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Interactive Effects of Cumulative Lifetime Traumatic Brain Injuries and Combat Exposure on Posttraumatic Stress among Deployed Military Personnel

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Abstract

Growing research links Traumatic Brain Injury (TBI) with greater posttraumatic stress disorder (PTSD) symptoms. Much of this research has focused on the influence of the presence or severity of a single TBI while neglecting the potential cumulative effects of multiple TBIs incurred across an individual's lifetime on combat-related PTSD. The present study addressed this gap using a sample of 157 military service members and 4 civilian contractors who underwent structured TBI interviews at a military hospital in Iraq and completed the Combat Experiences Scale (CES) and Posttraumatic Checklist – Military (PCL-M). Results indicated that a greater number of lifetime TBIs were associated with greater PTSD symptoms when accounting for the presence and severity of a recent, deployment-related TBI. Additionally, a significant interaction of number of lifetime TBIs and combat exposure emerged, indicating that exposure to combat yielded greater PTSD symptoms among those with multiple lifetime TBIs compared to those with one or zero lifetime TBIs. These data suggest that incurring multiple TBIs may amplify the link between combat exposure and PTSD and underscore the need to screen for lifetime TBI history.

Keywords

Traumatic Brain Injury; Posttraumatic Stress Disorder; Combat Exposure; Military

Introduction

The high prevalence of Traumatic Brain Injury (TBI) in recent military conflicts has led some to label TBI as a “signature injury” of Operations Ending Freedom (OEF) and Iraqi Freedom (OIF; Hoge et al., 2008; Okie, 2005; Warden, 2006). Of pressing concern is the apparent link between TBI and increased risk for posttraumatic stress disorder (PTSD; Bryan and Clemans, 2013; Bryant et al., 2010; Hoge, et al., 2008; Ruff, Riechers, Wang,

Piero, & Ruff, 2012; Schneiderman, Braver, & Kang, 2008) which results in considerable burden to soldiers and their families (Hoge, Terhakopian, Castro, Messer, & Engel, 2007).

Much of the early research on TBI has focused on the association of a single, recent TBI (often experienced during a traumatic event) on ensuing PTSD symptom severity. For example, experiencing a TBI has been linked with increased risk for PTSD in large surveys of both military personnel (Hoge, et al., 2008; Schneiderman, et al., 2008; Stein et al., 2015) and civilians presenting at a trauma center (Bryant, et al., 2010), even when accounting for trauma intensity and other relevant covariates such as non-TBI related physical injuries, depression, and demographics. Further, the severity of the recent TBI appears to correlate with greater risk for PTSD; Hoge, et al. (2008) demonstrated that those who experienced TBIs with a loss of consciousness (LoC), a marker of TBI severity (Cantu, 1992; WHO, 1992), were more likely to meet criteria for PTSD relative to those who experienced a TBI with only an altered mental state (e.g., feeling dazed/confused). Taken together, these studies suggest that incurring a recent TBI (Schneiderman et al., 2008; Stein et al., 2015), and the severity of that TBI (Hoge, et al., 2008), is associated with greater PTSD severity beyond the effects of physical injuries or combat intensity on PTSD.

Further research has demonstrated that the cumulative effect of multiple TBIs incurred across an individual's lifetime (referred to here as *lifetime TBIs*; as opposed to a single, recent TBI) is also linked with elevated PTSD severity (Bryan and Clemans, 2013; Ruff, et al., 2012; Valera and Berenbaum, 2003). For example, Ruff, et al. (2012) found that a greater number of lifetime TBIs was associated with greater likelihood of a PTSD diagnosis among combat veterans. Bryan and Clemans (2013) extended these findings by showing that deployed military personnel with a greater number of lifetime TBIs exhibited greater PTSD symptom severity. Likewise, Valera and Berenbaum (2003) found that female victims of physical domestic abuse with more extensive TBI histories reported elevated PTSD symptoms compared to victims without any prior TBIs. Thus, it appears that the number of TBIs an individual experiences over the course of their lifetime, and not only the experience and severity of a recent TBI, is also linked with PTSD.

Despite the established relations between both lifetime TBI history and recent TBI severity with PTSD, little is known about the unique effects of each of these indices on PTSD when accounting for the other. To our knowledge, two studies have demonstrated that deployment-related TBI predicts greater PTSD symptoms when covarying for the presence of at least one lifetime TBI (Stein, et al., 2015; Yurgil et al., 2014). However, neither of these studies assessed the cumulative effects of the number of lifetime TBIs, and instead evaluated the presence/absence of any lifetime TBIs despite the literature suggesting that multiple TBIs more strongly predict PTSD severity than a single TBI (Bryan and Clemans, 2013; Ruff, et al., 2012; Valera and Berenbaum, 2003). Moreover, neither study reported on the association of lifetime TBI history on PTSD symptoms when accounting for a recent TBI, and instead only focused on the impact of a recent, deployment-related TBI on PTSD.

In spite of these recent advances, several questions remain unanswered. First, the association of multiple TBIs over an individual's lifetime, relative to the severity of a recent TBI, on PTSD symptoms is unknown. Further, it remains unknown if multiple lifetime TBIs

moderates the effects of combat exposure on PTSD. Explanatory models of the relationship between TBI and PTSD posit that incurring multiple TBIs will leave the individual vulnerable in the face of subsequent traumas on PTSD symptoms (Aupperle, Melrose, Stein, & Paulus, 2012; Bryant, et al., 2010). Evidence supporting this would significantly enhance our understanding of TBI history's theorized deleterious cumulative effect on responses to subsequent traumatic events (e.g., that increasing levels of trauma exposure have a significantly stronger influence on the development of PTSD among those with more TBIs).

The present study aims to address these gaps by evaluating the unique association of multiple lifetime TBIs with PTSD when accounting for recent TBI severity and combat exposure among deployed soldiers and civilian contractors presenting to a TBI clinic in Ballad, Iraq. We hypothesized that multiple lifetime TBIs and a recent TBI with increasing severity (i.e., duration of LoC) would uniquely predict greater PTSD severity, indicating that lifetime TBI is associated with PTSD beyond recent TBI severity. We also hypothesized a significant interaction between number of lifetime TBIs and combat exposure predicting PTSD symptoms independent of recent TBI severity, such that the extent of combat exposure would have a stronger relationship with PTSD symptoms among those with multiple lifetime TBIs relative to zero or one lifetime TBI.

Methods

Participants

Participants included 157 military service members and 4 civilian contractors ($N = 161$) consecutively referred for evaluation of a suspected TBI at a military hospital in Iraq during a 6-month span in 2009. Of these, 9 participants were removed for missing data, yielding a final sample of 148 personnel. The sample predominantly self-identified as male (94.1%) and the racial/ethnic makeup was primarily Caucasian (71.7%) followed by African-American (14.5%), Hispanic (9.2%), Asian/Pacific Islander (2.6%), and Other (0.7%). Participants ranged in age from 19 to 56 ($M = 27.84$, $SD = 7.23$), engaged in between 0 and 6 *prior* deployments (not including the current tour; $M = .82$, $SD = 1.08$), reported 0 to 22 combat experiences ($M = 8.43$, $SD = 6.81$). Further, soldiers reported being in Iraq for 0 (i.e., their first month of deployment) to 13 months ($M = 4.49$, $SD = 2.80$) of their current deployment, which was scheduled to last for between 4 and 18 months ($M = 10.81$, $SD = 2.60$). Additional descriptive information can be found in Table 1.

Procedure

Personnel were referred to the outpatient TBI clinic for evaluation and treatment of potential brain injuries either directly from the battlefield or via the recommendation of a treating medical provider. A majority of patients were assessed within 7 days (77.2%) or 14 days (84.1%) of the event in which the recent TBI was suspected (median = 2 days; range = 0–72¹). Upon arrival at the clinic, patients completed a battery of neurocognitive and self-report measures, followed by clinical interview conducted by a clinical psychologist and a

¹A subset of individuals ($n = 14$) represented extreme values (> 72 ; 90th percentile) in the number of days from the index event to presenting to the TBI clinic. Analyses were also conducted without this subset of individuals and the pattern of results remained consistent. Therefore, these subjects were retained for all analyses.

physical examination conducted by a physician. Approval for this study was obtained from [removed for blind review]. All participants consented to research participation prior to completing study materials.

Measures

Clinical interview for TBI diagnosis—The diagnosis of a TBI was made by a clinical psychologist and/or examining physician extensively trained in the assessment, diagnosis, and management of TBI. All TBI diagnoses were made in accordance with criteria set forth by the Clinical Practice Guidelines issued by the U.S. Department of Veterans Affairs and U.S. Department of Defense. Specifically, TBI was defined as a traumatically induced structural and/or physiological disruption of brain function caused by external force and indicated by the new onset or worsening of at least 1 of the following clinical signs immediately after the event meeting criteria for a mild TBI: (1) a period of loss of or decreased level of consciousness lasting fewer than 30 minutes, (2) a loss of memory for events immediately preceding or following the injury lasting fewer than 24 hours, (3) an alteration in mental state at the time of the injury lasting fewer than 24 hours, (4) neurological deficits, and (5) intracranial lesion (Anstey et al., 2004). Consistent with prior literature (Schwab et al., 2006) the duration of LoC for the recent TBI being evaluated were stratified into: 1) None, 2) 0 to 1 minutes, 3) 1 to 20 minutes, and 4) 20 to 30 minutes. All personnel determined to have an acute injury meeting criteria for a moderate or severe TBI (i.e., LoC > 30 minutes, alteration of mental state > 24 hours, pos-traumatic amnesia > 24 hours; Management of Concussion/mTBI Working Group, 2009) were immediately evacuated from Iraq. Hence, only individuals meeting criteria for a mild recent TBI or no recent TBI completed all assessments and were included in the current study.

For the purposes of the current study, *recent* TBI severity refers to the diagnosis and severity of a TBI for the presenting injury and *lifetime TBI history* refers to any TBIs that occurred prior to the presenting injury. A majority of individuals (n = 132; 86.8%) met diagnostic criteria for a recent mild TBI with varying degrees of severity (i.e., durations of LoC; Cantu, 1992; WHO, 1992). Recent TBI severity was categorized as follows: No recent TBI (n = 20; 13.5%; coded 0), recent TBI with no LoC (n = 72; 48.6%; coded 1), recent TBI with LoC lasting less than 1 minute (n = 32; 21.6%; coded 2), recent TBI with LoC lasting 1–20 minutes (n = 21; 14.2%; coded 3), and recent TBI with LoC lasting 20–30 minutes (n = 3; 2.0%; coded 4). Among individuals who met criteria for a recent TBI, 8 reported no prior TBIs (i.e., the TBI evaluated at the clinic was their first TBI), 46 reported one prior TBI, and 78 reported two or more prior TBIs. A majority of those who did not meet criteria for a recent TBI reported zero (n = 9) or one prior TBI (n = 9), and two individuals without a recent TBI endorsed multiple prior TBIs (n = 2).

Consistent with prior research (Bryan and Clemans, 2013), individuals were classified into three groups based on the total number of lifetime TBIs (not including the recent TBI): Zero past TBIs (n = 17; 11.2%), single past TBI (n = 55; 36.2%), and multiple (2 or more) past TBIs (n = 76; 51.4%).

Self-report measures.

Post-traumatic Checklist – Military (PCL-M): The PCL-M is a well-validated self-report inventory that assesses PTSD symptom severity (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Weathers, Litz, Herman, Huska, & Keane, 1994). Participants are asked to rate the severity of their experience of 17 symptoms using a scale from 1 (not at all) to 5 (extremely). Total scores can be obtained by summing each item, with higher scores on the PCL-M indicating greater symptom severity. To reduce the Type I error rate, the current study utilized only the PCL-M total score, which demonstrated excellent internal consistency ($\alpha = 0.95$).

Walter Reed Army Institute of Research Combat Experiences Scale (WRAIR-CES): Extent of combat exposure was evaluated using the WRAIR-CES (Hoge et al., 2004), a 23-item checklist of common events that occur during deployments (e.g., *being attacked or ambushed, shooting or directing fire at the enemy*). Respondents are asked to indicate each item that describes a combat experience they had on the current deployment. All responses are summed to index an individual's extent of combat exposure, with high scores representing a larger number of different combat experiences reported. Prior research has demonstrated the WRAIR-CES to have good psychometric properties (Hoge, et al., 2004).

Data Analysis

All analyses were conducted using the IBM SPSS Statistics software Version 22. Missing data were handled using casewise deletion, per recommendations when using the PROCESS macro for SPSS (Hayes, 2012). First, a linear multiple regression was used to test the unique associations of lifetime number of TBIs and recent TBI severity with PTSD symptoms. Extent of combat exposure and months in Iraq were included as covariates given prior research associating both of these with greater PTSD symptoms (Shen, Arkes, Kwan, & Tan, 2010).

Next, the moderating effects of lifetime TBIs on the relationship between the extent of combat exposure and PTSD symptoms were examined using the PROCESS Macro for SPSS with 1000 random bootstrap samples and 95% confidence intervals of the estimates based on the bootstrap distribution (Hayes, 2012).

Results

Preliminary analyses.

Descriptive statistics and correlations can be found in Table 2.

Multiple regression testing the effects of recent TBI/TBI history on PTSD symptoms.

The overall model including lifetime TBIs, recent TBI severity, combat exposure, and months in Iraq accounted for 28.1% of variance in PCL-M total score, $F(4, 147) = 13.99, p < .001$. As hypothesized, lifetime TBIs ($\beta = 0.28, t = 3.49, p = .001$) significantly predicted PCL-M total when accounting for recent TBI severity ($\beta = 0.17, t = 2.32, p = .021$), combat

exposure level ($\beta = 0.32$, $t = 4.41$, $p < .001$), and months in Iraq ($\beta = -0.04$, $t = -0.52$, $p = .605$).

Moderating effects of TBI history on the relationship between combat exposure on PTS.

Lifetime TBIs moderated the relationship between level of combat exposure on PCL-M total ($B = 0.55$, $SE = 0.24$, $t = 2.34$, $p = .021$, 95% CI [0.09, 1.02]) when accounting for months in Iraq ($B = -0.03$, $SE = 0.38$, $t = -0.07$, $p = .948$, 95% CI [-0.78, 0.73]) and the mean-centered, lower-order factors of lifetime TBIs ($B = 7.95$, $SE = 1.67$, $t = 4.76$, $p < .001$, 95% CI [4.65, 11.25]) and level of combat exposure ($B = 0.63$, $SE = 0.16$, $t = 3.95$, $p = .001$, 95% CI [0.31, 1.02]). In total, the interactive effect explained an additional 3% of variance in PCL-M total, $F(1, 143) = 5.47$, $r^2 = .03$, $p = .021$.

Probing the simple slopes of the interaction revealed that the level of combat exposure was most strongly linked with PCL-M total among individuals with multiple lifetime TBIs ($B = 0.96$, $SE = 0.20$, $t = 4.88$, $p < .001$, 95% CI [0.57, 1.35]) compared to those with a single lifetime TBI ($B = 0.41$, $SE = 0.20$, $t = 2.09$, $p = .039$, 95% CI [0.02, 0.80]) or zero lifetime TBIs ($B = -0.14$, $SE = 0.39$, $t = -0.36$, $p = .717$, 95% CI [-0.90, 0.62]) when accounting for variance associated with months in Iraq.

Moderating effects of TBI history on the relationship between combat exposure and PTSD symptoms accounting for a recent TBI diagnosis.

Next, a separate analysis was conducted to evaluate if the number of lifetime TBIs potentiated the relationship between combat exposure and PTSD symptoms independent of recent TBI severity. The interaction of lifetime TBIs and combat exposure level remained significant ($B = 0.47$, $SE = 0.24$, $t = 1.98$, $p = .049$, 95% CI [0.001, 0.94]), though weaker, when recent TBI severity ($B = 6.42$, $SE = 3.28$, $t = 1.96$, $p = .052$, 95% CI [-0.06, 12.90]) was added as a covariate to the existing model that included months in Iraq ($B = -0.08$, $SE = 0.38$, $t = -.21$, $p = .833$, 95% CI [-0.83, 0.61]) and the mean-centered, lower-order factors of lifetime TBIs ($B = 6.92$, $SE = 1.73$, $t = 3.99$, $p = .001$, 95% CI [3.49, 10.34]) and level of combat exposure ($B = 0.65$, $SE = 0.16$, $t = 4.09$, $p = .001$, 95% CI [0.33, 0.96]).

Probing the simple slopes of this interaction revealed that the level of combat exposure was most strongly linked with PCL-M total among individuals with multiple lifetime TBIs ($B = 0.93$, $SE = 0.20$, $t = 4.75$, $p < .001$, 95% CI [.54, 1.32]) relative to those with a single lifetime TBI ($B = 0.46$, $SE = 0.20$, $t = 2.34$, $p = .021$, 95% CI [0.07, 0.85]) or zero past TBIs ($B = -0.01$, $SE = 0.39$, $t = -0.02$, $p = .982$, 95% CI [-0.78, 0.76]) when accounting for variance associated with months in Iraq and recent TBI status (see Figure 1).

Discussion

The present study tested the direct and interactive effects of lifetime TBI history and combat exposure on PTSD symptom severity when accounting for recent TBI severity and months in Iraq. Results were consistent with prior literature indicating that both a greater number of lifetime TBIs and experiencing a recent, deployment-related TBI demonstrated significant associations with PTSD symptom severity (Bryant, et al., 2010; Hoge, et al., 2004; Hoge, et al., 2008; McDonald, Flashman, & Saykin, 2002; Ruff, et al., 2012; Schneiderman, et al.,

2008). These findings also extended this literature by demonstrating that the association between lifetime TBIs and PTSD was not explained by recent TBI severity, and that the total number of lifetime TBIs moderates the relationship between combat exposure and PTSD. Taken together, these data suggest that lifetime TBI history plays an important role in PTSD symptom severity beyond the severity of a recent TBI.

As hypothesized, a significant interaction emerged such that combat exposure had a stronger relationship with PTSD symptom severity among individuals with multiple lifetime TBIs even when accounting for the presence and severity of a recent TBI. While other research has shown that a greater number of lifetime TBIs are positively related to PTSD symptoms (Bryan and Clemans, 2013; Ruff, et al., 2012; Valera and Berenbaum, 2003; Wang and Gorenstein, 2013), this is the first study to demonstrate that lifetime TBI history may potentiate the effects of combat experiences on PTSD severity. These results are consistent with two prior studies demonstrating that TBI history exacerbates the effects of other risk factors on PTSD (Albanese, Macatee, Boffa, et al., 2018; Albanese et al., 2017), suggesting that the observed moderating effects of TBI on risk for PTSD extend beyond the extent of trauma exposure. These findings also support theoretical conceptualizations positing that multiple TBIs have a cumulative detrimental effect on executive functioning which, in turn, enhances vulnerability for PTSD (Aupperle, et al., 2012; Bryant, et al., 2010). This interpretation is supported by an abundance of literature showing that experiencing multiple TBIs across an individual's lifetime is linked with poor executive functioning (see Dockree and Robertson, 2011 for a review). Adjacent to this literature is theoretical (Aupperle, et al., 2012) and empirical (Albanese, Macatee, Allan, et al., 2018; Bardeen, Fergus, & Orcutt, 2015; Leskin and White, 2007) work demonstrating that individuals with deficient executive control experience greater PTSD symptom severity, purportedly via difficulty disengaging attention from trauma reminders towards goal-oriented behaviors, thereby exacerbating distress experienced when confronted with a trauma reminder. Moreover, partial support for this hypothesis is derived from other recent studies demonstrating that poor executive function (Albanese, Macatee, Allan, et al., 2018; Bardeen and Fergus, 2015) and TBI history (Albanese, Macatee, Boffa, et al., 2018; Albanese, et al., 2017) have similar moderating effects on risk factors for PTSD. However, neither the current study nor any prior study has directly tested executive functioning deficits as an explanatory mechanism for the exacerbating effect of TBI on risk factors for PTSD; therefore, future research specifically testing this hypothesis is needed.

An alternative explanation for the significant interaction of lifetime TBIs and combat exposure could be that TBIs represent an intense form of trauma, which might then strengthen the association of cumulative traumas with PTSD. However, this interpretation has not received empirical support; in fact, the preponderance of evidence points toward a significant association of TBI with PTSD even when accounting for trauma intensity (Bryant, et al., 2010; Hoge, et al., 2008; Stein, et al., 2015; Valera and Berenbaum, 2003). To further clarify the role of TBI in PTSD, future research should investigate whether TBIs experienced in a non-traumatic context (e.g., falls, sport-related TBI) or other non-deployment TBIs are associated with PTSD.

There are several limitations to the current study. First, these data are cross-sectional therefore precluding causal inferences. Second, the measure of lifetime TBIs did not differentiate between deployment-related TBI and non-deployment-related TBI, leaving open the possibility that the setting in which a TBI occurred influenced the observed effects. With regard to the sample, only individuals presenting at a TBI clinic for a potential injury were included, which could have affected the results in several ways. For instance, it's plausible that individuals presenting to a TBI clinic for a potential injury may differ from those who do not seek a TBI assessment or that the experience of a recent injury could alter responding on self-report measures. Relatedly, only individuals with a mild TBI were included in the present analyses; future research is needed to examine if these effects generalize to individuals with moderate and/or severe TBIs. Moreover, the clinical interview to obtain information regarding recent and lifetime TBIs was unstructured. Although this interview conformed with guidelines set forth by the U.S. Department of Veterans Affairs and U.S. Department of Defense (Management of Concussion/mTBI Working Group, 2009), future research would benefit from the use of structured or semi-structured clinical interviews for the diagnosis of TBI. Perhaps the gold-standard TBI interview is the Ohio State University TBI Identification Method (Corrigan and Bogner, 2007), which has demonstrated excellent inter-rater reliability and predictive validity (Bogner and Corrigan, 2009; Corrigan and Bogner, 2007). Lastly, the present study included a moderate sample size ($n = 149$). Larger samples that may enhance generalizability, provide greater statistical power, and allow for the use of more sophisticated analytic tools (e.g., structural equation modeling) should be sought.

Despite these limitations, the present study contributes to the growing literature by demonstrating that multiple lifetime TBIs and the severity of a recent, deployment-related TBI are associated with greater PTSD severity. Moreover, the present study is the first, to our knowledge, to show that individuals with a history of multiple TBIs incurred across their lifetime may be more vulnerable to PTSD in the face of increasing levels of combat exposure. There are several possible interpretations for this, including that multiple TBIs reduce executive functioning thereby enhancing vulnerability to PTSD; however, the current study was unable to directly test this interpretation, thus warranting further research. Given the high prevalence of TBIs in the military (Hoge, et al., 2008), it is critical that future research further distangle the associations between TBI, combat exposure, and PTSD.

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Figure 1.

PCL-M = Posttraumatic Checklist – Military Version. TBI = Traumatic Brain Injury. The moderating effects of lifetime number of TBIs on the relationship between level of combat exposure and posttraumatic stress when accounting for number of deployments the experience/severity of a recent, deployment-related TBI warranting professional evaluation.

Table 1.

Participant characteristics

Characteristic	n (Valid %) or Mean (SD)
<u>Sex, n (Valid %)</u>	
Male	143 (94.1)
Female	9 (5.9)
<u>Race/Ethnicity, No. (Valid %)</u>	
Caucasian	109 (72.7)
African-American	22 (14.7)
Hispanic/Latino	14 (9.3)
Asian/Pacific Islander	4 (2.7)
Other	1 (.7)
Missing	2 (-)
<u>Branch, No. (Valid %)</u>	
Army	120 (78.9)
Air Force	21 (13.8)
Marines	8 (5.3)
Civilian	3 (2)
<u>Status, No. (Valid %)</u>	
Active Duty	75 (56)
National Guard	50 (37.3)
Reserves	6 (4.5)
Civilian	3 (2.2)
Missing	18 (-)
<u>Rank, No. (Valid %)</u>	
E1-E4	83 (55.7)
E5-E6	48 (32.2)
E7-E9	9 (6)
Warrant Officer	1 (.7)
Officer	8 (5.4)
Missing	3 (-)
<u>Other</u>	
Age (years), mean (SD), range	27.84 (7.23), [19–56]
Years of military service, mean (SD), [range]	6.74 (5.50), [0.75–29]
No. prior deployments, mean (SD), [range]	0.82 (1.08), [0–4]

Table 2.

Descriptive statistics and correlations

Measure	Mean (SD)	1	2	3	4	5	6	7	8	9
1. Lifetime TBIs	1.41 (0.69)	--	.29***	.40***	.34***	.30***	.36***	.43***	.26**	.29***
2. Recent TBI	1.43 (0.96)		--	.26**	.23**	.26**	.20*	.27***	.05	.13
3. PCL-M Total	31.49 (14.30)			--	.92***	.83***	.85***	.94***	.40***	.10
4. PCL-M Re-exp.	9.12 (4.65)				--	.76***	.66***	.83***	.40***	.07
5. PCL-M Avoid.	4.59 (2.38)					--	.66***	.67***	.30***	.05
6. PCL-M Neg.	6.42 (3.50)						--	.76***	.29***	.08
7. PCL-M Hyper.	11.21 (5.56)							--	.39***	.16*
8. Combat Exposure	8.43 (6.81)								--	.12
9. Months in Iraq	4.49 (2.80)									--

Note: SD = Standard Deviation. TBI = Traumatic Brain Injury. Lifetime TBIs = Number of lifetime TBIs incurred prior to most recent TBI but not including the most recent TBI (if applicable) and classified as zero, single, or multiple (i.e., 2) TBIs. PCL-M = Post-traumatic Checklist – Military Version. PCL-M Reexp. = PCL-M Re-experiencing subscale. PCL-M Avoid. = PCL-M Avoidance subscale. PCL-M Neg. = PCL-M Negative cognitions/mood subscale. PCL-M Hyper. = PCL-M Hyperarousal subscale. TBI Group (lifetime) = Zero TBIs, Single TBI, Multiple TBIs. Recent TBI = The severity of the most recent TBI that prompted evaluation (coded: 0 = No TBI, 1 = TBI with no loss of consciousness, 2 = TBI with loss of consciousness lasting less than 1 minute, 3 = TBI with loss of consciousness lasting 1 to 20 minutes, 4 = TBI with loss of consciousness lasting 20 to 30 minutes). Combat Exposure = Number of types of combat experiences reported as indexed by the Walter Reed Army Institute of Research Combat Experiences Scale (WRAIR-CES).

*
p < .01

**
p < .001