Dimensionality, Reliability, and Validity of the Combat Experiences Scale

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ABSTRACT Few studies have measured combat exposure during deployment to a war zone. Valid, reliable, and specific measurement is needed to broaden existing knowledge of combat experiences to accurately answer clinically important questions regarding postcombat treatment and recovery, particularly with the recognition of new kinds of combat and resulting psychological sequelae. The Combat Experiences Scale (CES) is a 33-item measure that assesses deployment-related experiences. The psychometrics of this measure, however, were undefined before this study. The purpose of this study was to examine aspects of internal and external validity of the CES. Data were collected as part of a study of 500 veterans of the conflicts in Iraq and Afghanistan across five Veterans Affairs medical centers in Upstate New York. An exploratory factor analysis suggested that three factors represented the scale well: Exposure to Combat Environment, Physical Engagement, and Proximity to Serious Injury and Death. The CES scores showed adequate internal consistency, and evidence for convergent validity and discriminant validity was also found. This study underscores the importance of casting a wide net with regard to the assessment of deployment-related experiences and provides evidence that probable post-traumatic stress disorder, depression, and anxiety are highly correlated with all forms of deployment-related experiences.

INTRODUCTION

Systematic assessment of veterans' combat experiences is relatively rare.[1] In a comprehensive review of the literature conducted by the Institute of Medicine[2] that spanned war eras from World War II to the current conflicts in Afghanistan and Iraq, it was found that few studies measured combat exposure during deployment to a war zone. Measurement of combat has been largely at the macro level (e.g., number of injuries, casualties); however, with the recognition of new kinds of combat and resulting psychological sequelae, there is a need for more subjective measure at the level of the individual.

A measure of combat experience offers a brief and systematic way of exploring war experiences. Appreciation of the specific type and nature of combat experience is important to ensure tailored treatment approaches. The Combat Experiences Scale (CES) is a 33-item measure that assesses experiences related to deployment to a war. Compared to previous measures of combat exposure, its breadth and depth are promising, particularly in light of the unique aspects of the recent Wars in Iraq and Afghanistan.[3] However, the psychometrics of this measure were not known before this study.

Correlates of Combat Experiences

Deployment Characteristics

Deployment characteristics have been found to be pertinent indicators of one's combat experience. The Institute of Medicine[2] identified deployment length as one of the most important noncombat stressors. Further, strain is imposed by multiple tours and shorter dwell time.[4]

Gender Differences

Research supports the notion that although men and women service members are often exposed to similar deployment-related events or stressors, they experience them differently. A principal components analysis of 100 items from the National Vietnam Veterans Readjustment Survey[5] revealed that exposure to combat violence, deprivation (inadequate living factors such as shelter, food, water, and supplies, and frequency of feeling fatigued or exhausted), and a feeling of loss of control were most significant for males, whereas females found exposure to the dead and the wounded to be the most significant, followed by exposure to enemy fire, direct combat involvement, exposure to abusive violence, deprivation, and a sense of loss of control.

Mental Health Problems

Mental health problems are also associated with combat exposure. Hoge et al[6] found that over one-quarter of returning

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troops from wars may have mental health conditions. Such veterans displayed a greater prevalence of psychiatric disorders, particularly post-traumatic stress disorder (PTSD), other anxiety disorders, and depression, than those who served in the military at the same time but who were not deployed.[2] The Institute of Medicine[2] also stated that the prevalence of PTSD increases as combat exposure and intensity increases, and posited that many studies demonstrate a dose–response relationship. Stretch et al[7] found that stressors most closely associated with PTSD were exposure to killing, wounding of soldiers by friendly fire, a buddy being killed or wounded, exposure to the dead or dying, and being fired upon. Comorbid anxiety disorders are associated with increasing PTSD symptoms,[8] suggesting that individuals are at increased risk for co-occurring disorders as PTSD symptoms become more intense. Although major depression is often not considered a combat-related injury, a study conducted by the RAND Center for Military Health Policy Research[4] suggested that it is highly associated with combat exposure and ought to be considered on the spectrum of postdeployment mental health consequences, and that the prevalence of depression among service members ranges from 2 to 10%.

Head Injury

Traumatic brain injuries (TBIs) are considered a signature injury of Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF). Mild concussive injuries have become a major focus in military medicine, as there has been a significant increase in mild traumatic brain injuries (mTBIs) in the current conflicts. Nonetheless, the exact nature of deficits resulting from blast exposure is not yet well understood.[3] With regard to the prevalence of TBI, it appears that anywhere from 8 to 15% of service members returning from deployment reported a head injury resulting in loss of consciousness.

Alcohol Use

Alcohol abuse or dependence has also been demonstrated to be an adverse consequence of deployment-related stress. Using the Vietnam Era Twin Registry, Goldberg et al[9] found that Vietnam veterans consumed higher levels of alcohol than those who did not serve, and that degree of combat exposure was related to higher consumption. More specifically, there was a 15.3% prevalence rate of high daily consumption among those who reported no combat exposure, a 20.7% high daily consumption prevalence rate among those who reported low combat exposure, and prevalence rates of 24.5 and 24.7% among the medium and high combat exposure groups, respectively.

Age and Education

Age and education have been demonstrated to be both risk and protective factors with regard to sequelae of combat experiences. Among Vietnam and Gulf War veterans, low income and lack of education were associated with chronic stress-related disorders, such as anxiety disorders, depression, and substance-use disorders.[10] Two studies found that being an officer or being college-educated reduced the risk of developing anxiety or depressive disorders postdeployment by at least half.[10,11] Evidence of age as a factor is mixed. Many studies[12] have found that younger veterans were more likely to develop PTSD following deployment than older veterans; however, other studies[10,13] have found no such age group differences.

Purpose of the Study

The purpose of this study was to examine the reliability, validity, and dimensionality of the CES. Valid, reliable, and specific measurement is needed to broaden existing knowledge of combat experiences to accurately answer clinically important questions regarding postcombat treatment and recovery. The Institute of Medicine's review of deployment characteristics studies suggest that the degree of combat experienced was the most important determinant of service members' mental health.[2] External validity of derived factors was examined with concomitant measures of demographic and war experience scales as well as cognitive, affective, and behavioral scales. In doing so, the relationship of the CES to clinically relevant outcomes, such as TBI status, PTSD, depression, and anxiety symptoms, and other psychopathology was also explored.

METHODS

Settings and Participants

Data were collected from 500 OEF/OIF Veterans postdeployment as part of a larger study (VA HSR&D SDR 06-162). The study took place at five Veterans Affairs (VA) medical centers in Upstate New York and represented a mix of metropolitan and rural locations. Five hundred participants were then screened for outlying (e.g., too high or too low of a score) and missing values (e.g., blank scores) on the CES. Extreme values were checked against original paper forms that were completed at the time of assessment and corrected when necessary. Any participant who had any missing values on the CES was excluded, resulting in a study sample of 451 participants (Table I).

Measures

Sociodemographics

A demographics form was used to gather basic personal information; educational, vocational, and treatment data; deployment and health information; and self-reported premilitary history of head injury and mental health problems.

Combat Experiences Scale

The Walter Reed Army Institute of Research CES is a 36-item scale that measures combat intensity based on frequency and type of combat experiences. The first 33 items are various deployment-related experiences that range from combat-related questions ("being attacked or ambushed")

TABLE I. Demographic Characteristics of Participants ($N = 451$)

Characteristic	*M*	SD	Range
Age	32.20	8.90	20–60
Years in Military	10.00	7.60	1–33
Number of Deployments to a War Zone	1.6	1.2	1–15
Months Since Return From Most Recent Deployment	36.1	22.2	1–108
	Frequency (%)		*n*
Gender			
Male	90.2		(407)
Female	9.8		(44)
Race			
African American	5.8		(26)
Asian American	1.1		(5)
White/Caucasian	85.4		(385)
Hispanic	3.9		(17)
Native American	1.1		(5)
Other	2.7		(12)
Military Branch			
Air Force	2.9		(13)
Army	48.1		(217)
Marines Corps	16.6		(75)
Navy	5.1		(23)
National Guard	18.6		(84)
Reserves	8.5		(38)
Air Force	1.5		(7)
Army	5.1		(23)
Marines	0.2		(1)
Navy	1.6		(7)

to deployment duties ("handling or uncovering remains") to possible deployment or combat-related events ("knowing someone seriously injured or killed," "had a close call, dud landed near you," and "provided aid to the wounded"). Item responses are on a 5-point scale related to how often the event was experienced, ranging from 0 ("never") to 5 ("10 or more times"). The last three items of the scale are each scored differently and pertain to how often a service member was in serious danger of being injured or killed, how many times one engaged in enemy firefight, and whether one or more nights were spent in the hospital. These items were excluded from the analysis because of the difference in the scale format. Before this study, psychometric data were not available for this instrument, which was recently used in a study of 2,525 Army infantry soldiers following their return from Iraq.[3] The scale is one of 14 measures in the Deployment Risk and Resilience Inventory available from the National Center for PTSD (http://www.ptsd.va.gov/professional/pages/assessments/list-drri-measures.asp). The results of this study, particularly the exploration of the factor structure of the CES, will enhance the use of the measure in the kind of research and clinical applications supported by the National Center for PTSD.

Tampa Blast Injury Questionnaire

The Tampa Blast Injury Questionnaire is a 7-item survey of primary, secondary, tertiary, and quaternary effects of blast injury developed for use with the Florida National Guard. The instrument was modified to determine the proximity to and location relative to the explosion (inside a building, outside, in a vehicle, other). For the purpose of this study, an index score of intensity of blast exposure was created by summing the number of blasts reported where a blast or explosion included a loss or alteration of consciousness and where the respondent saw someone killed or injured by the explosion.

Psychological Features (PTSD, Anxiety, Depression, and Psychopathology)

Probable PTSD was measured by the PTSD Checklist-Military (PCL-M), a widely used, 17-item checklist developed at the National Center for PTSD. It follows Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV) diagnostic criteria for PTSD.[14]

The Beck Depression Inventory II (BDI-II), a 21-item scale tracking DSM-IV criteria, was used to measure the intensity of depressive symptoms in the sample.[15] The 21-item Beck Anxiety Index (BAI) was used to assess general anxiety. This instrument reliably discriminates anxiety from depression while displaying convergent validity.[16] General psychopathology was measured by the Personality Assessment Screener (PAS), a 22-item measure that provides scores on 10 clinical scales and a total score. The clinical scales include negative affect, acting out, health problems, psychotic features, social withdrawal, hostile control, suicidal thinking, alienation, alcohol problem, and anger control. This test was derived from the Personality Assessment Inventory and was designed as a screening instrument.

Substance Use

The Alcohol Use Disorders Identification Test-C (AUDIT-C) is a 3-item scale used to screen for alcohol abuse and dependence. Scores of 3 or more for women and 4 or more for men are recommended for a positive screen.[17]

TBI and Postconcussive Symptoms

A 22-item structured diagnostic interview was completed by licensed psychologists to determine the likelihood and severity of TBI among participants. The Neurobehavioral Symptom Inventory (NSI) provided information on 22 postconcussive symptoms in four clinical clusters: affective, cognitive, somatic, and sensory. Items were endorsed on a 5-point scale of intensity. Recently published validity data demonstrated that the measure is informative in describing the multidimensional nature of postconcussive symptoms.[18,19]

Overview of Data Analysis

First, the internal validity of the CES was examined through exploratory factor analysis to determine the factor structure of the combat experiences measure. Next, evidence for convergent validity was gathered to assess the degree to which

the measure of combat experiences was correlative with like measures. Discriminant validity was also examined to assess the degree to which the CESs would have little to no relationship among theoretically dissimilar variables.

RESULTS

Internal Validity

Exploratory Factor Analysis

First, data from the CES were examined at the item level for accuracy and completeness. No item was excluded because of excessive missing data. Next, data were examined and screened at the item level for skewness and kurtosis. Table II displays descriptive statistics on the scale items. Four items had skewness values greater than an absolute value of 2, and five items had kurtosis values greater than an absolute value of 2 (Table II); however, all items were retained because of the exploratory nature of the study.

An exploratory factor analysis using principal axis factoring (PAF) was conducted on item-level data of the CES. A combination of empirical and substantive criteria was employed to determine the dimensions underlying the CES items. This included an examination of the scree plot and the variance accounted for (VAF) to assess if each additional factor increased the VAF by a significant degree, along with examination of the substantive make-up of the factors. The scree plot and percentage of variance suggested there were one to three factors present within these data. The first three eigenvalues (amount of variation accounted for by each factor) were (% VAF in parentheses) 13.49 (40.89), 1.63 (4.94), and 1.04 (3.16). To help determine the number of factors to retain, a parallel analysis was conducted.[20]

Velicer and Jackson[21] contended that parallel analysis is one of the most accurate methods for selecting the number of factors to retain in a factor analysis. Comparison of mean eigenvalues at the 95% confidence interval from the parallel analysis to the actual eigenvalues obtained provided support for the identified factor structure. This process involved extracting eigenvalues from randomly generated data sets that parallel the actual data set in terms of number of cases and variables. The actual data set consisted of 451 observations for each of the 33 CES variables. Thus, a series of random data matrices was generated, and eigenvalues were computed for each of the random data sets.

O'Connor[22] suggested using eigenvalues that correspond to the 95th percentile of the random data eigenvalues, that is,

TABLE II. Descriptive Statistics of CES Items

No.	Item Description	*M*	SD	Skewness	Kurtosis
1	Was Attacked or Ambushed	3.10	1.56	−0.12	−1.46
2	Saw Destroyed Homes and Villages	3.65	1.55	−0.67	−1.11
3	Received Small Arms Fire	3.20	1.57	−0.21	−1.46
4	Saw Dead Bodies or Human Remains	3.20	1.50	−0.21	−1.33
5	Handled or Uncovered Human Remains	2.12	1.43	0.97	−0.45
6	Witnessed an Accident That Resulted in Serious Injury or Death	2.29	1.33	0.72	−0.61
7	Witnessed Violence With Locals or Between Ethnic Groups	2.49	1.49	0.45	−1.19
8	Saw Dead or Seriously Injured Americans	2.75	1.40	0.26	−1.11
9	Knew Someone Who Was Seriously Injured or Killed	2.78	1.26	0.26	−0.80
10	Participated in Demining Operations	1.92	1.52	1.27	−0.12
11	Worked in Areas That Were Mined	2.49	1.69	0.52	−1.44
12	Hostile Reactions From Civilians	3.10	1.52	−0.16	−1.39
13	Disarmed Civilians	2.49	1.65	0.48	−1.44
14	In Threatening Situation but Unable to Respond Because of Rules of Engagement	2.74	1.57	0.23	−1.44
15	Shot or Directed Fire at the Enemy	2.66	1.65	0.33	−1.51
16	Called in Fire on the Enemy	1.67	1.21	1.68	1.55
17	Engaged in Hand-to-Hand Combat	1.23	0.68	3.39	12.17
18	Cleared/Searched Homes or Buildings	2.81	1.80	0.17	−1.78
19	Cleared/Searched Caves or Bunkers	1.68	1.25	1.73	1.70
20	Witnessed Brutality/Mistreatment Toward Noncombatants	1.71	1.22	1.58	1.28
21	Was Wounded or Injured	1.53	0.83	1.91	4.19
22	Saw Ill/Injured Women/Children Whom You Were Not Able to Help	2.51	1.56	0.47	−1.29
23	Received Incoming Artillery, Rocket, or Mortar Fire	3.77	1.50	−0.82	−0.82
24	Was Directly Responsible for Death of an Enemy Combatant	1.94	1.40	1.22	0.01
25	Directly Responsible for Death of Noncombatant	1.25	0.79	3.65	13.12
26	Was Responsible for Death of U.S. or Ally Personnel	1.05	0.34	7.66	67.08
27	Had a Member of Your Own Unit Become a Casualty	2.40	1.28	0.50	−0.75
28	Had a Close Call, Dud Landed Near You	1.79	1.08	1.34	1.13
29	Had a Close Call When You Were Shot or Hit but Protective Gear Saved You	1.40	0.82	2.46	6.37
30	Had a Buddy Shot or Hit Who was Near You	1.57	0.94	1.59	1.81
31	Improvised Explosive Device or Booby Trap Exploded Near You	2.04	1.37	0.73	−0.60
32	Provided Aid to the Wounded	2.05	1.37	1.04	−0.23
33	Saved the Life of a Soldier or Civilian	1.53	1.10	2.11	3.33

TABLE III. Results of Principal Axis Factor Analysis and Descriptive Statistics for Items and Scales

No.	Item Description	Loadings F1	F2	F3	h^2
1	Was Attacked or Ambushed	**0.64**	–0.12	0.30	0.60
2	Saw Destroyed Homes and Villages	**0.67**	–0.12	–0.05	0.42
3	Received Small Arms Fire	**0.80**	–0.10	–0.15	0.70
7	Witnessed Violence With Locals or Between Ethnic Groups	**0.63**	0.10	–0.10	0.53
9	Knew Someone Who was Seriously Injured or Killed	**0.41**	0.06	–0.36	0.47
11	Worked in Areas That Were Mined	**0.58**	–0.05	–0.01	0.32
12	Hostile Reactions From Civilians	**0.82**	–0.08	0.03	0.60
13	Disarmed Civilians	**0.76**	0.16	0.07	0.65
14	In Threatening Situation but Unable to Respond Because of Rules of Engagement	**0.65**	0.10	0.01	0.48
15	Shot or Directed Fire at the Enemy	**0.76**	0.13	–0.01	0.69
18	Cleared/Searched Homes or Buildings	**0.76**	0.07	0.12	0.39
19	Cleared/Searched Caves or Bunkers	**0.45**	0.31	0.05	0.39
20	Witnessed Brutality/Mistreatment Toward Noncombatants	**0.45**	0.29	0.12	0.34
22	Saw Ill/Injured Women/Children That You Were Not Able to Help	**0.64**	0.07	0.02	0.44
23	Received Incoming Artillery, Rocket, or Mortar Fire	**0.49**	–0.18	–0.29	0.38
24	Was Directly Responsible for Death of an Enemy Combatant	**0.48**	0.37	–0.07	0.58
31	IED or Booby Trap Exploded Near You	**0.63**	0.10	–0.14	0.56
16	Called in Fire on the Enemy	0.33	**0.41**	–0.03	0.41
17	Engaged in Hand-to-Hand Combat	0.15	**0.55**	–0.02	0.41
21	Was Wounded or Injured	0.14	**0.45**	–0.10	0.34
25	Directly Responsible for Death of Noncombatant	0.05	**0.71**	–0.06	0.58
26	Was Responsible for Death of U.S. or Ally Personnel	–0.11	**0.42**	–0.08	0.17
29	Had a Close Call When You Were Shot or Hit but Protective Gear Saved You	0.17	**0.46**	–0.14	0.41
30	Had a Buddy Shot or Hit Who was Near You	0.30	**0.46**	–0.22	0.61
5	Handled or Uncovered Human Remains	0.34	0.17	**–0.41**	0.55
8	Saw Dead or Seriously Injured Americans	0.24	0.07	**–0.55**	0.54
32	Provided Aid to the Wounded	0.07	0.14	**–0.67**	0.60
33	Saved the Life of a Soldier or Civilian	0.11	0.31	**–0.59**	0.50

retaining factors whose eigenvalues are greater than the corresponding eigenvalues at this percentile from the random data. O'Connor[22] also provided sample SPSS syntax, which was used to generate the parallel data sets. This procedure indicated that the first three eigenvalues from the actual analysis were greater than the mean eigenvalues generated from the parallel analysis, supporting the presence of three factors. Therefore, a three-factor solution was extracted by PAF. Independent factors were not expected, so an oblique rotation was applied. The resulting three eigenvalues were 13.45, 1.59, and 1.00. The three factors correlated from 0.61 to 0.67.

Empirical and substantive criteria also guided item analyses. Items were retained if they loaded ≥0.4 on only one factor. Item analyses of the CES indicated that 29 of the 33 items produced adequate loadings (i.e., pattern coefficients) on one of the three factors, as evidenced by all values ≥0.40. In addition, one item had cross-loadings >0.4 on two factors. As such, five items were then dropped, and a new three-factor solution was extracted by PAF. All 28 items produced adequate loadings, and no item cross-loaded on any factors. Table III shows the pattern coefficient matrix and communality estimates of the 28 retained CES items.

Next, the substantive makeup of the empirical scales was explored. The final labels of the scales were "Exposure to Combat Environment," "Close Physical Engagement," and "Nearness to Serious Injury or Death." The Exposure to Combat Environment factor contained items that relate to various aspects and duties of the combat setting, such as "cleared or searched homes or buildings" or "worked in areas that were mined." The Close Physical Engagement factor included items that represent proximity—near engagement—in combat such as "engaged in hand-to-hand contact" or "had a close call when you were shot or hit but protective gear saved you." The Nearness to Serious Injury or Death pertains to direct involvement with those seriously injured or dead, such as "provided aid to the wounded" or "handled or uncovered human remains."

Table IV presents the means, SDs, scale intercorrelations, and internal consistency estimates. The new factor-based

TABLE IV. Means, SDs, Correlations, and Reliability Estimates of CESs

	CESs 1	2	3	Total
M	2.67	1.39	2.11	2.64
SD	1.07	0.57	1.08	1.01
α	0.94	0.81	0.82	0.95
		r		
1	1			
2	0.67	1		
3	0.65	0.61	1	
Total	0.97	0.78	0.77	1

subscales correlated strongly with each other (r's from 0.61 to 0.67). The internal consistency estimates for this sample were adequate; the Cronbach Coefficient, α, for the Exposure to Combat Environment, Close Physical Engagement, and Nearness to Serious Injury or Death scales were 0.94, 0.81, and 0.82, respectively.

External Validity

To assess convergent validity, the relationships between the three subscales of the CES, deployment characteristics, brain and blast injury measures, alcohol use, and affective and personality measures, were examined. Specifically, Pearson correlation coefficients were calculated between the CES subscales and number of deployments, number of TBIs, intensity of blast exposure based on the Tampa Blast Injury Questionnaire, total score on the NSI, total score on the AUDIT-C, and total scores on the BDI-II, the BAI, the PCL-M, and the PAS (Table V).

No correlation between number of deployments and any CES subscale was significant. Higher reporting of all three aspects of combat experience was significantly related to the number of times a veteran felt at serious risk. Number of times engaged in firefight was also found to be significantly and positively related to all three CES subscales (r = 0.76, 0.58, and 0.52, $p < 0.0001$ for Exposure to Combat Environment, Direct Physical Engagement, and Nearness to Serious Injury/Death of Others, respectively). Number of TBIs was also found to be positively related to all three CES subscales (r = 0.47, 0.43, and 0.39 for Exposure to Combat Environment, Direct Engagement, and Nearness to Serious Injury/Death of Others, respectively, $p < 0.0001$). An index of severity of blast exposure was found to correlate most significantly with the CES Direct Physical Engagement subscale (r = 0.37, $p < 0.0001$), while it still significantly correlated at the $p < 0.05$ level to the other two CES subscales (Exposure to Combat Environment, r = 0.18; Nearness to Serious Injury/Death of Others, r = 0.22). Scores on the NSI correlated significantly with all three CES subscales at $p < 0.0001$: Exposure to Combat Environment (r = 0.47), Physical Engagement (r = 0.36), and Nearness to Injury/Death of Others (r = 0.33).

Alcohol use in the past year was not related to any of the CES subscales. Measures of depression, generalized anxiety, and PTSD were significantly related to all three CES subscales. Depression scores on the BDI-II correlated with Exposure to Combat Environment, Direct Engagement, and Nearness to Serious Injury/Death of Others at r's of 0.32, 0.30, and 0.32 ($p < 0.0001$), respectively. Similarly, correlations of scores on the BAI with Exposure to Combat Environment, Direct Engagement, and Nearness to Serious Injury/Death of Others were 0.37, 0.30, and 0.32, respectively ($p < 0.0001$). PTSD scores on the PCL-M were also significantly and positively related to these three subscales (Exposure to Combat Environment, r = 0.53; Direct Engagement, r = 0.40; and Nearness to Serious Injury/Death of Others, r = 0.41, $p < 0.0001$). Last, PAS (global psychopathology) scores significantly correlated ($p < 0.0001$) with Exposure to Combat Environment (r = 0.29), Direct Engagement (r = 0.19), and Nearness to Serious Injury/Death of Others (r = 0.15), suggesting greater psychopathology was associated with higher reporting of all three factors of combat experience.

Discriminant Validity

Age was significantly and negatively correlated with all three CES subscales (Exposure to Combat Environment, $r = -0.27$, $p < 0.0001$; Direct Engagement, $r = -0.15$, $p < 0.0001$; and Nearness to Serious Injury/Death of Others, $r = -0.12$, $p < 0.05$). High school grade point average correlated in a similar fashion to the three CES subscales (Exposure to Combat

TABLE V. Correlations between CES Subscales and Other Study Measures

	Factor 1	Factor 2	Factor 3	
	Combat Environment	Proximate Engagement	Nearness to Injury/Death	Total CES Score
Factor 1	1			
Factor 2	0.67**	1		
Factor 3	0.65**	0.61**	1	
Total CES Score	0.97**	0.78**	0.77**	1
Age	−0.27**	−0.15**	−0.12*	−0.25**
High School Grade Point Average	−0.18**	−0.16**	−0.13*	−0.18**
Highest Grade Completed	−0.23**	−0.13**	−0.09	−0.21**
No. of Deployments	0.01	0.02	0.07	0.02
No. of Times in Serious Danger	0.61**	0.35**	0.39**	0.58**
No. of Times Engaged in Firefight	0.76**	0.58**	0.52**	0.76**
No. of TBIs	0.47**	0.43**	0.39**	0.49**
Tampa Index of Blast Injury	0.18*	0.37**	0.22**	0.25**
NSI Total	0.47**	0.36**	0.33**	0.47**
AUDIT-C Total	0.01	0.03	0.02	0.02
Factor BDI-II	0.32**	0.21**	0.25**	0.32**
BAI	0.37**	0.30**	0.32**	0.38**
PCL-M	0.53**	0.40**	0.41**	0.54**
PAS	0.29**	0.19**	0.15**	0.28**

*$p < 0.05$; **$p < 0.01$.

Environment, $r = -0.18$, $p < 0.001$; Direct Engagement, $r = -0.16$, $p < 0.001$; and Nearness to Serious Injury/Death of Others, $r = -0.13$, $p < 0.04$). Educational attainment correlated negatively and significantly for the first two CES subscales (Exposure to Combat Environment, $r = -0.23$, $p < 0.0001$ and Direct Engagement, $r = -0.13$, $p < 0.0001$) but not on the Nearness to Serious Injury/Death of Others scale ($r = -0.09$).

Additional support for validity of the three factor model of the CES was sought using separate tests of analysis of variance. It was hypothesized that there may be gender differences on the CES subscales, but that differences on the three CES subscales based on study site would not be found. Significant gender differences were found on all three CES subscales (Exposure to Combat Environment, $F_{1,449} = 39.49$, $p < 0.0001$; Direct Engagement, $F_{1,449} = 11.24$, $p < 0.0001$; and Nearness to Serious Injury/Death of Others, $F_{1,449} = 8.02$, $p < 0.0001$; Table VI). On the first scale, Exposure to Combat Environment, males outscored females, whereas females outscored males on the other two scales. This suggests that males experienced more exposure to the general combat environment, while females reported higher degrees of direct combat involvement and experiences of being near those seriously injured or killed. The greatest gender difference was observed on the first CES subscale, Exposure to Combat Environment, where males outscored females by about 1 point, and the differences on the other two scales differed by less than one-half of a point, perhaps suggesting that the gender differences on the former two scales was of little practical meaningfulness. With regard to study site, the Direct Engagement Scale was not found to differ across sites ($F_{4,446} = 2.07$, p-value not significant). However, contrary to the expected outcome, study sites did differ significantly on the other CES subscales (Exposure to Combat Environment, $F_{4,446} = 6.77$, $p < 0.0001$ and Nearness to Serious Injury/Death of Others, $F_{4,446} = 2.84$, $p < 0.05$). The observed mean differences on these two CES subscales differ by less than 1 point on the Exposure to Combat Environment scale and by about half a point on the Nearness to Serious Injury/Death scale, making the practical significance of this difference small.

In summary, an exploratory factor analysis was conducted on the first 33 items of the CES using PAF to explore the latent factors among the items. Three factors representing 28 of the 33 items were yielded. On substantive review, the three factors were named "Exposure to Combat Environment," "Direct Engagement," and "Nearness to Death/Injury of Others." Evidence for convergent validity and discriminant validity was found, particularly in the relationship of CES scores to clinically important psychological outcomes including TBI status, affective symptoms, and psychopathology.

DISCUSSION

This study produced new information about the factor structure and psychometric properties of the CES[3]. Results from the exploratory factor analysis yielded three viable factors (Exposure to Combat Environment, Direct Engagement, and Nearness to Serious Injury/Death of Others). Although this study shows that the factors all have strong internal consistency, as well as internal and external validity, distinctions among the three factors were not as clear. The three CES subscales relate in similar pattern to other variables. However, most strikingly, being near to serious injury or witnessing death of others is approximately as significant a factor as the remaining two factors assessing more traditional measures of direct combat.

As one would suspect, the number of TBIs, severity of blast injuries, and postconcussive symptoms were all significantly related to higher scores on all three subscales. Moreover, probable PTSD is consistently found to be highly comorbid with other psychiatric conditions. It was not surprising to see significant correlations between probable PTSD, depression, and anxiety with all three CES subscales, with the PCL-M having the highest correlations among all affective measures and the CES subscales, given the prevalence of similar findings in the literature.

Gender, Age, and Education Differences

Gender differences were observed on all three CES subscales, consistent with prior findings. Both age and education were found to be negatively correlated with all three CES subscales to a relatively small degree, perhaps related to higher rank and associated distance from frontline combat

TABLE VI. Means, SDs, and Summary of the Analysis of Variance Tests of Mean Differences Across Gender and Study Site

Variable	Exposure to Combat Environment				Direct Physical Engagement				Nearness to Serious Injury or Death			
	M	SD	*df*	F	*M*	SD	*df*	F	*M*	SD	*df*	F
Gender			1,449	39.49**			1,449	11.24**			1,449	8.02**
Male ($n = 407$)	2.77	1.06			1.11	0.27			1.68	0.93		
Female ($n = 44$)	1.74	0.70			1.41	0.59			2.16	1.08		
Study Site			4,446	6.77**			4,446	2.07			4,446	2.844*
Albany ($n = 88$)	2.51	1.04			1.30	0.42			1.95	0.99		
Bath ($n = 22$)	2.00	0.89			1.16	0.30			1.95	0.90		
Buffalo ($n = 177$)	2.87	1.08			1.41	0.56			2.26	1.10		
Canandaigua/Rochester ($n = 95$)	2.84	0.95			1.48	0.72			2.20	1.06		
Syracuse ($n = 69$)	2.33	1.12			1.37	0.59			1.84	1.13		

*$p < 0.05$; **$p < 0.01$.

responsibilities. The negative correlation between combat stress exposure with age and education may, in part, explain the lower rates of psychiatric symptoms found among those older and more educated.

Limitations of the Study

Time since deployment was heterogeneous in this sample and may have influenced the report of combat stress as found in other studies.[2] As in many studies, predeployment data on participants are limited, and relationships among variables might be clearer had the study participants been assessed before deployment as well. The ultimate practical value of this scale in clinical settings may rest on the development of norms and cutoffs that signal clinically important differences in scores, but that goal is beyond the scope of this study.

Strengths of the Study and Future Directions

This study underscores the importance of casting a wide net with regard to the assessment of deployment-related experiences and provides evidence that probable PTSD, depression, and anxiety are highly correlated with all forms of deployment-related experiences. The results of this study support the use of the total score as well as subscales based on the three factors in future research. Clinically, the total score can be regarded as a reliable and valid global measure of combat exposure. In addition, the individual items may be useful in assessment of specific combat experiences and treatment of subsequent post-deployment distress. Future studies might examine the three CES factors in relation to long-term clinical outcomes, such as responsiveness to various PTSD treatments, or the persistence of symptoms, which may yield clearer distinctions among the three factors as well as evidence of clinical and research utility for this scale.

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