



## Research paper

## Examination of the indirect effects of combat exposure on suicidal behavior in veterans



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## ABSTRACT

**Background:** Researchers have theorized that increased rates of suicide in the military are associated with combat exposure; however, this hypothesis has received inconsistent support in the literature, potentially because combat exposure may be indirectly related to suicide risk through its influence on posttraumatic stress disorder (PTSD) and depressive symptoms. The current study tested the hypothesis that combat exposure has a significant indirect effect on suicidal behavior among Iraq/Afghanistan-era veterans through its effects on PTSD-depressive symptomatology.

**Methods:** Iraq/Afghanistan-era veterans ( $N = 3,238$ ) participated in a cross-sectional, multi-site study of post-deployment mental health consisting of clinical interviews and self-report questionnaires. Structural equation modeling (SEM) was used to examine direct and indirect relationships between three latent variables: combat exposure, PTSD-depression, and suicidal behavior (past attempts and current ideation, intent, and preparation). **Results:** A partial mediation model was the best-fitting model for the data. Combat exposure was significantly associated with PTSD-depression ( $\beta = 0.50, p < .001$ ), which was in turn associated with suicidal behavior ( $\beta = 0.62, p < .001$ ). As expected, the indirect effect between combat exposure and suicidal behavior was statistically significant,  $\beta = 0.31, p < .001$ .

**Limitations:** Data were cross-sectional, and suicidal behavior was measured via self-report.

**Conclusions:** Results indicated that combat exposure was indirectly related to suicidal behavior via PTSD-depressive symptomatology. Findings lend support for a higher-order combined PTSD-depression latent factor and suggest that Iraq/Afghanistan-era veterans with high levels of PTSD-depressive symptoms are at increased risk for suicidal behavior.

## 1. Introduction

Since the onset of the conflicts in Iraq and Afghanistan, rates of suicide in the military have increased significantly (Ramchand et al., 2011). Researchers have hypothesized that this increase in suicide risk is associated with exposure to combat (Hoge and Castro, 2012; Ramchand et al., 2011). According to the interpersonal-psychological theory of suicide (IPTs), in order for an individual to engage in suicidal

behavior they must have the acquired capability to inflict lethal harm upon themselves (Joiner, 2005). This acquired capability develops through repeated exposure to painful and provocative events such as violence, abuse, and death (Joiner, 2005). As a result, IPTs posits that combat exposure should increase one's acquired capability for suicide (Selby et al., 2010); however, prior research has not reported consistent relationships between combat exposure and suicidal behavior (Bryan et al., 2016, 2013). For example, a large longitudinal study of current

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and former military personnel suicides found that combat experience was not associated with heightened risk of suicide (LeardMann et al., 2013)

A recent meta-analysis of 22 published studies among service members and veterans found that combat exposure was associated with suicidal thoughts and behaviors, but that the effect size was very small, suggesting that there are other factors that contribute to suicide risk (Bryan et al., 2016). The authors of this meta-analysis hypothesized that combat exposure operates as a long-term risk factor for suicide over time but that other acute stressors are more proximally related to suicide-related outcomes. This conceptualization of the relationship between combat exposure and suicide is consistent with the fluid vulnerability theory of suicide (Rudd, 2006), which proposes that suicide risk fluctuates over time as a function of both chronic and acute risk factors. According to this theory, individuals each have a baseline level of suicide risk that is relatively stable over time; however, suicide risk can acutely increase in response to situational triggers.

It is also possible that combat exposure may indirectly influence suicidal behavior by increasing risk for posttraumatic stress disorder (PTSD) and depressive symptomatology. Prior research has indicated that military service members and veterans with symptoms of PTSD and depression are at heightened risk for suicidal behavior (e.g., Jakupcak et al., 2009; Kimbrel et al., 2014a, 2016b; Ramsawh et al., 2014). For example, Kimbrel et al. (2016b) found that comorbid PTSD and depression were a significant prospective predictor of suicidal behavior at 12-month follow-up. Furthermore, research with civilian samples has also found that comorbid PTSD and depression are more predictive of suicidal behavior than depression alone (e.g., Cougle et al., 2009; Oquendo et al., 2005, 2003). Thus, combat exposure may have indirect effects on suicidal thoughts and behaviors via PTSD and depressive symptomatology.

In contrast with this theorized indirect effect, Bryan et al. (2013) found no evidence for an indirect effect of combat exposure on suicide risk via symptoms of PTSD, depression, and additional variables associated with suicide risk; however, it is quite possible that this was due to the analytical approach employed. For example, this study also included several other variables that were hypothesized to further intervene in between PTSD and depression and suicidality, including thwarted belongingness and perceived burdensomeness. Thus, the specific indirect effects between combat, PTSD, depression, and suicidality were not examined separately. In addition, PTSD and depression were examined separately and a formal path was not specified between these variables. Instead, the observed variables for PTSD and depression symptoms were co-varied. Notably, in both of the samples that Bryan et al. (2013) examined, significant paths were observed between combat and PTSD. Moreover, a significant covariance was also modeled between PTSD and depression in both samples, and depression was either directly or indirectly related to suicidality in both models. Thus, while combat was not directly related to depression in these models, it was associated with PTSD, which was associated with depression, which was associated with suicidality (either directly or indirectly).

We suspect that if PTSD and depression had been modeled as indicators on a higher-order latent factor that an indirect association between combat and suicidality would have been observed, as there is ample evidence for just such a higher order latent factor (Cox et al., 2002; Kimbrel et al., 2014a; Miller et al., 2008). For example, Miller et al. (2008) found that PTSD and depression loaded onto a higher-order “distress” factor among 1,325 Vietnam veterans. Similarly, Kimbrel et al. (2014) found that symptoms of PTSD and depression also loaded onto a higher-order latent “distress” factor among 1,897 Iraq/Afghanistan-era veterans, and that a combined PTSD-depression “distress” factor was strongly associated with both current suicidality and history of suicide attempt. Accordingly, the objective of the present study was to use structural equation modeling (SEM) to test the hypothesis that a combined PTSD-depression latent factor mediates the

association between combat exposure and suicidal behavior among a large and diverse sample of Iraq/Afghanistan-era veterans.

## 2. Methods

### 2.1. Participants and procedures

A total of 3,238 Iraq/Afghanistan-era veterans participated in a cross-sectional, multi-site study of Post-Deployment Mental Health led by the Department of Veterans Affairs’ (VA) VISN 6 Mid-Atlantic Mental Illness, Research, Education, and Clinical Center (MIRECC). Study procedures have been described in detail elsewhere (Brancu et al., 2017; Kimbrel et al., 2014a). Recruitment began in 2005 and is ongoing. To be eligible for inclusion, participants must have served in the U.S. military after September 11, 2001. Participants were recruited via mailings, advertisements, and referrals. The local institutional review boards at each participating VA site approved the study protocol. Written informed consent was obtained from all participants prior to enrollment. Study procedures consisted of a diagnostic clinical interview and completion of a battery of self-report questionnaires.

### 2.2. Measures

The *Structured Clinical Interview for DSM-IV-TR* (SCID; First and Pincus, 2002) was used to diagnose current and lifetime PTSD and depression according to *DSM-IV-TR* criteria. Clinical interviewers received extensive training in SCID administration as well as ongoing supervision from experienced clinicians. Clinical interviewers demonstrated excellent reliability (Fleiss’ kappa = 0.95) when scoring a series of seven training videos.

The *Beck Scale for Suicide Ideation* (BSS; Beck and Steer, 1991) was used to assess current suicidal behavior and history of suicide attempts. The BSS is a self-report questionnaire designed to assess severity of suicidal ideation, plans, and preparations during the past week. Respondents are asked to rate items on a Likert scale that ranges from 0 to 2, with higher values indicating greater severity. Internal consistency reliability for the BSS was good ( $\alpha = 0.83$ ). Item 20 from the BSS was used to identify participants with a lifetime history of suicide attempts. The mean BSS score was 0.98 ( $SD = 3.20$ ; range = 0–32).

The *Beck Depression Inventory-II* (BDI-II; Beck et al., 1996) was used to assess the severity of participants’ depressive symptoms during the past two weeks. The scale consists of 21 self-report items that are rated from 0 to 3, with higher scores indicating greater severity. In the current study, the item assessing suicidal ideation (i.e., item 9) was not included in the total score calculations since the primary outcome variable was suicidal behavior. Instead, this item was used as an additional indicator of suicidal ideation in the suicidal behavior latent variable. Internal consistency for the 20-item version of the BDI-II used in the present study was excellent ( $\alpha = 0.94$ ). The mean BDI-II score (not including item 9) was 14.30 ( $SD = 12.57$ ; range = 0–59).

The *Combat Exposure Scale* (CES; Keane et al., 1989) was used to assess combat exposure. The CES consists of 7-item self-report items that are each rated on a 5-point scale reflecting frequency, duration, or percentage of combat exposure. Internal consistency for the CES was 0.88. The mean CES score was 11.32 ( $SD = 10.64$ ; range = 0–40).

The *Davidson Trauma Scale* (DTS; Davidson et al., 1997) was used to assess severity of PTSD symptoms. This is a self-report measure that assesses the 17 symptoms of PTSD, based on the DSM-IV criteria. Participants rate the frequency and severity of each item on a 0 to 4 scale based on how they felt during the past week regarding their most bothersome traumatic event. Internal consistency for the DTS in the present study was excellent ( $\alpha = 0.98$ ). The mean DTS score was 40.76 ( $SD = 39.96$ ; range = 0–136).

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