

# Suicide Mortality Among Individuals Receiving Treatment for Depression in the Veterans Affairs Health System: Associations with Patient and Treatment Setting Characteristics

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Suicide is a complex, multidetermined phenomenon.<sup>1</sup> There are individual-level biological and psychological contributors, in addition to social, environmental, and economic risk factors.<sup>2–4</sup> Rates of suicide also differ based on demographic and clinical characteristics. In the general population, the incidence of suicide is higher among older than among younger individuals<sup>5</sup> and among males than among females.<sup>6</sup> Whites are more likely to commit suicide than are African Americans, and older White men have the highest risk of suicide among all age and race groups.<sup>6</sup> Suicide rates vary with rates of gun ownership, poverty, employment status, geographical location, and levels of social support,<sup>4,7,8</sup> as well as other clinical and demographic characteristics. The US Surgeon General,<sup>9</sup> the Institute of Medicine,<sup>4</sup> and the Department of Veterans Affairs<sup>10</sup> (VA) recognize suicide as a key public health problem in need of a national strategy for suicide prevention.

Patients with psychiatric disorders, particularly depressive disorders, are at much greater risk for suicide than those in the general population.<sup>11–16</sup> Approximately 5% to 12% of men and 10% to 25% of women will have a major depressive episode during their lifetimes, and higher percentages will experience significant depressive symptoms, which increases their risk for suicide.<sup>17,18</sup> Of patients treated for depression in a variety of settings, approximately 2% to 7% die from suicide,<sup>19,20</sup> with higher rates of suicide occurring among patients who have been hospitalized for depression.<sup>3,14,19,21</sup> Patients with co-occurring disorders, such as depression and alcohol abuse or depression and posttraumatic stress disorder (PTSD), have been reported to be at much higher risk for suicide than patients with only 1 of these

**Objectives.** We sought to report clinical and demographic factors associated with suicide among depressed veterans in an attempt to determine what characteristics identified depressed veterans at high risk for suicide.

**Methods.** We used longitudinal, nationally representative data (1999–2004) to determine suicide rates among depressed veterans, estimating time until suicide using Cox proportional hazards regression models.

**Results.** Of 807 694 veterans meeting study criteria, 1683 (0.21%) committed suicide during follow-up. Increased suicide risks were observed among male, younger, and non-Hispanic White patients. Veterans without service-connected disabilities, with inpatient psychiatric hospitalizations in the year prior to their qualifying depression diagnosis, with comorbid substance use, and living in the southern or western United States were also at higher risk. Posttraumatic stress disorder (PTSD) with comorbid depression was associated with lower suicide rates, and younger depressed veterans with PTSD had a higher suicide rate than did older depressed veterans with PTSD.

**Conclusions.** Unlike the general population, older and younger veterans are more prone to suicide than are middle-aged veterans. Future research should examine the relationship between depression, PTSD, health service use, and suicide risks among veterans. (*Am J Public Health.* 2007;97:2193–2198. doi:10.2105/AJPH.2007.115477)

disorders.<sup>11,12,22,23</sup> Patients with prior hospitalizations for psychiatric disorders, such as depression or prior suicide attempts, are also at higher risk of suicide.<sup>24–26</sup>

The relationship between depression and other risk factors for suicide is likely complex. Qin et al. found that having a psychiatric disorder increased suicide risk more among women than among men.<sup>7</sup> Major depression also may increase suicide risk more among older adults than among younger adults.<sup>14</sup>

As a group, veterans may be at particularly high risk for suicide as a result of their high prevalence of depressive disorders and comorbid psychiatric conditions. According to the Veterans Health Study, the prevalence of significant depressive symptoms among veterans is 31%, 2- to 5-times higher than among the general US population.<sup>27</sup> In 2002, 12% of veterans treated in VA health care facilities

were diagnosed with depressive disorders by a health care provider during an encounter.<sup>28</sup> Among veterans, as in the general population, completed suicide is usually associated with a mental disorder, most often depressive disorders and alcohol or substance use disorders; those with comorbid psychiatric disorders are at highest risk.<sup>29,30</sup>

Because of limited research examining completed suicide, little is known about the relative risks of suicide associated with demographic and clinical factors among depressed veterans. Among depressed patients, the relative risk of suicide among men compared with among women appears to be smaller than that seen for the same comparison among the general population.<sup>7,31</sup> Pokorny reported that, among former VA psychiatric inpatients, older patients did not have a greater suicide risk than did younger patients.<sup>32</sup> Thompson et al.

reported that the relative risk of suicide deaths in the VA was 2.3 for Whites compared with African Americans,<sup>26</sup> which is the same as relative risk of suicide between Whites and African Americans in the general population.<sup>6</sup> However, among former VA medical center psychiatric inpatients, Desai et al. reported relative risks for suicide of only 1.5 among men compared with those among women, but relative risks of 3.8 among Whites compared with those among African Americans<sup>33</sup>—a race disparity that is substantially higher than that observed in the general population.<sup>6</sup>

Several investigators have noted the importance of determining risk profiles for the particular population being targeted.<sup>26</sup> Clinicians use this information as “background knowledge” when completing suicide assessments. Administrators also need this information to be able to design, evaluate, and target interventions to decrease suicide risks.

In this study, we examined associations between demographic and clinical characteristics and risk of suicide among veterans treated for depression in the VA health system. Based on previous studies of veterans, we hypothesized that the differential risks for suicide associated with being older, male, White, and having medical comorbidities would be smaller within the depressed VA patient population than has been reported for the general population. We also hypothesized that patients with depression and comorbid substance use, PTSD, or a recent psychiatric hospitalization would be at higher risk for suicide than would be patients who have depression without these psychiatric comorbidities.

## METHODS

We collected study data from the VA's National Registry for Depression (NARDEP), which is maintained by the VA Serious Mental Illness Treatment Research and Evaluation Center in Ann Arbor, Michigan.<sup>28</sup> The NARDEP includes an array of VA data sources and provides a unique longitudinal data resource, with detailed services and pharmacy data for over 1 500 000 patients diagnosed with depressive disorders in VA health facilities from fiscal year 1997 forward.<sup>28</sup> NARDEP data were linked to data from the VA Medicare

Data Merge Initiative and the National Death Index. National Death Index data provide information on all causes of death, including suicide. These resources enabled us to provide important and currently unavailable information about suicide rates among VA patients with depression, as well as the relative risks for suicide for important patient subgroups.

### Study Design

To determine suicide rates among our depressed veteran population, we conducted a retrospective cohort study. This study design takes maximum advantage of the unique strengths of VA data resources and has distinct advantages when studying rare outcomes, such as suicide.<sup>34,35</sup>

The study observation period for our cohort began on April 1, 1999, and extended until the end of fiscal year 2004 (September 30, 2004). Observations from 1997 to 1999 were not included in the study cohort, because of a lack of national pharmacy data prior to 1999. Patients were included in the study if they had (1) a diagnosis of a depressive disorder and an antidepressant had been prescribed, or (2) two medical visits that resulted in diagnoses of depressive disorders during the study period. We excluded patients with bipolar I, schizophrenia, or schizoaffective diagnoses recorded during their observation period or the year prior to their entry into the cohort. We note that patients with bipolar disorder and depressed patients with concurrent psychotic disorders, such as schizophrenia, are at high risk for suicide, and they are important populations within the VA. However, when compared with patients with depression alone or with depression and other psychiatric comorbidities, these patients are likely to have different prognoses and require different or additional treatments. Including these patients in the current study would have made analyses more complex and the interpretation of study results more difficult. Finally, we excluded patients with “unknown” race. A total of 807 694 patients qualified for study inclusion based on these inclusion and exclusion criteria.

### Measures

The primary outcome of interest is suicide, which was identified from the National

Death Index cause of death indicators, which in turn, are based on state death certificates. Based on associations with suicidality observed in prior studies, we examined patient age (<45, 45–65, ≥65 years), race (White, African American, and other), gender (male or female), substance abuse diagnosis (either alcohol abuse or other substance abuse), diagnosis of PTSD (yes or no), Hispanic ethnicity (yes or no), treatment location (northeast, central, west, south), prior VA hospitalization (for any psychiatric diagnosis in the year prior to cohort entry), service connection (indicating some VA-recognized disability stemming from injuries or conditions that occurred or were exacerbated during military service; yes or no responses), and baseline medical comorbidity using the Charlson Comorbidity Index<sup>36</sup> (a weighted index designed to classify comorbid conditions to identify risk of mortality in longitudinal studies; scored as 0, ≥1). Patients with missing data for key covariates were excluded from all analyses (in particular, 9% of the original sample data were excluded as a result of missing race data).

### Analysis

We first calculated unadjusted suicide rates and median time from date of entry in the study period until suicide. We then calculated suicide rates for patients by age group, gender, race, ethnicity, and psychiatric and substance abuse comorbidity status. Next, we used survival analysis method based on time until suicide and estimated suicide rate using crude mortality and estimated hazard ratios using Cox proportional hazards regression models.<sup>37</sup> Finally, we estimated the adjusted hazard ratios and 95% confidence intervals (CIs) of suicide associated with each patient characteristic of interest, such as old versus young, male versus female, and White versus African American.

## RESULTS

Of the 807 694 veterans included in the study, 1683 (0.21%) committed suicide during the study period. The median time between the date of entry into the study and date of suicide was 390 days.

Patient characteristics associated with suicide rates per 100 000 person-years are presented in Table 1. Of note, men had a higher rate of suicide than did women (89.58 vs 28.92, respectively), and Whites had a higher rate of suicide (95.01) compared with patients of other races (27.08 for African Americans and 56.17 for other races). Hispanic patients had a lower rate of suicide compared with non-Hispanic patients (46.28 vs 86.80, respectively), whereas younger veterans (i.e., aged 18–44 years) had a moderately higher rate of suicide than did middle-aged patients (94.98 vs 77.93 for patients aged 45–64 years) and modestly higher rates than elderly patients (94.98 vs 90.06 for patients aged 65 years or older). Veterans with a substance abuse diagnosis had a higher rate of suicide than did veterans with no substance abuse diagnosis (119.73 vs 72.63, respectively). However, veterans who received a PTSD diagnosis had a lower rate of suicide than did veterans without PTSD (68.16 vs 90.66, respectively). The suicide rate was higher in the South than in the Northeast (88.93 vs 73.55, respectively) or central regions (88.93 vs 83.09, respectively), but slightly lower than rates in the West (88.93 vs 90.04, respectively). Veterans with a service-connected disability had a lower rate of suicide than those without a service-connected disability (70.06 vs 92.20). Veterans with a psychiatric hospitalization in the 12 months prior to their date of entry into the study had a higher rate of suicide than those without such a hospitalization (174.83 vs 80.20), whereas having 1 or more physical comorbidities (as indicated using the Charlson score) did not have a significant effect on the rate of veteran suicide compared with those who had no physical comorbidities (84.86 vs 84.65).

Unadjusted and adjusted hazard ratios and 95% CIs are presented in Table 2. The adjusted findings maintained the direction and general magnitude of the unadjusted estimates. Because of the unexpected finding that PTSD was associated with a lower risk of suicide, we evaluated whether the inverse hazard ratios for PTSD and suicide were limited to specific population subgroups defined by individuals' clinical or demographic characteristics. Specifically, we examined possible heterogeneity in

**TABLE 1—Sample Characteristics and Suicide Rate Among Depressed Veterans (N=807 694): United States, 1999–2004**

	No. of Suicides	Person-Years	Suicide Rates <sup>a</sup>
<b>Gender</b>			
Woman	46	159 020	28.92
Man	1 637	1 827 376	89.58
<b>Race</b>			
African American	74	273 294	27.08
White	1 582	1 665 034	95.01
Other	27	48 069	56.17
<b>Hispanic</b>			
No	1 636	1 884 833	86.80
Yes	47	101 563	46.28
<b>Any substance abuse<sup>b</sup></b>			
No	1 072	1 476 071	72.63
Yes	611	510 326	119.73
<b>Age, y</b>			
18–44	305	321 109	94.98
45–64	782	1 003 477	77.93
≥65	596	661 810	90.06
<b>Posttraumatic stress disorder<sup>b</sup></b>			
No	1 326	1 462 639	90.66
Yes	357	523 758	68.16
<b>Inpatient psychiatric stay (12 mo prior to entry)</b>			
No	1 517	1 891 447	80.20
Yes	166	94 949	174.83
<b>Charlson score (12 mo prior to entry)<sup>c</sup></b>			
0	1 042	1 231 003	84.65
≥1	641	755 394	84.86
<b>Service connection (12 mo prior to entry)<sup>d</sup></b>			
No	1 213	1 315 581	92.20
Yes	470	670 815	70.06
<b>Region of residence</b>			
Northeast	297	403 793	73.55
Central	367	441 666	83.09
South	663	745 570	88.93
West	356	395 367	90.04

<sup>a</sup>Suicide rates are calculated per 100 000 person-years.

<sup>b</sup>This was defined as any diagnosis of alcohol or substance use 12 months prior to entry into the study through end of study period.

<sup>c</sup>A weighted index designed to classify comorbid conditions to identify risk of mortality in longitudinal studies.

<sup>d</sup>Service connection indicated a Department of Veterans Affairs-recognized disability stemming from injuries or conditions that occurred or were exacerbated during military service.

the hazard ratios for PTSD and suicide by assessing whether there were statistical interactions between PTSD and each of the other covariates in the Cox proportional hazards models; we also examined interactions between age and gender and age and race. There was little evidence of statistical heterogeneity in these associations; however, in a fully adjusted model with the added interaction of PTSD and age, we did find that the protective effect of a diagnosis of PTSD increased with older age, where the hazard ratio of PTSD to no PTSD was 0.96 (95% CI=0.73, 1.26) in the subgroup of those aged 18 to 44 years, 0.80 (95% CI=0.58, 1.01) in the subgroup of those aged 45–64 years, and 0.66 (95% CI=0.44, 0.99) in the subgroup of those aged 65 years or older, after we adjusted for all other patient characteristic variables.

## DISCUSSION

Our study takes advantage of a large, nationally representative, longitudinal data set of depressed veterans whose causes of death have been definitively identified using linked National Death Index data. We are unaware of any other existing data source that would enable such precise assessment of patient characteristics associated with suicide among VA patients with depression. These findings can help identify depressed veterans at greatest risk of suicide, allowing providers in the VA health care system to more closely monitor these patients, and can provide policy makers with valuable information about high-risk veterans.

Overall, the rates of suicide among the depressed VA treatment population were 7–8 times higher than among the general population. The suicide rate in the general population from 1999 to 2004 (using the same years and age groupings as the veteran cohort used in this study) was 13.50 per 100 000 person-years,<sup>6</sup> whereas the overall rate for this suicide cohort was 88.25 per 100 000 person-years. However, suicide rates in the VA depressed population were similar to those of men receiving depression treatment in a large managed-care setting.<sup>21</sup> These populations are at high risk, requiring clinical vigilance and carefully designed and vigorous systematic efforts to reduce suicide risks.

**TABLE 2—Unadjusted and Adjusted Hazard Ratios for Suicide by Selected Covariates Among Depressed Veterans: United States 1999–2004**

	Unadjusted Hazard Ratio (95% CI)	Adjusted Hazard Ratio (95% CI)	Adjusted Results with PTSD × Age, Hazard Ratio (95% CI)
<b>Gender</b>			
Woman	0.33 (0.25, 0.44)	0.35 (0.26, 0.47)	0.35 (0.26, 0.47)
Man (Ref)	1	1	1
<b>Race</b>			
African American	0.29 (0.23, 0.36)	0.24 (0.19, 0.30)	0.24 (0.19, 0.30)
Other	0.61 (0.41, 0.87)	0.61 (0.42, 0.89)	0.61 (0.42, 0.89)
White (Ref)	1	1	1
<b>Hispanic</b>			
Yes	0.54 (0.40, 0.72)	0.47 (0.35, 0.63)	0.47 (0.35, 0.63)
No (Ref)	1	1	1
<b>Any substance abuse<sup>a</sup></b>			
Yes	1.70 (1.54, 1.87)	1.74 (1.55, 1.96)	1.74 (1.56, 1.96)
No (Ref)	1	1	1
<b>Age, y</b>			
≥ 65	0.91 (0.80, 1.00)	0.85 (0.73, 0.99)	0.90 (0.76, 1.01)
45–64	0.81 (0.71, 0.93)	0.74 (0.64, 0.84)	0.77 (0.66, 0.90)
18–44 (Ref)	1	1	1
<b>PTSD</b>			
Yes	0.78 (0.70, 0.87)	0.77 (0.68, 0.87)	0.96 (0.73, 1.26)
No (Ref)	1	1	1
<b>Previous inpatient stay for psychiatric disorder in last 12 mo</b>			
Yes	2.25 (1.92, 2.65)	1.92 (1.61, 2.28)	1.92 (1.61, 2.28)
No (Ref)	1	1	1
<b>Charlson score</b>			
≥ 1	0.99 (0.90, 1.10)	0.95 (0.86, 1.01)	0.95 (0.86, 1.01)
0 (Ref)	1	1	1
<b>Service connection<sup>b</sup></b>			
Yes	0.77 (0.69, 0.86)	0.86 (0.77, 0.96)	0.87 (0.78, 0.97)
No (Ref)	1	1	1
<b>Region</b>			
Northeast	0.83 (0.72, 0.95)	0.76 (0.66, 0.87)	0.76 (0.66, 0.87)
Central	0.93 (0.82, 1.01)	0.80 (0.71, 0.91)	0.80 (0.71, 0.91)
West	1.00 (0.90, 1.16)	0.92 (0.81, 1.01)	0.92 (0.81, 1.01)
South (Ref)	1	1	1
PTSD × Age ≥ 65 y	NA	NA	0.66 (0.44, 0.99)
PTSD × Age 45–64 y	NA	NA	0.80 (0.58, 1.01)

Note. CI = confidence interval; PTSD = posttraumatic stress disorder; NA = not applicable. A higher Charlson score indicates greater comorbidity.

<sup>a</sup>This was defined as any diagnosis of alcohol or substance use 12 months prior to entry into the study through end of study period.

<sup>b</sup>Service connection indicated a Department of Veterans Affairs–recognized disability stemming from injuries or conditions that occurred or were exacerbated during military service.

Congruent with our hypotheses, we found that the relative risk ratio for men compared with women in the depressed VA population was somewhat smaller than that reported for

the general population, with a male to female ratio of approximately 3:1 rather than 4:1.<sup>6</sup> These findings are similar to those of previous reports of a closing of the suicide gap between

men and women in depressed populations. We note that at least 1 study indicates an even smaller gap between men and women who likely have the most severe depression: patients discharged from inpatient settings.<sup>33</sup>

However, unlike the frequently reported increased risks of suicide among older versus younger individuals in the general population, we found that younger rather than older depressed veterans were at greater risk for suicide. However, we note that the conventional wisdom of older individuals being at greater risk for suicide than younger individuals<sup>5,38</sup> in the general population may be somewhat overstated. The 2004 data from the Web-Based Injury Statistics Query and Reporting System (WISQARS) of the National Center for Injury Prevention and Control suggest that rates of suicide are fairly constant across the adult age categories, with approximately 14 suicide deaths per 100 000 person-years (range: 13–15 per 100 000 among adults aged 20 years and older), although rates do rise among older White men and begin to rise in all men aged 75 years and older.<sup>6</sup> Our finding from depressed veterans indicated much higher rates (88.25 per 100 000 person-years), with the highest rates being among younger rather than among older people. Mental health professionals treating depressed veterans must be cognizant of these higher risks among younger veterans, who are perhaps particularly suffering from recent combat exposure; VA administrators and clinicians might consider targeted outreach to veterans in this age group.

Our results were consistent with the hypothesis that suicide rates would be higher in patients who had both depression and substance use, again indicating that these patients are at very high risk for suicide. However, we also had the surprising finding of reduced rates of suicide among depressed patients with comorbid PTSD.

Veterans with PTSD have been reported to have high levels of suicidal ideation and behaviors<sup>22</sup>; thus, it is unclear why veterans with comorbid depression and PTSD might be at lower risk for suicide than are depressed veterans without this comorbidity. Potentially, depressed veterans with comorbid PTSD are receiving more psychotherapy or other mental health treatment than are depressed veterans without this comorbidity, because the VA has



specific initiatives and funding dedicated to PTSD treatment for veterans. PTSD treatment also emphasizes psychotherapeutic approaches in addition to medication-based treatment approaches. For example, in our study group, we found that the rate of psychiatric hospitalization among patients with comorbid depression and PTSD was approximately twice as high as that among depressed veterans without PTSD (data not shown), although there were lower suicide rates in the veterans with comorbid depression and PTSD. We also note that our ability to adjust for prior psychiatric hospitalization and concurrent substance use, and to examine completed suicide rather than attempted suicide or ideation, is a unique strength of this study and may also have resulted in findings that diverged from some of the previous research on this topic. By contrast, our results were consistent with a previous study by Desai et al. that examined suicide in a large population of patients with a variety of diagnoses discharged from psychiatric settings, and reported decreased risk of suicide among patients with a PTSD diagnosis.<sup>33</sup>

Interestingly, we found that younger depressed veterans with a PTSD diagnosis had a higher rate of suicide than did older depressed veterans with PTSD. That is, a comorbid PTSD diagnosis appeared to have an inverse association that was stronger among older veterans. Further research is needed to determine how and why PTSD may be associated with a lower rate of suicide overall in this depressed veteran population while being associated with higher rates of suicide, as documented by other research on veterans. This finding again indicates that younger veterans may be a particularly high-risk group, whose access and use of psychiatric and psychological services should be closely monitored.

In this study, we also found that service connection was a protective factor for suicide. This is congruent with findings from a recent study from Desai et al. of patients who had been discharged from psychiatric inpatient stays.<sup>33</sup> Thus, veterans with service-connected disability may have reduced suicide risks as a result of their greater access to VA health services and regular compensation payments that bolster and stabilize their overall income.

We note that veterans from the northeast and central United States had lower rates of

suicide than do veterans from the South and West. These findings are in line with the geographic or regional variations in suicide rates and suggest that veterans share in the cultural or health system access factors that may promote higher rates of suicide in the general population in these same regions. Previous research suggests that the degree to which a region is rural or urban may influence rates of suicide.<sup>39,40</sup> Further research is needed to examine in finer detail the variation in suicide rates in specific states or hospitals.

We found that physical comorbidity status did not affect rates of suicide in this population. These findings are in contrast with the existing literature, which reports that medical illnesses<sup>41</sup> are typically associated with higher rates of suicide. In the case of medical illness, it is possible that our comorbidity measure, the Charlson Comorbidity Index, does not specifically identify rates of serious or terminal medical illnesses, which may increase the risk of suicide.

### Limitations

Although this study benefited from several strengths, there are some limitations to note. As with other studies using administrative claims data, there are some potentially key covariates that we cannot identify, such as a veteran's family structure, stress level, and details about potential prior suicide attempts. In addition, one should be careful about generalizing these findings to patient populations outside of the VA. In particular, this study was limited to veterans receiving care in the VA health care system, and these individuals are only a subset of all veterans.<sup>42</sup> However, the VA is the largest integrated health care delivery system in the United States, serving over 5 million people annually at over 1400 VA sites of care nationwide.<sup>43</sup> Therefore, this study can provide useful data about a significant proportion of the US population at high risk for suicide.

### Conclusions

This study provides important information regarding patient characteristics associated with higher risks for suicide among depressed veterans. These findings can assist clinicians and policy makers in determining which veterans to more closely monitor for signs and symptoms of potential suicidal behavior and which subgroups might be targeted first in

systematic efforts to reduce suicide. We found that the risk ratios between men and women were smaller among this population than among the general population, and that younger veterans rather than older veterans were most at risk. PTSD appeared to be inversely related to suicide among older but not among younger veterans with comorbid depression. Future research should investigate potential mediators and effect measure modifiers for the association between PTSD and suicide among depressed patients. For example, use and frequency of psychotherapy visits and adherence to psychiatric medications could influence the relationship between depression, PTSD, and completed suicide.

In addition, future research should examine the time periods in which depressed veterans may be at highest risk of suicidal behavior, because it is unlikely that the risk remains constant over time. For example, veterans may be at highest risk at specific time periods after completing military service, or during the course of psychiatric treatment, such as immediately after discharge from a psychiatric inpatient unit or during periods of treatment change, such as initiation and dose change of antidepressant therapy.

Furthermore, new VA research could examine nonclinical factors known to be associated with high rates of suicide, such as divorce or separation, low religiosity, and migration across state lines.<sup>44</sup> Other research could examine cultural and economic factors, such as poverty and exposure to mass media.<sup>45</sup> By further investigating the relationships between key characteristics associated with suicide, the psychiatric needs of depressed veterans can be better served and it is hoped that the rates of suicide throughout the veteran population will decline. This will be particularly important as a whole new cohort of military personnel who have fought in Afghanistan and Iraq become veterans and enter the VA health care system. ■

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### Contributors

K. Zivin was the primary author and supervised all data analysis and interpretation. H.M. Kim was a senior statistical consultant for this project. J.F. McCarthy assisted with study conception and article development. K.L. Austin assisted with the study and completed the analyses. K.J. Hoggatt was a senior epidemiological consultant for this project. H. Walters assisted with literature review and article preparation. M. Valenstein originated the overall study and supervised all aspects of its implementation.

### Human Participant Protection

This study was approved by the institutional review board at the Veterans Affairs Ann Arbor Health Center and the University of Michigan Medical School.

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