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PTSD and Death from Suicide: An Update from 2017

Introduction

Concern about increasing suicide rates among U.S. military personnel and Veterans has led to a proliferation of research on potential risk factors for suicide (Power & McKeon, 2012). Military personnel and Veterans experience an increased risk of a wide array of trauma, including combat-related experiences, military sexual assault, childhood abuse, and intimate partner violence (Lehavot et al., 2018). As such, researchers have posited the higher prevalence of PTSD among Veterans as a potential explanation for suicidal behavior (e.g., suicidal ideation, suicide plan, suicide gesture, and suicide attempts) and death from suicide (Pompili et al., 2013). While there is long-standing literature on the connection between PTSD and suicidal behavior, only about 15% of people who survive a suicide attempt eventually die by suicide (Gradus, 2017). Given the rarity of death from suicide on a population level, studying the relationship between PTSD and suicide mortality presents an important challenge.

While systematic reviews have demonstrated an association between PTSD and suicide (Holliday et al., 2020; Pompili et al., 2013), there is conflicting evidence regarding the direction and magnitude of the association. While the majority of studies have reported an increased risk of suicide among persons with PTSD, a select few studies have reported a decreased risk of suicide among persons with PTSD. Methodological issues

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pertaining to population, sample size, and covariates may explain the conflicting evidence. Importantly, studies have inconsistently examined the effect of psychiatric comorbidity (e.g., depression or substance use) on the association between PTSD and suicide mortality. Finally, while many studies have focused on PTSD symptoms, not all have required a formal PTSD diagnosis. The inclusion of persons without a PTSD diagnosis may limit our ability to draw precise inferences about the association between PTSD and suicide mortality.

In this guide, we will provide an enhanced review of research examining the association between PTSD diagnosis and suicide mortality across civilian, U.S. military personnel, and Veteran populations. To update prior work (c.f. Gradus, 2017), this guide focuses on literature published between 2013 and 2023 and exclusively on risk factors for suicide mortality (not suicidal behavior). Further, we focus only on studies that specifically examined the association between PTSD and suicide, and we exclude studies that examine prediction of suicide from many variables as the interpretation of results for any one predictor in these models can be complex (e.g., machine learning methods). To reduce complexity, this guide also excludes studies that examine traumatic brain injury as a source of PTSD. In the terminal section of this guide, we will discuss contrasting findings, address methodologic variation, and present directions for future research.

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Point: PTSD Increases Risk for Death from Suicide

In studies of civilian samples, analyses with adjustment for pre-PTSD psychiatric comorbidity have reported a strong association between PTSD and increases in suicide mortality. [Gradus et al. \(2015\)](#) examined death by suicide among all persons diagnosed with stress disorders in Denmark from 1995–2011 ($n = 101,663$). After adjustment for demographics and pre-existing comorbid psychiatric diagnoses, persons diagnosed with PTSD had 13 (95% confidence interval [CI] = 4.3, 42) times the rate of suicide than persons without PTSD. Similarly, [Fox et al. \(2021\)](#) conducted a nationwide cohort study of all people living in Sweden, born 1973-1997, followed from their 14th birthday until suicide or 31 December 2016 ($n = 3,177,706$). Compared with women and men without PTSD, suicide rates were 6.7 (95% CI = 5.6, 8.1) and 3.9 (95% CI = 3.1, 5.0) times higher in those with PTSD, respectively, after sociodemographic adjustment. Estimates remained elevated in women (Hazard Ratio (HR), 2.6; 95% CI = 2.2, 3.1) and men (HR, 1.7; 95% CI = 1.3, 2.1) after adjustment for previous psychiatric conditions.

In studies of U.S. military personnel, analyses without adjustment for psychiatric comorbidity have reported similar associations between PTSD and increases in suicide mortality. [LeardMann et al. \(2013\)](#) used data from the Millennium Cohort Study ($n = 151,560$) that included current and former military personnel and found an 80% increase (HR, 1.8; 95% CI = 0.90, 3.6) in suicide mortality among people with PTSD after adjusting for age and sex. However, this association was not statistically significant likely due to the small sample size, and thus PTSD was not further examined in multivariate models.

In U.S. Veteran studies, analyses *without* adjustment for psychiatric comorbidity have reported strong associations between PTSD and increases in suicide mortality. [Forehand et al. \(2019\)](#) compared mortality rates among a national sample of Veterans with PTSD ($n = 491,040$) with the US general population using age- and sex-matched mortality tables. Compared with the U.S. population, Veterans with PTSD had a significant increase in suicide mortality (Standardized Mortality Ratio (SMR), 2.5; 95% CI = 2.2, 2.8). This study also stratified specific causes of excess mortality among Veterans with PTSD by age and found that younger Veterans (18-34 years) were more likely to die by suicide. This study did not assess depression or other psychiatric comorbidities.

Similarly, several U.S. Veteran studies *with* adjustment for psychiatric comorbidity have also reported associations between PTSD and increases in suicide mortality. [Conner et al. \(2013\)](#) examined psychiatric comorbidity and suicide in all male patients who used Department of Veterans Affairs (VA) services in FY 1999 ($n = 2,962,810$). Veterans with PTSD and any psychiatric comorbidity had 2.6 (95% CI = 2.4, 2.8) times the rate of suicide than those without psychiatric diagnoses. Veterans with PTSD and no psychiatric comorbidity had 1.6 (95% CI = 1.3, 1.9) times the rate of suicide than those without psychiatric diagnoses. By conducting analyses on Veterans with PTSD and no psychiatric comorbidity, the authors controlled for confounding by comorbidity through restriction. [Bullman et al. \(2019\)](#) examined the association between PTSD, depression and suicide mortality among Vietnam Veterans who received a (VA Agent Orange Registry (AOR) examination from 1982-1989 ($n = 117,958$). After adjustment for

depression, the suicide rate among Veterans with PTSD was 7.1 times that for Veterans without PTSD (95% CI = 4.9, 10).

[Cooper et al. \(2020\)](#) examined the association between patient-reported PTSD symptoms using the Primary Care-PTSD Screen (PC-PTSD) and suicide mortality among a national sample of Veterans from 2014-2016 ($n = 1,552,581$). After adjusting for psychiatric comorbidity, positive PC-PTSD screens were associated with a 58% increase in suicide mortality at 1 day after screening (HR, 1.6; 95% CI = 1.2, 2.1), but the risk decreased over time (365 days after screening; HR, 1.3; 95% CI = 1.1, 1.5). The authors found that a positive response on item 4 of the PC-PTSD (“felt numb or detached from others, activities, or surroundings”) was associated with a 70% increase in suicide mortality at 1 day after screening (HR, 1.7; 95% CI = 1.3, 2.3).

Building on this work, [Forehand et al. \(2022\)](#) examined suicide mortality rates among a national sample of Veterans with PTSD ($n = 754,197$) using both diagnostic codes and symptom severity documented in the PTSD Checklist (PCL). Compared to negligible PTSD symptoms, having low (HR, 2.1; 95% CI = 0.77, 5.9), moderate (HR, 2.5; 95% CI = 1.0, 6.4), or high PTSD symptoms (HR, 2.6; 95% CI = 1.0, 6.4) increased the rate of suicide mortality at 1 month after assessment even after adjusting for psychiatric comorbidity. The authors observed a modest gradient effect whereby higher levels of PTSD symptoms increased the long-term rate of suicide. Although comorbid depression or substance abuse increased the suicide mortality rate in Veterans with PTSD, Veterans without comorbidities and moderate (HR, 1.7; 95% CI = 1.2, 2.5) to high PTSD symptoms (HR, 2.0; 95% CI = 1.4, 2.9) continued to have increased long-term suicide rates. Therefore, PTSD symptom severity alone may be an independent risk factor for suicide mortality. Compared to not having a clinically meaningful change in PTSD symptoms, worsening PTSD symptoms increased the suicide rate (HR, 1.3; 95% CI = 0.98, 1.6). Although improved PTSD symptoms alone did not predict suicide, improving to the point of symptomatic remission lowered the suicide rate (HR, 0.56; 95% CI = 0.37, 0.88).

Counterpoint: PTSD Lowers Risk for Death from Suicide

Contrary to expectation, some studies have reported that PTSD somehow protects against suicide mortality. However, the validity of this finding is questionable given the methodological and etiological issues shared by these studies.

U.S. military studies have reported an association between PTSD and decreases in suicide mortality. [Shen et al. \(2016\)](#) studied all U.S. military personnel from 2001–2011 ($n = 3,795,823$) and examined suicide during military service or post-separation. The authors found a protective effect of PTSD on suicide across a range of time periods between diagnosis and death. Persons with PTSD in the earliest time period had 0.63 (95% CI = 0.51, 0.78) times the rate of suicide than persons without PTSD, and persons with PTSD in the most recent time period had 0.82 (95% CI = 0.53, 1.3) times the rate of suicide than persons without PTSD. However, adjustment for psychiatric comorbidity likely occurred without consideration for the timing of psychiatric comorbid diagnoses relative to PTSD diagnoses.

U.S. Veteran studies have also reported an association between PTSD and decreases in suicide mortality. [Conner et al. \(2014\)](#) surveyed diagnostic codes among VA users from FY 2007–2008

($n = 5,913,648$). In unadjusted analyses, PTSD was associated with an increased risk of suicide (Odds Ratio (OR), 1.3; 95% CI = 1.2, 1.5). In adjusted analyses, this association was reduced to 0.77 (95% CI = 0.69, 0.86), indicating a protective effect of PTSD on suicide. [Britton et al. \(2017\)](#) studied all male Veterans discharged from VA inpatient units from FY 2005-2010 ($n = 346,662$). After adjustment for psychiatric comorbidity, the authors found an association between PTSD and decreased suicide mortality (HR, 0.66; 95% CI = 0.56, 0.78) for the year following discharge. However, similar to military studies, adjustment for psychiatric comorbidity in these studies likely occurred without regard for timing relative to PTSD.

Understanding Disparate Findings

This review found an association between PTSD and increased risk of suicide mortality across civilian, U.S. military personnel, and U.S. Veteran populations. Of the eleven featured studies, eight studies reported that PTSD increased suicide mortality, and three studies reported that PTSD decreased suicide mortality. There is compelling evidence for an association between PTSD and increased risk of suicide, because studies ([Gradus et al., 2015](#); [Fox et al., 2021](#); [Conner et al., 2013](#); [Bullman et al., 2018](#); [Cooper et al., 2020](#); [Forehand et al., 2022](#)) that provide large magnitude estimates also include an appropriate adjustment for pre-PTSD psychiatric comorbidity. Conversely, the protective effect of PTSD on suicide observed among the minority studies may be spurious and the result of methodological artifact. Specifically, studies that found a protective effect may have induced collider bias through improper statistical adjustment for psychiatric comorbidity that does not account for the timing of psychiatric comorbid diagnoses relative to PTSD diagnoses.

Unlike confounding which occurs when an exposure and outcome share a common cause (e.g., a confounder) that is uncontrolled, collider bias occurs when an exposure and outcome influence a common variable (e.g., a collider) that is most often controlled for *after* the exposure ([Holmberg & Andersen, 2022](#)). Depression may act as a collider in the association between PTSD and suicide because it is affected by PTSD and shares a common cause with suicide. Any adjustment for depression that occurs after the onset of PTSD can introduce collider bias in the association between PTSD and suicide. Collider can create confounding that makes the effect of PTSD on suicide appear null or protective ([Gradus, 2018](#)). Studies that adjust for depression after PTSD likely obscure the effect of PTSD on suicide that is due to comorbid depression and result in the observation of a protective effect ([Shen et al., 2016](#); [Conner et al., 2014](#); [Britton et al., 2017](#)). However, without longitudinal measurements of depression, it is difficult to establish the temporal ordering of variables and avoid collider bias ([Jiang et al., 2021](#)).

A second way in which bias may occur when examining the association between PTSD and suicide is restriction to samples that are at high risk for suicide, such as persons with depression. Compared to a high-risk reference group, the effect size of PTSD may appear numerically smaller than it would in comparison to a lower-risk reference group (since relative effects are dependent on the risk or rate of the outcome in the comparison group). [Zivan et al. \(2007\)](#) restricted their entire study sample to Veterans with depression and found that Veterans with comorbid PTSD and depression had lower suicide rates than Veterans with depression alone. This does not necessarily indicate that PTSD is generally

protective against suicide. It indicates that when compared with a group that is at very high risk for suicide, PTSD may not confer substantial additional suicide risk beyond the high risk inherent in the reference group definition. Importantly, restriction without regard to timing of depression diagnoses relative to PTSD may also induce collider bias in the same way as statistical adjustment. In contrast, [Bullman et al. \(2019\)](#) found a large magnitude increase in the rate of suicide among Veterans with PTSD, and also provided empirical evidence that these methodological choices can produce an artificial protective result. When the authors properly adjusted for depression, PTSD increased the rate of suicide (HR 7.1; 95% CI = 4.9, 10). However, when the authors restricted to Veterans with depression as a reference group, PTSD decreased the rate of suicide (HR 0.85; 95% CI = 0.44, 1.6). The high-risk reference group likely made the observed association between PTSD and suicide appear protective, because the effect of depression on suicide is stronger relative to the effect of PTSD on suicide.

While appropriate adjustment for psychiatric comorbidity (e.g., depression) is crucial for internal validity, two studies that found an association between PTSD and increased risk of suicide mortality did not adjust for depression. Unadjusted depression in [LeardMann et al. \(2013\)](#) may have accounted for part of the weak to moderate magnitude effect observed in the association between PTSD and suicide. Similarly, [Forehand et al. \(2019\)](#) did not adjust for depression, however, it is unlikely that depression alone could fully account for the large magnitude effect reported in the association between PTSD and suicide.

Beyond methodological choices and bias, there are likely cross-population differences between studies that found a protective effect and studies that did not. One explanation for the difference in adjusted findings between civilian and military studies may be that drivers of suicide risk, including combat-related trauma, are unique among military populations. However, few studies report on trauma type making it difficult to differentiate associations based on trauma. Further, Veteran studies include predominantly older white male cohorts, whereas civilian studies include more women as well as increased racial and ethnic diversity. Similarly, disparate findings between Veteran studies may be attributed to within-population differences. A recent study examining gender in suicide mortality among post-9/11 Veterans with PTSD ($n = 352,476$) found that female Veterans had a decreased rate of suicide mortality compared with male Veterans (HR, 0.43; 95% CI = 0.29, 0.62) ([Ronzi et al., 2019](#)). Further, as not all Veterans with PTSD use VA services, VA users may have unique sociodemographic or clinical characteristics that play a role in suicide risk. Therefore, population differences across studies and within studies may influence the direction and magnitude of the observed effect.

Future research will need to examine patient-level and contextual risk factors for both PTSD and suicide. Given that suicide risk may differ based on trauma type, researchers should assess and report type of index trauma among their samples. Future work will need to include careful consideration of the study design (e.g., choice of referent group) and analysis (e.g., appropriate adjustment for psychiatric comorbidity to avoid collider bias) and incorporate rigorous methods like marginal structural modeling (e.g., to examine variables as both confounders and modifiers) ([Gradus, 2017](#)). Given the rarity of suicide deaths, methodological approaches will also need to account for small sample sizes

and misclassification of suicides. Finally, patient-level treatment characteristics may also be an important consideration in risk. Additional multiyear longitudinal cohorts are warranted to assess whether implementation of evidence-based treatment for PTSD or psychiatric comorbidity influences suicide mortality outcomes.

Consistent with the 2017 review, the current review found evidence of an association between PTSD and increased risk of suicide mortality. However, methodological issues related to improper adjustment for depression may have induced an artificially protective effect in several studies. In addition, cross- and within-population differences likely contributed to study incongruencies. What is new in this review, however, is the potential finding that specific PTSD symptoms or symptom severity may be independent risk factors for suicide mortality among Veterans with PTSD. Cooper et al. (2020) reported that specific symptoms of PTSD (e.g., feeling numb or detached) are associated with increases in suicide mortality. Forehand et al. (2022) reported that worsening PTSD symptoms increased the rate of suicide, while lowering PTSD symptoms to the point of symptomatic remission lowered the suicide rate. Therefore, symptomatic remission from PTSD may be an important treatment target for clinicians and patients. Given the importance of this finding, more longitudinal research with methodological consistency is warranted to better understand the drivers of suicide risk.

FEATURED ARTICLES

Britton, P. C., Bohnert, K. M., Ilgen, M. A., Kane, C., Stephens, B., & Pigeon, W. R. (2017). **Suicide mortality among male veterans discharged from Veterans Health Administration acute psychiatric units from 2005 to 2010.** *Social Psychiatry and Psychiatric Epidemiology*, 52, 1081–1087. doi.org/10.1007/s00127-017-1377-x *Purpose:* The purpose of this study was to calculate suicide rates and identify correlates of risk in the year following discharge from acute Veterans Health Administration psychiatric inpatient units among male veterans discharged from 2005 to 2010 (fiscal years). *Methods:* Suicide rates and standardized mortality ratios were calculated. Descriptive analyses were used to describe suicides and non-suicides and provide base rates for interpretation, and unadjusted and adjusted proportional hazard models were used to identify correlates of suicide. *Results:* From 2005 to 2010, 929 male veterans died by suicide in the year after discharge and the suicide rate was 297/100,000 person-years (py). The suicide rate significantly increased from 234/100,000 py (95% CI = 193–282) in 2005 to 340/100,000 py (95% CI = 292–393) in 2008, after which it plateaued. Living in a rural setting, HR (95% CI) = 1.20 (1.05, 1.36), and being diagnosed with a mood disorder such as major depression, HR (95% CI) = 1.60 (1.36, 1.87), or other anxiety disorder, HR (95% CI) = 1.52 (1.24, 1.87), were associated with increased risk for suicide. *Conclusions:* Among male veterans, the suicide rate in the year after discharge from acute psychiatric hospitalization increased from 2005 to 2008, after which it plateaued. Prevention efforts should target psychiatrically hospitalized veterans who live in rural settings and/or are diagnosed with mood or other anxiety disorders.

Bullman, T., Schneiderman, A., & Gradus, J. L. (2019). **Relative importance of posttraumatic stress disorder and depression in predicting risk of suicide among a cohort of Vietnam Veterans.** *Suicide and Life-Threatening Behavior*, 49(3), 838–845.

doi.org/10.1111/sltb.12482 *Objective:* Research has demonstrated that posttraumatic stress disorder (PTSD) among Vietnam veterans is associated with increased risk of suicide. It is also widely reported that suicide is related to depression. This study examined the effect of PTSD and depression on risk of suicide among a cohort of Vietnam veterans. *Method:* All study subjects were selected from the Department of Veterans Affairs Agent Orange Registry. Suicide risk associated with PTSD was first assessed by comparing the number of suicides among a cohort of 2,874 veterans with PTSD to that of 8,537 veterans not diagnosed with PTSD. Risk of suicide was approximated by hazard ratios (HRs), generated by Cox proportional hazard models, including a model that utilized competing risk analyses. *Results:* The risk of suicide associated with PTSD and depression when examined separately was similar, HR = 7.1 (95% confidence interval (CI): 4.9, 10.3) and HR = 7.2 (95% CI: 4.8–10.8), respectively. Competing risk analysis indicated that veterans with both PTSD and depression compared to veterans with neither diagnosis had the highest risk of suicide, HR = 15.22. *Conclusions:* This study suggests that depression as well as PTSD should be monitored as a way of reducing suicides among Vietnam veterans.

Conner, K. R., Bohnert, A. S., McCarthy, J. F., Valenstein, M., Bossarte, R., Ignacio, R., Lu, N., & Ilgen, M. A. (2013). **Mental disorder comorbidity and suicide among 2.96 million men receiving care in the Veterans Health Administration health system.** *Journal of Abnormal Psychology*, 122(1), 256–263. doi.org/10.1037/a0030163 Comorbid mental disorders are common among suicide decedents. It is unclear if mental disorders in combination confer additive risk for suicide, in other words, if risk associated with two disorders is approximately the sum of the risk conferred by each disorder considered separately, or if there are departures from additivity such that the combined risk is less (i.e., subadditive) or more than additive (i.e., synergistic). Using a retrospective cohort design, all male Department of Veterans Affairs, Veterans Health Administration (VHA) service users who utilized VHA services in fiscal year (FY) 1999 and were alive at the start or FY 2000 ($N = 2,962,810$) were analyzed. Individuals were followed until death or the end of FY 2006. Using the VHA National Patient Care Database, diagnoses of mental disorders in FY 1999 were grouped into six categories (e.g., posttraumatic stress disorder). In proportional hazards models, 2-way interactions between disorders were used to examine departures from additive risk. There were 7,426 suicide deaths in the study period. Two-way interaction tests were nearly all statistically significant, indicating departures from additivity, and the results of these tests were consistent with subadditive risk. Sensitivity analyses examining the first year of follow-up showed similar results. Subadditive risk may be explained by factors that serve to lower the increased risk associated with a comorbid diagnosis, which may include common underlying causes of mental disorders, difficulties of differential diagnosis, the nature of etiological relationships between mental disorders, and intensive clinical care and monitoring of patients with comorbidity.

Conner, K. R., Bossarte, R. M., He, H., Arora, J., Lu, N., Tu, X. M., & Katz, I. R. (2014). **Posttraumatic stress disorder and suicide in 5.9 million individuals receiving care in the Veterans Health Administration health system.** *Journal of Affective Disorders*, 166, 1–5. doi.org/10.1016/j.jad.2014.04.067 *Background:* Post-traumatic stress disorder (PTSD) confers risk for suicidal ideation and suicide attempts but a link with suicide is not yet established. Prior analyses of users of the Veterans health administration (VHA) Health System

suggest that other mental disorders strongly influence the association between PTSD and suicide in this population. We examined the association between PTSD and suicide in VHA users, with a focus on the influence of other mental disorders. *Methods:* Data were based on linkage of VA National Patient Care Database records and the Centers for Disease Control and Prevention's National Death Index, with data from fiscal year 2007–2008. Analyses were based on multivariate logistic regression and structural equation models. *Results:* Among users of VHA services studied ($N = 5,913,648$), 0.6% ($N = 3620$) died by suicide, including 423 who had had been diagnosed with PTSD. In unadjusted analysis, PTSD was associated with increased risk for suicide, with odds ratio, OR (95% confidence interval, 95% CI) = 1.34 (1.21, 1.48). Similar results were obtained after adjustment for demographic variables and veteran characteristics. After adjustment for multiple other mental disorder diagnoses, PTSD was associated with decreased risk for suicide, OR (95% CI) = 0.77 (0.69, 0.86). Major depressive disorder (MDD) had the largest influence on the association between PTSD and suicide. *Limitations:* The analyses were cross-sectional. VHA users were studied, with unclear relevance to other populations. *Conclusion:* The findings suggest the importance of identifying and treating comorbid MDD and other mental disorders in VHA users diagnosed with PTSD in suicide prevention efforts.

Cooper, S. A., Szymanski, B. R., Bohnert, K. M., Sripada, R. K., & McCarthy, J. F. (2020). **Association between positive results on the Primary Care-Posttraumatic Stress Disorder Screen and suicide mortality among US veterans.** *JAMA Network Open*, 3(9), e2015707. doi.org/10.1001/jamanetworkopen.2020.15707

Importance: Suicide rates are higher among veterans compared with nonveterans, and the prevalence of posttraumatic stress disorder (PTSD) is higher among veterans compared with the general adult population in the US. To date, no study has examined the association between PTSD screening results and suicide mortality among veterans. *Objective:* To examine whether veterans receiving care in the US Veterans Health Administration (VHA) health system who had positive results on the Primary Care–Posttraumatic Stress Disorder Screen (PC-PTSD) had a greater risk of suicide mortality compared with those who had negative results and to assess whether such risk decreased over time. *Design, Setting, and Participants:* Multivariable proportional hazards regression models were used to evaluate suicide mortality risk through December 31, 2016, among a cohort of veterans who received the PC-PTSD in the VHA health system. The VHA administers the PC-PTSD to patients nationwide, and screening results are routinely documented in the VHA Corporate Data Warehouse. The PC-PTSD includes 4 questions regarding PTSD symptoms, to which patients respond with either a positive (yes) or negative (no) answer. All patients who completed the PC-PTSD in 2014 and who did not have a diagnosis of PTSD in the year before screening were included in the analysis. A score of 3 or 4 on the PC-PTSD indicated a positive result, and a score of 0, 1, or 2 indicated a negative result. Data collection and analyses were performed from November 13, 2018, to June 18, 2019. *Exposures:* Primary Care–Posttraumatic Stress Disorder Screen (PC-PTSD). *Main Outcomes and Measures:* Suicide mortality risk, as assessed through data obtained from the US Veterans Affairs/Department of Defense Mortality Data Repository. *Results:* A total of 1 693 449 PC-PTSDs were completed by 1 552 581 individual

veteran patients in 2014. Most of the patients were White (73.9%), married (52.2%), male (91.1%), 55 years or older (62.5%), and had completed only 1 PC-PTSD (92.1%). In multivariable analyses, positive PC-PTSD results (ie, total scores of 3 or 4) were associated with a 58% increase in the risk of suicide mortality at 1 day after screening (hazard ratio [HR], 1.58; 95% CI, 1.19–2.10) and a 26% increase in the risk of suicide mortality at 1 year after screening (HR, 1.26; 95% CI, 1.07–1.48). A positive response on item 4 (“felt numb or detached from others, activities, or your surroundings”) of the PC-PTSD was associated with a 70% increase in suicide mortality risk at 1 day after screening (HR, 1.70; 95% CI, 1.27–2.28). *Conclusions and Relevance:* Positive PC-PTSD results, and specifically reports of feeling numb or detached, were associated with increases in the risk of suicide mortality. These associations decreased over time. The findings of this study can inform interpretation of PC-PTSD responses and suggest the importance of recent improvements made to the VHA suicide risk assessment.

Forehand, J. A., Dufort, V., Gradus, J. L., Maguen, S., Watts, B. V., Jiang, T., Holder, N., & Shiner, B. (2022). **Association between post-traumatic stress disorder severity and death by suicide in US military veterans: Retrospective cohort study.** *British Journal of Psychiatry*, 221, 676–682. doi.org/10.1192/bjp.2022.110

Background: There is mixed evidence regarding the direction of a potential association between post-traumatic stress disorder (PTSD) and suicide mortality. *Aims:* This is the first population-based study to account for both PTSD diagnosis and PTSD symptom severity simultaneously in the examination of suicide mortality. *Method:* Retrospective study that included all US Department of Veterans Affairs (VA) patients with a PTSD diagnosis and at least one symptom severity assessment using the PTSD Checklist (PCL) between 1 October 1999 and 31 December 2018 ($n = 754\ 197$). We performed multivariable proportional hazards regression models using exposure groups defined by level of PTSD symptom severity to estimate suicide mortality rates. For patients with multiple PCL scores, we performed additional models using exposure groups defined by level of change in PTSD symptom severity. We assessed suicide mortality using the VA/Department of Defense Mortality Data Repository. *Results:* Any level of PTSD symptoms above the minimum threshold for symptomatic remission (i.e. PCL score > 18) was associated with double the suicide mortality rate at 1 month after assessment. This relationship decreased over time but patients with moderate to high symptoms continued to have elevated suicide rates. Worsening PTSD symptoms were associated with a 25% higher long-term suicide mortality rate. Among patients with improved PTSD symptoms, those with symptomatic remission had a substantial and sustained reduction in the suicide rate compared with those without symptomatic remission (HR = 0.56; 95% CI 0.37–0.88). *Conclusions:* Ameliorating PTSD can reduce risk of suicide mortality, but patients must achieve symptomatic remission to attain this benefit.

Forehand, J. A., Peltzman, T., Westgate, C. L., Riblet, N. B., Watts, B. V., & Shiner, B. (2019). **Causes of excess mortality in veterans treated for posttraumatic stress disorder.** *American Journal of Preventive Medicine*, 57(2), 145–152. doi.org/10.1016/j.amepre.2019.03.014

Introduction: Published research indicates that posttraumatic stress disorder (PTSD) is associated with increased mortality. However, causes of death

among treatment-seeking patients with PTSD remain poorly characterized. The study objective was to describe causes of death among Veterans with PTSD to inform preventive interventions for this treatment population. **Methods:** A retrospective cohort study was conducted for all Veterans who initiated PTSD treatment at any Department of Veterans Affairs Medical Center from fiscal year 2008 to 2013. The primary outcome was mortality within the first year after treatment initiation. In 2018, collected data were analyzed to determine leading causes of death. For the top ten causes, standardized mortality ratios (SMRs) were calculated from age- and sex-matched mortality tables of the U.S. general population. **Results:** A total of 491,040 Veterans were identified who initiated PTSD treatment. Mean age was 48.5 (± 16.0) years, 90.7% were male, and 63.5% were of white race. In the year following treatment initiation, 1.1% (5,215/491,040) died. All-cause mortality was significantly higher for Veterans with PTSD compared with the U.S. population (SMR = 1.05, 95% CI = 1.02, 1.08, $p < 0.001$). Veterans with PTSD had a significant increase in mortality from suicide (SMR = 2.52, 95% CI = 2.24, 2.82, $p < 0.001$), accidental injury (SMR = 1.99, 95% CI = 1.83, 2.16, $p < 0.001$), and viral hepatitis (SMR = 2.26, 95% CI = 1.68, 2.93, $p < 0.001$) versus the U.S. population. Of those dying from accidental injury, more than half died of poisoning (52.3%, 325/622). **Conclusions:** Veterans with PTSD have an elevated risk of death from suicide, accidental injury, and viral hepatitis. Preventive interventions should target these important causes of death.

Fox, V., Dalman, C., Dal, H., Hollander, A. C., Kirkbride, J. B., & Pitman, A. (2021). **Suicide risk in people with post-traumatic stress disorder: A cohort study of 3.1 million people in Sweden.** *Journal of Affective Disorders*, 279, 609–616. doi.org/10.1016/j.jad.2020.10.009 **Background:** It is unclear whether post-traumatic stress disorder [PTSD] is associated with suicide risk in the general population, whether this differs by sex, or what the population impact of PTSD is for suicide. **Methods:** We constructed a nationwide cohort of all people living in Sweden, born 1973–1997, followed from their 14th birthday (or immigration, if later) until suicide, other death, emigration or 31 December 2016. We used Cox proportional hazards regression to estimate hazard ratios [HR] and calculated the population impact of PTSD on suicide. We included sensitivity analyses to explore effects of outcome and exposure definitions, and to account for potential competing risks. **Results:** Of 3,177,706 participants, 22,361 (0.7%) were diagnosed with PTSD, and 6,319 (0.2%) died by suicide over 49.2 million person-years. Compared with women and men without PTSD, suicide rates were 6.74 (95% CI: 5.61–8.09) and 3.96 (95% CI: 3.12–5.03) times higher in those with PTSD, respectively, after sociodemographic adjustment. Suicide rates remained elevated in women (HR: 2.61; 95% CI: 2.16–3.14) and men (HR: 1.67; 95% CI: 1.31–2.12) after adjustment for previous psychiatric conditions; attenuation was driven by previous non-fatal suicide attempts. Findings were insensitive to definitions or competing risks. If causal, 1.6% (95% CI: 1.2–2.1) of general population suicides could be attributed to PTSD, and up to 53.7% (95% CI: 46.1–60.2) in people with PTSD. **Limitations:** Residual confounding remains possible due to depressive and anxiety disorders diagnosed in primary care but unrecorded in these registers. **Conclusions:** Clinical guidelines for the management of people with PTSD should recognise increased suicide risks.

Gradus, J. L., Antonsen, S., Svensson, E., Lash, T. L., Resick, P. A., & Hansen, J. G. (2015). **Trauma, comorbidity, and mortality following diagnoses of severe stress and adjustment disorders: A nationwide cohort study.** *American Journal of Epidemiology*, 182(5), 451–458. doi.org/10.1093/aje/kwv066 Longitudinal outcomes following stress or trauma diagnoses are receiving attention, yet population-based studies are few. The aims of the present cohort study were to examine the cumulative incidence of traumatic events and psychiatric diagnoses following diagnoses of severe stress and adjustment disorders categorized using *International Classification of Diseases, Tenth Revision*, codes and to examine associations of these diagnoses with all-cause mortality and suicide. Data came from a longitudinal cohort of all Danes who received a diagnosis of reaction to severe stress or adjustment disorders (*International Classification of Diseases, Tenth Revision*, code F43.x) between 1995 and 2011, and they were compared with data from a general-population cohort. Cumulative incidence curves were plotted to examine traumatic experiences and psychiatric diagnoses during the study period. A Cox proportional hazards regression model was used to examine the associations of the disorders with mortality and suicide. Participants with stress diagnoses had a higher incidence of traumatic events and psychiatric diagnoses than did the comparison group. Each disorder was associated with a higher rate of all-cause mortality than that seen in the comparison cohort, and strong associations with suicide were found after adjustment. This study provides a comprehensive assessment of the associations of stress disorders with a variety of outcomes, and we found that stress diagnoses may have long-lasting and potentially severe consequences.

LeardMann, C. A., Powell, T. M., Smith, T. C., Bell, M. R., Smith, B., Boyko, E. J., Hopper, T. I., Gackstetter, G. D., Ghamsary, M., & Hoge, C. W. (2013). **Risk factors associated with suicide in current and former US military personnel.** *JAMA*, 310(5), 496–506. doi.org/10.1001/jama.2013.65164 **Importance:** Beginning in 2005, the incidence of suicide deaths in the US military began to sharply increase. Unique stressors, such as combat deployments, have been assumed to underlie the increasing incidence. Previous military suicide studies, however, have relied on case series and cross-sectional investigations and have not linked data during service with postservice periods. **Objective:** To prospectively identify and quantify risk factors associated with suicide in current and former US military personnel including demographic, military, mental health, behavioral, and deployment characteristics. **Design, Setting, and Participants:** Prospective longitudinal study with accrual and assessment of participants in 2001, 2004, and 2007. Questionnaire data were linked with the National Death Index and the Department of Defense Medical Mortality Registry through December 31, 2008. Participants were current and former US military personnel from all service branches, including active and Reserve/National Guard, who were included in the Millennium Cohort Study ($N = 151\,560$). **Main Outcomes and Measures:** Death by suicide captured by the National Death Index and the Department of Defense Medical Mortality Registry. **Results:** Through the end of 2008, findings were 83 suicides in 707 493 person-years of follow-up (11.73/100 000 person-years [95% CI, 9.21–14.26]). In Cox models adjusted for age and sex, factors significantly associated with increased risk of suicide included

male sex, depression, manic-depressive disorder, heavy or binge drinking, and alcohol-related problems. None of the deployment-related factors (combat experience, cumulative days deployed, or number of deployments) were associated with increased suicide risk in any of the models. In multivariable Cox models, individuals with increased risk for suicide were men (hazard ratio [HR], 2.14; 95% CI, 1.17-3.92; $P = .01$; attributable risk [AR], 3.5 cases/10000 persons), and those with depression (HR, 1.96; 95% CI, 1.05-3.64; $P = .03$; AR, 6.9/10000 persons), manic-depressive disorder (HR, 4.35; 95% CI, 1.56-12.09; $P = .005$; AR, 35.6/10000 persons), or alcohol-related problems (HR, 2.56; 95% CI, 1.56-4.18; $P < .001$; AR, 7.7/10000 persons). A nested, matched case-control analysis using 20:1 control participants per case confirmed these findings. **Conclusions and Relevance:** In this sample of current and former military personnel observed July 1, 2001–December 31, 2008, suicide risk was independently associated with male sex and mental disorders but not with military-specific variables. These findings may inform approaches to mitigating suicide risk in this population.

Shen, Y. C., Cunha, J. M., & Williams, T. V. (2016). **Time-varying associations of suicide with deployments, mental health conditions, and stressful life events among current and former US military personnel: A retrospective multivariate analysis.** *The Lancet Psychiatry*, 3(11), 1039–1048. doi.org/10.1016/S2215-0366(16)30304-2 **Background:** US military suicides have increased substantially over the past decade and currently account for almost 20% of all military deaths. We investigated the associations of a comprehensive set of time-varying risk factors with suicides among current and former military service members. **Methods:** We did a retrospective multivariate analysis of all US military personnel between 2001 and 2011 ($n = 110\,035\,573$ person-quarter-years, representing 3 795 823 service members). Outcome was death by suicide, either during service or post-separation. We used Cox proportional hazard models at the person-quarter level to examine associations of deployment, mental disorders, history of unlawful activity, stressful life events, and other demographic and service factors with death by suicide. **Findings:** The strongest predictors of death by suicide were current and past diagnoses of self-inflicted injuries, major depression, bipolar disorder, substance use disorder, and other mental health conditions (compared with service members with no history of diagnoses, the hazard ratio [HR] ranged from 1.4 [95% CI 1.14–1.72] to 8.34 [6.71–10.37]). Compared with service members who were never deployed, hazard rates of suicide (which represent the probability of death by suicide in a specific quarter given that the individual was alive in the previous quarter) were lower among the currently deployed (HR 0.50, 95% CI 0.40–0.61) but significantly higher in the quarters following first deployment (HR 1.51 [1.17–1.96] if deployed in the previous three quarters; 1.14 [1.06–1.23] if deployed four or more quarters ago). The hazard rate of suicide increased within the first year of separation from the military (HR 2.49, 95% CI 2.12–2.91) and remained high for those who had separated from the military 6 or more years ago (HR 1.63, 1.45–1.82). **Interpretation:** The increased hazard rate of death by suicide for military personnel varies by time since exposure to deployment, mental health diagnoses, and other stressful life events. Continued monitoring is especially needed for these high-risk individuals. Additional

information should be gathered to address the persistently raised risk of suicide among service members after separation. **Funding:** Partly funded by the Naval Research Program.

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