (95% CI)	OR (95% CI)	(Standardized Beta Coefficient)
<b>Model 1</b>			
ACE class <sup>b</sup>			
Class 1	1.00	1.00	—
Class 2	6.52 [2.98, 14.25]	8.49 [3.68, 19.59]	-0.34 [-0.47, -0.20]
Class 3	4.59 [1.91, 11.02]	4.78 [1.96, 11.63]	-0.27 [-0.40, -0.14]
Class 4	4.05 [1.65, 9.89]	3.04 [1.226, 7.33]	-0.14 [-0.27, -0.01]
<b>Model 2</b>			
ACE class			
Class 1	1.00	1.00	—
Class 2	6.25 [2.84, 13.72]	8.01 [3.45, 18.63]	-0.32 [-0.45, -0.19]
Class 3	4.28 [1.77, 10.39]	4.23 [1.72, 10.39]	-0.25 [-0.38, -0.12]
Class 4	3.72 [1.50, 9.22]	2.59 [1.06, 6.36]	-0.12 [-0.25, 0.01]
Age	0.99 [0.97, 1.01]	0.98 [0.96, 0.99]	0.10 [-0.03, 0.22]
<b>Model 3</b>			
ACE class			
Class 1	1.00	1.00	—
Class 2	5.58 [2.51, 12.39]	7.27 [3.10, 17.02]	-0.29 [-0.42, -0.16]
Class 3	3.56 [1.45, 8.89]	3.65 [1.46, 9.15]	-0.22 [-0.35, -0.08]
Class 4	3.82 [1.53, 9.58]	2.63 [1.06, 6.49]	-0.12 [-0.25, 0.01]
Age	0.99 [0.97, 1.01]	0.98 [0.96, 1.00]	0.08 [-0.05, 0.21]
Social network			
Negative/equal <sup>c</sup>	1.00	1.00	—
Positive	0.48 [0.25, 0.92]	0.55 [0.29, 1.08]	0.17 [0.04, 0.30]

Note. OLS = ordinary least squares; ACE = adverse childhood experience; OR = odds ratio; CI = confidence interval.

<sup>a</sup>SF Role-E = Limitations in Usual Role Activities Due to Emotional Problems.

<sup>b</sup>ACE classes: 1 = minimal, 2 = physical/verbal abuse of child who witnessed physical abuse of mother,

3 = physical/verbal abuse of child, and 4 = verbal abuse of child.

<sup>c</sup>Equal is defined as having identical numbers of supportive and stressful categories of social relationships.

## Discussion

This study builds on earlier research by modeling the complex interplay of different combinations of ACEs and their effects later in life. To date, most research has focused on either one ACE (does not account for other traumatic experiences in childhood) or on numerical counts of ACEs to measure trauma severity (assumes each ACE is equally distressing). In reality, children can



experience different combinations of ACEs with varying levels of cumulative distress. Using LCA, this study provided a more in-depth understanding of the different subgroups (or classes) of respondents who experienced similar combinations of ACEs in childhood.

Four distinct ACE classes were identified in this study. Although there was minimal exposure to ACEs in Classes 1 and 4, this was not the case for the other two classes. High endorsements in Class 2 included being physically and verbally abused, witnessing physical violence toward one's mother, and living in a household with at least one member who abused alcohol. In comparison, Class 3 had high endorsements for physical and verbal abuse, while living in a household with mental illness. These findings support the polyvictimization model, in that different combinations of abuse can occur over the course of a child's life and that it is not uncommon for abuse children to witness violence against their mothers (Appel & Holden, 1998; Hamby, Finkelhor, Turner, & Ormrod, 2010).

Of all the ACE classes, respondents in Class 2 had the most compromised outcomes as adults, particularly anxiety, depression, and role limitations due to emotional problems, whereas the outcomes for Class 3 respondents followed closely behind. Class 2 was the only class with high endorsements of witnessing maternal abuse. One explanatory factor may involve the dose-effect, as the most compromised adult outcomes correspond to the number of ACEs experienced in childhood. Another interpretation involves the severity of different combinations of traumatic experiences. One example, grounded in attachment theory, is the terror of abuse children experience when they see their mother punched, kicked, beaten, and threatened with a weapon, particularly when their well-being and survival hinges on her primary caregiving role to protect and nurture them. To date, most studies on abused children who did and did not witness maternal violence found no differences in adverse outcomes during adulthood (Kitzmann, Gaylord, Holt, & Kenny, 2003). Less is known about the long-term effects in adulthood, although several studies found that children who both witnessed and experienced abuse reported depression, substance use, interpersonal violence, trauma symptoms, and suicide attempts as adults (Bensley, Van Eenwyk, & Wynkoop, 2003; Maker, Kemmelmeier, & Peterson, 1998).

The findings in this study corroborate the important role of social networks on the mental health of adult survivors of childhood abuse. Compared with other ACE classes, respondents in Classes 2 and 3 had significantly fewer supportive social networks, more negative social networks, or equal numbers of both. Supportive social networks were also inversely associated with depression, anxiety, and role limitations due to emotional problems (Role-E). In fact, having more supportive social networks relative to stressful

ones partly accounted for the association between both ACE Classes 2 and 3 to depression, as well as the relationship of ACE Class 3 to anxiety and Role-E. Although most research has focused on the buffering or main effect of social support on stress outcomes, clinical interventions that focus on decreasing the negative effects of stressful social networks in this population may be particularly effective in improving outcomes. Some interventions focus on empowering survivors to make these changes, whereas others focus on the treatment of couples, such as conjoint cognitive behavioral therapy for adults with posttraumatic stress disorder (PTSD) and their partners (Monson & Fredman, 2012).

The findings in this study clearly demonstrated the relationship of childhood trauma and compromised mental health in adulthood. However, a similar relationship was not found for physical health, although there was a trend in the expected direction for perceptions of general health. This finding is counterintuitive, given evidence that demonstrates the relationship of ACEs to medical conditions in adulthood (e.g., cardiovascular diseases, diabetes; Felitti et al., 1998). Explanatory factors in this study are likely to be measures of physical health used in this study (e.g., number of common medical conditions in primary care, current pain severity, perceived physical functioning), the use of self-report methods, or the inclusion criteria for sample selection.

Although this study contributes to a better understanding of ACE classifications and the role of social networks in adult outcomes, its limitations warrant consideration. First, the respondents in this study were patients with CLBP seeking primary care treatment in the state of Texas. With limited generalizability, prospective studies using population-based samples are needed in the future. Not only could it establish a firm temporal relationship among the constructs used in this study, more in-depth measures of multiple childhood trauma could also be used, such as duration, frequency of ACEs, and information on household perpetrators. Next, it is possible that ACEs may have been underreported in this study. This is not uncommon when respondents are asked for sensitive personal information, particularly by someone they do not know. Another consideration with important implications for future research is the measurement of social networks. Respondents were asked to identify whether categories of social networks (e.g., parents, children, in-laws) were either stressful or supportive. Although answering these questions required minimal respondent time, it did not measure the degree that respondents had supportive or stressful relationships with individual members of their network. Future research is likely to enrich our understanding of how social networks influence health outcomes of this population with a more in-depth assessment of individual social network members, including the quality of relationships, their earlier role in childhood abuse, their current

contributions in the relationship, and frequency of contact. Finally, research on other protective factors and adverse conditions outside the family or household may have an important impact on adult outcomes for this special population.

This study is relevant to a very diverse patient population. Nearly one third of participants had less than a high school education, and almost half were non-White. The findings should be relevant to persons with fewer resources and to minorities. Additional research is warranted to determine whether ACEs have different long-term effects on health among persons in poverty compared with middle- and upper-class patients.

## Conclusion

Exposure to four different combinations of traumatic experiences in childhood was identified in this study. Children who were physically and verbally abused, particularly those who also witnessed violence against their mother, reported significantly more anxiety, depression, and poor role functioning due to emotional problems as adults. They also reported having fewer supportive and more negative social networks as adults. This study suggests that the clinical treatment of adult survivors of childhood trauma consider ways to strengthen their social networks and mitigate the negative effects of stressful ones. Future population-based research that uses LCA and explores social networks in more depth will contribute to a better understanding of the pathways through which childhood trauma effects health and mental health outcomes later in life.

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