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Research report

Posttraumatic stress disorder and suicide in 5.9 million individuals receiving care in the veterans health administration health system

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ABSTRACT

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.
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1. Introduction

Suicide is the 10th leading cause of death in the United States, accounting for approximately 38,000 deaths annually (Hoyert and Xu, 2012). There is solid evidence that posttraumatic stress disorder (PTSD) is associated with suicidal thoughts and nonlethal suicide attempts (Krysinska and Lester, 2010; Panagioti et al., 2012). However, far more limited are studies of PTSD and suicide deaths (heretofore referred to as suicide). Along these lines, meta-analyses have not demonstrated that PTSD is associated with suicide (Krysinska and Lester, 2010; Panagioti et al., 2012).

Although the role of PTSD in suicide is unclear and the study of PTSD and suicide overall is at a nascent stage, there is a growing database on PTSD and suicide in users of the Veterans health administration (VHA) healthcare system (Bullman and Kang, 1994; Desai et al., 2005; Ilgen et al., 2010; Zivin et al., 2007). As a result, there is an opportunity to take stock of what has been learned about PTSD and suicide in VHA users in order to inform hypothesis-driven research moving forward. Such work is critical because VHA is the largest integrated health care system in the United States and individuals who use VHA services, the large majority of whom are Veterans, are at increased risk for suicide compared to the US general population (McCarthy et al., 2009). Taken as a whole, studies of VHA users suggest the central importance of considering mental disorders that co-occur with PTSD in assessing the link between PTSD and suicide. In particular, studies of general samples of VHA users (i.e., those not selected based on clinical diagnosis or

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treatment setting) have shown that PTSD is associated with suicide including analyses of a cohort who had been deployed to Viet Nam (Bullman and Kang, 1994) and analyses of a more recent study of the total population of VHA users that adjusted for age (Ilgen et al., 2010). In the study of Viet Nam Veterans the association between PTSD and suicide was reduced (though not eliminated) after adjustment for mental disorders (Bullman and Kang, 1994). Studies of clinical populations of VHA users with high rates of mental disorders have not concluded that PTSD is associated with suicide including analyses of cohort of patients discharged from inpatient psychiatric treatment that adjusted for comorbid mental disorders (Desai et al., 2005) and analyses of a cohort of patients, all with depressive disorders, which showed that a diagnosis of comorbid PTSD is associated with lowered risk for suicide (Zivin et al., 2007). In summary, the results suggest that PTSD is associated with increased risk for suicide in VHA users generally (Ilgen et al., 2010) but the association may be attenuated (Bullman and Kang, 1994), not observed at a statistically significant level (Desai et al., 2005), or PTSD may be associated with lower risk (Zivin et al., 2007) in studies that adjust for other mental disorders and/or in analyses of clinical populations with high rates of mental disorders.

There are several potential explanations for attenuation of the relationship between PTSD and suicide after adjustment for mental disorders among VHA users that include: there are many common contributors to PTSD and other mental disorders (e.g., trauma history) which may lower the independent contribution to suicide risk of different mental disorders when they are modeled simultaneously; the difficulty of accurate differential diagnosis in complex patients, for example the potential for severe PTSD to be mislabeled as other condition(s); the ability to tolerate PTSD without developing other mental health or substance use disorders as complications may indicate less severe cases and/or increased resilience and stress tolerance; and that the identification of mental disorders comorbid with PTSD may lead to more intensive clinical care and monitoring which may serve to lower risk for suicidal behavior among Veterans treated in VHA (Conner et al., 2013; Desai et al., 2005; Zivin et al., 2007). Another potential explanation is that PTSD may lead to or exacerbate the symptoms of other mental disorders, for example major depressive disorder (MDD), which may in turn confer risk for suicide (Panagioti et al., 2009). In this scenario PTSD plays a causal role in suicide risk albeit an indirect one (i.e., by promoting other mental disorders), consistent with the concept of mediation (Kaplan, 2000; Xia et al., 2012).

With few exceptions (Gradus et al., 2010), reports of PTSD and suicide are based on users of VHA services, per above. However, a recent report of current and former US military service members is topical insofar as it examined the roles of PTSD, comorbid conditions, and deployment history in suicide (LeardMann et al., 2013). The investigators reported that PTSD is not associated with suicide in unadjusted analyses or in analyses that adjusted for age and sex and therefore conducted no further analyses of PTSD. Military deployment history was associated with risk for suicide in models with minimal adjustment but not after additional adjustment for depression and other correlates. The study had a moderate number of suicides ($N=83$), limiting statistical power.

The purpose of the current study was to examine the association of PTSD and suicide in a well powered, national analysis of VHA service users. We hypothesized that PTSD is associated with suicide in unadjusted analyses and those that adjust for demographic variables and military service during the wars in Afghanistan (i.e., Operation Enduring Freedom, OEF) or Iraq (i.e., Operation Iraqi Freedom, OIF). We further hypothesized that the association between PTSD and suicide is attenuated, if not eliminated, after statistical adjustment for mental disorders. If our hypothesis is confirmed, particularly if an association between PTSD and suicide is not observed after adjustment for mental disorders, it would suggest the importance of identifying and treating co-occurring mental disorders in efforts to reduce suicide risk in VHA users with PTSD. We also explored the potential mediating role of other mental disorders on the association between PTSD and suicide.

2. Method

Data sources: Data are based on linkage of the VA National Patient Care Database (NPCD) and the Centers for Disease Control and Prevention's National Death Index (NDI). The NPCD included demographic and diagnostic information for all treatment contacts of patients seen anywhere within the VHA treatment system. Diagnoses in the NPCD are based on clinical assessments and correspond to the International Classification of Diseases, Ninth Revision, Clinical Modification (Medicode, 1995). NDI provided information about vital status and cause of death for all US residents from state vital statistics offices. Suicide decedents were identified using International Classification of Diseases, 10th Revision, Clinical Modification Codes X60-X84 and Y87.0 (World Health Organization, 2004). Individuals who died by other causes were censored in analyses. For more information on the use of these sources in suicide research see prior reports (McCarthy et al., 2009; Bohnert et al., 2014).

Sample: The population analyzed consisted of all users of VHA health care services in FY 2007–2008, ($N=5,913,648$).

Measures: PTSD (vs. no. PTSD) was the primary variable of interest. Other measures that served as covariates in analyses included demographic variables, Veteran-specific variables, and other mental disorders. Demographic characteristics include age categorized into four groups (ages 18–29, 30–59, 60–74, and 75+), sex, married (vs. unmarried), urban (vs. rural), and region of the country in four categories (northeast, south, Midwest, west). Veteran characteristics included OEF/OIF Veteran (vs. non-OEF/OIF Veteran), multiple OEF/OIF deployments (vs. non-multiple OEF/OIF deployments), and being new to VHA (vs. experienced users). Along with PTSD, mental disorders included a diagnosis (vs. no such diagnosis) of MDD, non-MDD depression, drug use disorder, alcohol use disorder, bipolar disorder, anxiety disorder (non-PTSD), and schizophrenia.

Analyses: Descriptive analytic methods were used to examine characteristics of the total cohort and by PTSD status. The number and percentage of deaths by suicide of the total sample as well as those with and without a diagnosis of PTSD were also calculated. A series of logistic regressions, generalized linear models with the logit link (Tang et al., 2012), were used to estimate the association between PTSD and the risk of suicide, with analyses yielding Odds Ratios (ORs) and corresponding 95% confidence intervals (CIs). These analyses began with an unadjusted model to examine the bivariate association of PTSD and suicide (model 1) and built on this model by adding covariates in blocks including demographic variables (model 2), Veteran-specific variables (model 3), and other mental disorders (model 4). The potential problem of multi-colinearity was examined in models 2, 3 and 4 using the variance inflation factor (Hair et al., 2006). Logistic regression analyses were conducted using SAS 9.3 and these results are presented based on the template used in a recent study of tobacco use disorder and suicide (Bohnert et al., 2014).

We ran further analyses using structural equation models (SEM) in order to explore the potential mediating influence of mental disorders on the association between PTSD and suicide (Kaplan, 2000; Xia et al., 2012). In these models the estimated parameters for the various associations or “pathways” are standardized regression coefficients for the probit model for binary responses. A statistically significant positive sign of an estimate

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