

Childhood Adversity and Combat as Predictors of Depression and Post-Traumatic Stress in Deployed Troops

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Background: Previous studies have shown a relationship between childhood adversity and health outcomes in adulthood. The military represents a segment of the young working population that faces unique hazards that may be worsened by previous adverse life experiences. To date, no comprehensive studies of childhood adversity have been conducted with military samples that have included combat troops before and after a combat deployment.

Methods: Surveys were administered in 2003 to 4529 male soldiers who had not deployed to Iraq, and in 2004 to a separate group of 2392 male soldiers 3 months after returning from Iraq. The main predictor was adverse childhood experiences, an aggregated construct representing incremental exposure to six types of traumatic childhood experiences. This construct correlated with depression and post-traumatic stress disorder rates, as well as symptom scores. For the post-Iraq sample, analyses were conducted to assess whether individuals with childhood trauma were affected differently by exposure to combat.

Results: The likelihood of screening positive for depression and post-traumatic stress disorder was significantly higher for individuals reporting exposure to two or more categories of childhood adversity. Core analyses showed that adverse childhood experiences were a significant predictor of mental health symptoms, beyond the expected contribution of combat.

Conclusions: This study confirms the high prevalence of adverse childhood experiences and the association of these experiences with key mental health outcomes. In addition, the results highlight the importance of considering pre-enlistment childhood traumatic experiences as well as the level of combat exposure in the treatment of military personnel returning from combat operations. (Am J Prev Med 2007;33(2):77–82) © 2007 American Journal of Preventive Medicine

Introduction

Developmental theorists have postulated a stable association between childhood adversity and behavioral difficulties in later life.¹ Empirical studies have provided confirmation of these postulates.^{2,3} Concurrently, research has shown a relationship between adults' exposure to combat and mental health outcomes.^{4,5} These lines of research indicate that exposure to traumatic experiences across the life span is associated with deleterious mental health outcomes. However, little is known about whether child-

hood adversity adds independently to the risk associated with combat exposure, or if childhood adversity and combat exposure interact in predicting mental health.

Adverse Childhood Experiences

The most comprehensive study of the relationship between childhood adversity and health was the adverse childhood experiences (ACE) study.⁶ This was a large retrospective examination of over 8000 adults, queried about exposure to seven types of adverse childhood experiences (e.g., psychological abuse, mental illness in the home). Analyses were conducted using an aggregated ACE score that represented incremental exposure to childhood adversity. Results showed a dose-response relationship between ACE and heart disease, obesity, drug abuse, depression, and suicidality.⁶ Other ACE researchers replicated this relationship, and found that ACE was related to other key health outcomes, such as alcohol abuse and smoking behaviors.^{7–11}

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Combat Experiences

Combat is related positively to post-traumatic stress (PTSD) and depression.^{4,5,12} Data from the National Vietnam Veterans Readjustment Study showed lifetime rates of PTSD among veterans substantially higher than those of civilians.¹² Among Operation Desert Storm veterans, rates of PTSD around 10% were reported.⁵ A recent study of soldiers returning from service in Operation Iraqi Freedom found rates of PTSD around 12%,¹³ similar to the 9% reported in a recent re-evaluation of PTSD among Vietnam veterans.¹⁴ Symptom increase following combat has also been documented among non-American soldiers.¹⁵⁻¹⁷ Finally, combat has been noted to have a significant impact on depression.^{12,13} This last finding suggests that exposure to war trauma can be a critical factor in fostering mental health impairment.

Current Study

In this study, the following were examined: (1) rates of ACE in two samples of male soldiers, one that had deployed to Iraq and one that had not, (2) the association between ACE and depression and PTSD in the two samples, (3) the independent predictive value of ACE and combat exposure in the post-Iraq sample, and (4) the interaction between ACE and combat in predicting depression and post-traumatic stress symptoms in the post-Iraq sample.

With regard to the interaction, questions about developmental sequelae associated with exposure to repeated traumatic events remain contentious. Some researchers have suggested that individuals with previous trauma are likely to react more negatively to combat than individuals not similarly traumatized.^{4,18-20} However, Stein et al.²¹ found the opposite: individuals with higher exposure to developmental trauma appeared **less** reactive to the effects of combat than individuals who reported no such trauma.

Method

Participants

The pre-Iraq sample consisted of 4529 soldiers who had not deployed to Iraq, surveyed in 2003. Approximately 43% ($n=1926$) had deployed to Afghanistan; however, rates of depression and PTSD were similar to those reported among nondeployed soldiers.¹³ With regard to the mental health issues that were the focus of this study, the primary difference lay between those who had deployed to Iraq and those who had not. The post-Iraq sample consisted of 2392 participants surveyed 3 months after returning from Iraq, in 2004. All participants were males serving on active duty in infantry and support units, recruited for this study under a human use protocol approved by the Institutional

Table 1. Demographics

	Pre-Iraq <i>n</i> (%)	Post-Iraq <i>n</i> (%)
Age (years)		
18-24	2916 (64.6)	1357 (56.8)
25-29	892 (19.8)	550 (23.0)
30-39	652 (14.4)	432 (18.1)
≥40	57 (1.3)	51 (2.1)
Race/ethnicity		
Caucasian	3137 (70.2)	1642 (69.3)
African American	404 (9.1)	316 (13.3)
Hispanic	593 (13.3)	253 (10.7)
Asian	135 (3.0)	50 (2.1)
Other	197 (4.4)	109 (4.6)
Married	1625 (39.9)	1026 (48.2)

Review Board of the Walter Reed Army Institute of Research. Written consent was obtained from each soldier.

Access to soldiers was provided by their leaders, and soldiers were informed that surveys were anonymous and voluntary. Participation rates were high; for a more detailed discussion of response rates and representativeness, see Hoge et al.¹³ Briefly, it can be said that the composition of this sample mirrors that of the combat brigades from which they were drawn. Detailed demographic information is presented in [Table 1](#).

Instruments

Childhood adversity was measured using a modified version of the scale used in Felitti et al.⁶ In the current study, one item was used to test for exposure to six adverse experiences: (1) exposure to a mentally ill person in the home, (2) exposure to an alcoholic adult in the home, (3) sexual abuse, (4) physical abuse, (5) psychological abuse, and (6) violence directed against the respondent's mother. The first two items were dichotomous ("yes"/"no"). The remaining items were measured on a five-point scale (1="never" to 5="very often"), but were dichotomized as "yes"/"no" based on item wording criteria used in Felitti et al.⁶ The six final dichotomous items were summed to create the ACE variable (range=0-6).

Depression was measured using a nine-item scale, the Patient Health Questionnaire (PHQ).²² The PHQ is a short scale that has demonstrated excellent psychometric properties and substantial convergent validity with more established scales.²³ Two outcome variables were extracted: (1) a categorical outcome representing status as defined in Hoge et al.¹³; and (2) a symptom variable representing the sum of items (range=9-36).

Post-traumatic stress disorder was assessed using the 17-item Post-Traumatic Stress Disorder Checklist (PCL).²⁴ The stem question follows: "Below is a list of reactions that soldiers sometimes experience following deployment or in response to other stressful life experiences. Please mark how much you have been both-

Table 2. Exposure to adverse childhood experiences among men (%)

ACE score	Soldiers, pre-Iraq (n=4067)	Soldiers, post-Iraq (n=2166)	Civilians, Felitti et al. ⁶ (n=3859)	Civilians, Dube et al. ⁸ (n=7970)
0	47.2	45.6	53.7	41.3
1	23.6	23.8	25.8	28.5
2	14.4	14.4	11.6	15.3
3	8.0	8.0	5.0	7.5
≥4	6.8	8.1	3.9	7.4

ACE, adverse childhood experience.

ered by each problem in the past month.” Two outcome variables were extracted: (1) a score created by summing the items (range=17 to 85), and (2) a categorical variable using criteria developed in Hoge et al.¹³

Combat exposure among post-Iraq soldiers was assessed using 29 items, measured on a five-point Likert-type scale (1=“never” to 5=“ten or more times”). Soldiers were asked: “How often did you experience the following during the most recent deployment?” Examples of combat experiences that soldiers could endorse included: (1) “being attacked or ambushed”; (2) “handling or uncovering human remains”; and (3) “shooting or directing fire at the enemy.” Each item was dichotomized into “never” or “once or more” categories, and summed to create the combat exposure variable (range=0–29).

Analysis of the data took place in 2005 and 2006.

Results

Descriptive Information

Approximately 53% of pre-Iraq soldiers reported at least one adverse experience, and 29% reported exposure to two or more categories; post-Iraq soldiers reported similar rates at 54% and 31%, respectively. Endorsement rates by number of experiences are presented in Table 2.

Table 3. Rates of outcomes by age and ethnicity (%)

	Pre-Iraq		Post-Iraq	
	PTSD	Depression	PTSD	Depression
Age (years)				
18–24	6.4	7.8	14.7	8.9
25–29	4.6	3.8	11.9	6.6
30–39	2.8	1.9	9.6	6.2
≥40	3.5	1.8	11.8	7.8
Ethnicity				
Caucasian	5.2	6.3	12.7	7.6
African American	6.7	3.5	12.6	6.5
Hispanic	6.0	5.7	14.7	7.9
Asian	3.1	8.4	14.0	10.2

PTSD, post-traumatic stress disorder.

Table 4. Odds ratios derived from mixed effects logistic regression

ACE score	Pre-Iraq		Post-Iraq	
	Odds ratio	95% CI	Odds ratio	95% CI
Depression				
1	2.18	1.54–3.10	1.34	0.84–1.76
2	2.60	1.77–3.82	1.75	1.06–2.92
3	2.75	1.74–4.31	3.13	1.85–5.26
≥4	6.11	4.10–9.12	5.64	3.53–9.03
PTSD				
1	1.38	0.91–2.09	1.55	1.06–2.26
2	1.93	1.24–3.00	1.99	1.32–3.03
3	3.90	2.50–6.05	3.63	2.31–5.70
≥4	5.47	3.53–8.50	4.90	3.19–7.54

ACE, adverse childhood experience; CI, confidence interval; PTSD, post-traumatic stress disorder.

Overall, 6.0% (n=262) of pre-Iraq soldiers met criteria for depression, and 5.6% (n=227) did so for PTSD. Rates were higher for post-Iraq soldiers: 7.8% (n=180) for depression and 13.5% (n=295) for PTSD. Rates of each outcome, by age and ethnicity, are presented in Table 3.

Section I: Logistic Analyses of ACE Using Pre-Iraq and Post-Iraq Samples

A five-point ACE predictor was created by grouping soldiers reporting: (1) no adverse childhood experiences, (2) one experience, (3) two experiences, (4) three experiences, and (5) four or more experiences. This variable was then used to predict categorical depression and PTSD.

Mixed-effects, random-intercept logistic regression models were estimated to account for variations across the units in which soldiers were embedded. Adjustment for unit membership is important in military samples, as group differences may violate assumptions of statistical independence.^{25,26} Race/ethnicity (Caucasian versus non-Caucasian) and age (18 to 24 versus older) were included as covariates in all models.

Results were consistent with previous research. Among pre-Iraq soldiers, the odds ratio for depression rose from about 2.2 with one adverse experience to 6.1 with four or more experiences. Among post-Iraq soldiers, the confidence interval associated with depression straddled the referent point among those reporting only one experience. The pattern became stable with exposure to two or more experiences.

In analyses of PTSD, odds ratios straddled the referent point among pre-Iraq soldiers reporting only one adverse childhood experience. The trend stabilized, however, among pre-Iraq soldiers reporting multiple experiences. By contrast, the dose-response trend was fairly stable for post-Iraq soldiers: odds ratios rose from 1.6 to 4.9.

Model indices are presented in Table 4, while Figure 1 illustrates the trend.

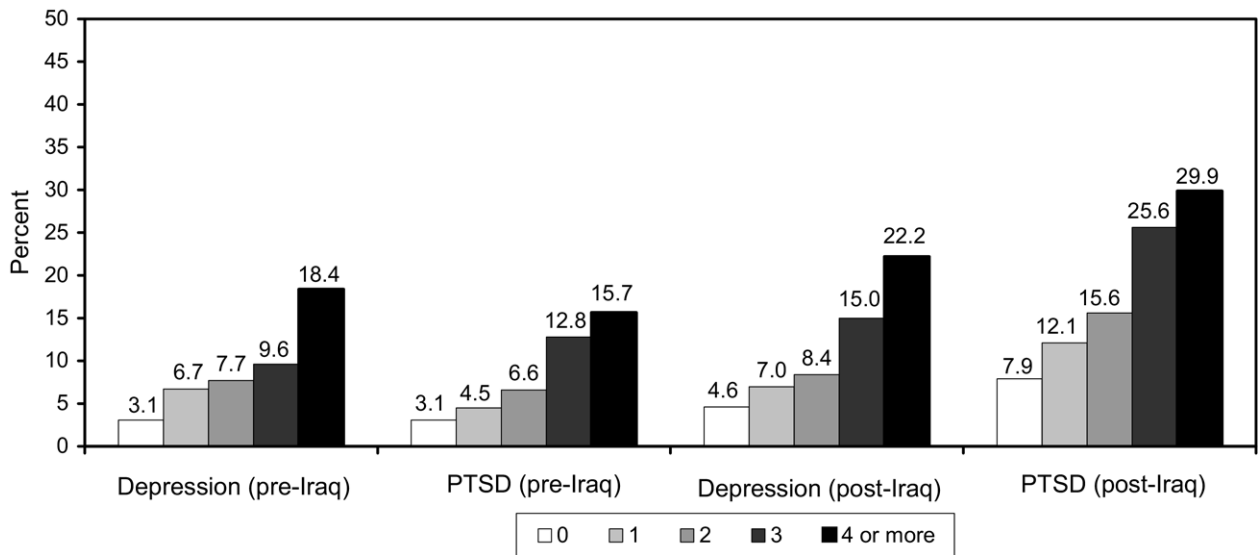


Figure 1. Percent meeting criteria for depression or post-traumatic stress disorder as a function of adverse childhood experience score. PTSD, post-traumatic stress disorder.

Section II: Poisson Regression Analyses of ACE and Combat in Post-Iraq Sample Only

The independent and interactive power of ACE and combat exposure in predicting PCL and PHQ were estimated using over-dispersed Poisson mixed-effects models.²⁷

In both models, the following were entered: (1) combat exposure, (2) the raw ACE variable, (3) an ACE × combat exposure interaction term, (4) age, and (5) race/ethnicity. Combat exposure and ACE were grand-mean centered to reduce collinearity with interaction terms.

Analyses of PHQs showed that ACE was a significant predictor ($t=6.46$, $p<0.001$), as was combat exposure ($t=7.94$, $p<0.001$). Moreover, a statistically significant interaction between ACE and combat exposure was noted ($t=-3.21$, $p<0.01$). This interaction showed that

the slope marking the relationship between combat exposure and depressive symptoms was steeper for those reporting no ACE exposure than for those reporting higher ACE exposure.

Similarly, ACE was found to be a significant predictor of PCL ($t=5.68$, $p<0.001$), as was combat exposure, $t=13.4$, $p<0.001$. A significant interaction was also found ($t=-3.28$, $p<0.01$). The interaction effect indicated that the slope of the relationship between combat and post-traumatic stress was steeper among those

Table 5. Model indices from overdispersed mixed-effects Poisson regression

	B	SEB	t
Depression			
ACE	0.31	0.05	6.46***
Combat exposure	0.05	0.006	7.94***
ACE × combat exposure	-0.009	0.003	-3.21**
Age	-0.08	0.05	-1.24
Race/ethnicity	0.08	0.05	1.15
Post-traumatic stress			
ACE	0.28	0.05	5.68***
Combat exposure	0.08	0.006	13.43***
ACE × combat exposure	-0.009	0.003	-3.28**
Age	-0.09	0.05	-2.32*
Race/ethnicity	0.06	0.05	1.40

* $p<0.05$; ** $p<0.01$; *** $p<0.001$ (all bolded).

ACE, adverse childhood experience; PTSD, post-traumatic stress disorder; SEB, standard error of B coefficient.

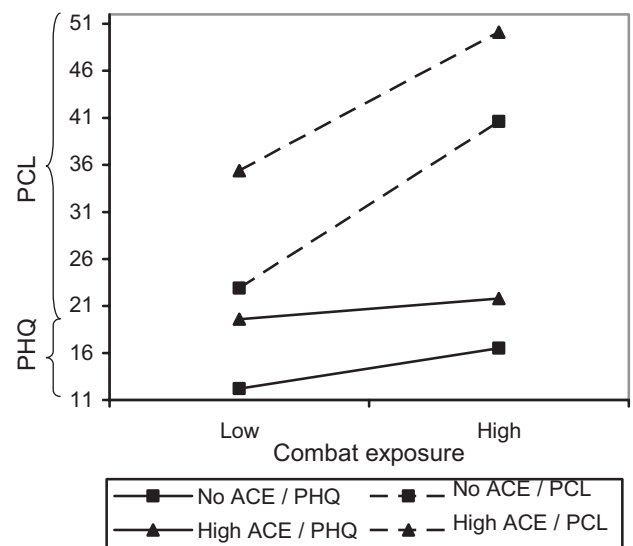


Figure 2. Interaction between ACE and combat exposure in predicting PHQ and PCL scores. ACE, adverse childhood experience; PCL, Post-Traumatic Stress Disorder Checklist; PHQ, Patient Health Questionnaire.

reporting no ACE exposure versus those reporting higher ACE exposure.

Model indices for Poisson regression analyses are presented in Table 5. Interaction effects are illustrated in Figure 2.

Discussion

This is the first study to assess the relationship between mental health outcomes and adverse childhood experiences among soldiers recently returned from combat. Results showed that individuals who reported two or more traumatic childhood experiences were at increased risk of meeting criteria for depression and PTSD; this held true for pre- and post-deployment samples.

Analyses of the post-Iraq sample showed that ACE was a significant predictor of depression and post-traumatic stress symptoms, above and beyond the role of combat exposure. Poisson regression analyses yielded statistically significant ACE-by-combat exposure interactions. Two plausible explanations for this finding can be advanced. First, it is possible that individuals with exposure to childhood traumatic events may be displaying **lower** reactivity to combat exposure. Alternatively, soldiers with previous developmental trauma who are exposed to combat may be manifesting as much symptom variation as they are likely to display; that is, previous trauma may act to create a symptom “ceiling effect.”

Although interactions were statistically significant, it is important to note that inspection of predicted values showed negligible shifts in symptoms. Of more practical importance was the finding that ACE independently predicted higher depression and post-traumatic stress symptoms, beyond the expected contribution of combat exposure.

Limitations

This study had limitations. First, data were retrospective. Second, exposure to childhood adversity and combat were measured using self-reports, with no assessment of the validity of these reports or the stability of recall over time. The ACE construct has shown good test-retest reliability over a one-year period.²⁸ Moreover, studies on the accuracy of adult recall of child abuse have shown substantial rates of false-negatives: adults whose abuse experiences are documented in official sources tend to under-report exposure when surveyed.^{29,30} The literature indicates under-reporting is more widespread among males than females, so it is highly likely that under-reporting is a feature of this study. Thus, one could argue that extant data represent low estimates of the true impact of the ACE construct.^{6,31} As regards retrospective self-reports of combat exposure, research indicates substantial stability over time.^{32,33}

Conclusion

This study represents an important addition to the developmental and combat trauma literatures. Results highlighted the importance of considering developmental trauma as well as the level of combat exposure when treating symptomatic military personnel returning from war. In clinical settings, assessment of developmental trauma might be worthwhile as this factor may contribute to the intractability of symptoms and/or the length of treatment.

Some issues remain. It is noteworthy that findings in this study parallel those of Stein et al.,²¹ although both studies used cross-sectional data. Longitudinal data are needed, to control for pre-deployment mental health. Second, there is the issue of gender. In the present study, there were not enough females to conduct analyses; they were excluded to allow for a more streamlined sample. In future, it may be possible to obtain a post-combat sample of women for adequate analyses to be done.

There is a dearth of data on the existence of PTSD relative to the intersection between adult trauma and childhood trauma; analyzing for these symptoms could potentially shed more light on the topic, and may be a suggestion for future research.

Opinions or assertions contained herein are the private views of the authors, and are not to be construed as reflecting views of the U.S. Department of Defense or the Department of the Army. Research was conducted under Walter Reed Army Institute of Research (protocol 1026), funded by U.S. Army Medical Research and Materiel Command.

The authors wish to thank Amy Adler, PhD, for assistance in the preparation of the manuscript, and staff at the Walter Reed Army Institute of Research for data collection and preparation.

No financial conflict of interest was reported by the authors of this paper.

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