

# Changes in Suicide Mortality for Veterans and Nonveterans by Gender and History of VHA Service Use, 2000–2010

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**Objective:** Veterans are believed to be at high risk of suicide. However, research comparing suicide rates between veterans and nonveterans is limited, and even less is known regarding differences by history of Veterans Health Administration (VHA) service use. This study directly compared veteran and nonveteran suicide risk while for the first time differentiating veterans by VHA service use.

**Methods:** The cross-sectional study analyzed data from 173,969 adult suicide decedents from 23 states (2000–2010) included in the U.S. Department of Veterans Affairs suicide data archive. Annual standardized mortality ratios (SMRs) were computed for veterans compared with nonveterans and for veterans who used VHA services compared with veterans who did not, overall and separately for males and females.

**Results:** After the analysis controlled for age and gender differences, the number of observed veteran suicides was

approximately 20% higher than expected in 2000 (SMR=1.19, 95% confidence interval [CI]=1.10–1.28), and this increased to 60% higher by 2010 (SMR=1.63, CI=1.58–1.68). The elevated risk for female veterans (2010 SMR=5.89) was higher than that observed for male veterans (2010 SMR=1.54). Trends for non-VHA-utilizing veterans mirrored those of the veteran population as a whole, and the SMR for VHA-utilizing veterans declined. Since 2003, the number of suicides among VHA-utilizing veterans was less than expected when compared directly with the suicide rate among non-VHA-utilizing veterans.

**Conclusions:** Veterans are members of the community and, as such, are an important part of observed increases in U.S. suicide rates. Not all veterans are at equal or increasing risk of suicide, however. VHA-utilizing veterans appear to have declining absolute and relative suicide rates.

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In 2010, suicide was the tenth leading cause of death in the United States (1). Although preventing suicide is a complicated problem, the National Strategy for Suicide Prevention asserts that suicide is indeed preventable (2). In 2012, the National Action Alliance for Suicide Prevention made suicide a top public health priority, setting the goal to save 20,000 lives in the next five years (2). To achieve this goal, the strategy called for the development of an agenda prioritizing research on individuals at increased risk of suicide. Members of the Armed Forces and veterans were among 11 high-risk populations of interest named in this call to action.

An increase in suicide among active military personnel has been documented (3,4). Further research is needed, however, to better understand the distribution of suicide risk among veterans after active-duty service and to understand population-based differences between those with and without a history of military service, after accounting for key demographic differences (5–7). The demographic composition of the veteran population is changing as the proportions of younger, female, and nonwhite veterans increase (8). There are also early indicators

of changes in the prevalence of service-related injuries, such as traumatic brain injury (9), and exposures, such as military sexual trauma (10), that may precipitate changes in suicide risk among post-9/11 veterans (11,12). A more complete picture of the absolute and relative risk of suicide for all veterans and within meaningful subgroups is necessary to appropriately target and evaluate treatment and prevention programs, allocate suicide prevention resources, and track changes in suicide rates over time.

A small number of studies limited to veterans who used services provided by the Veterans Health Administration (VHA) observed a 42% to 66% increase between 2000 and 2007 in relative risk of suicide compared with the general U.S. population (13,14), but these studies were unable to determine the absolute or relative mortality for veterans not using VHA services. Little is known about differences in suicide rates between veterans who use VHA services and those who do not. One study estimated a 50% increased risk among male veterans using VHA services (15). Although these findings are important, they may not be generalizable to the broader veteran population.

Thus, as an initial step toward improving our understanding of suicide risk among veterans, this study aimed to characterize veteran suicide risk compared with risk among nonveterans, characterize differences in relative suicide risk between veterans with and without a history of VHA service use, and examine the role gender plays in these differences.

## METHODS

### Study Population

Data for this project were obtained from the U.S. Department of Veterans Affairs (VA) archive of state suicide data. Data collection is ongoing and includes suicide mortality information (ICD-10 codes X60–X84 and Y87.0) directly from state death certificate records beginning with calendar year 1999 (16). Information was analyzed for all suicides of persons age 18 years and older reported by 23 states with available, validated data for 2000–2010. Four Northeastern states (New Jersey, New York, Pennsylvania, and Rhode Island), five Midwestern states (Iowa, Kansas, Michigan, Minnesota, and Nebraska), eight Southern states (Alabama, Arkansas, Florida, Louisiana, North Carolina, Tennessee, Texas, and West Virginia), and six Western states (Alaska, Idaho, Montana, Oregon, Utah, and Washington) were included. The 2010 suicide rates for these states ranged from 8.0 to 23.1 per 100,000; ten states were at or below the national average of 12.4 per 100,000, and 13 were above it (17).

### Variable Classifications

Variables for age at death, gender, and cause of death were used as reported on the death certificate. Veteran status was validated through an extensive linking procedure using VA and Department of Defense data (16). Veteran status of all suicide decedents is validated by using this process, regardless of an indication of military history on the death certificate. “VHA-utilizing veterans” were defined as validated veterans with any record of VHA service use in the fiscal year prior to or of death. Service utilization included any inpatient, outpatient, extended, or fee-basis care recorded in the National Patient Care Database. Receipt of pharmacy benefits only was not considered service utilization. [Details of the suicide decedent validation process are illustrated in a figure included in an online supplement to this report.]

### Statistical Analysis

Age and gender distributions were compared over time for four groups: all veterans, VHA-utilizing veterans, non-VHA-utilizing veterans, and nonveterans. Age at death was categorized to capture meaningful age-related differences in suicide rates and to permit direct comparison to population estimates (18–29, 30–39, 40–49, 50–59, 60–69, 70–79, and  $\geq 80$ ). Annual crude suicide rates were computed overall for each study group as the number of suicide deaths divided by the corresponding population at risk and reported per 100,000 lives. Direct age-adjusted suicide rates (18) were also computed for veterans and nonveterans overall and by gender but not by VHA utilization

history because of sample size limitations. Estimates for the population at risk in each group within age- and gender-defined strata were computed on the basis of data for the 23 states of interest from the American Community Survey (ACS), National Center for Veterans Analysis and Statistics (VetPop), and VHA Support Services Center. For each calendar year, the total veteran population was determined by using VetPop estimates, and the nonveteran population was computed by subtracting VetPop estimates from ACS figures. The population of VHA-utilizing veterans was estimated from VHA support service figures, and the non-VHA-utilizing veteran population was computed by subtracting VHA figures from VetPop estimates. VetPop figures are reported by fiscal year (October 1–September 30) but were assumed to closely estimate the calendar year veteran population.

To compare suicide-specific mortality between veterans and nonveterans, annual standardized mortality ratios (SMRs) were computed for all veterans and by VHA utilization history. Overall age- and gender-standardized SMRs were computed as well as gender-stratified, age-standardized SMRs. To evaluate precision, 95% likelihood ratio-based confidence intervals were computed (19). SMRs were computed as the ratio of observed to expected suicides. The expected number of suicides for a given year and for a veteran subgroup were computed by multiplying the population at risk by the corresponding calendar year-, age-, and gender-specific nonveteran suicide rates. To enhance comparability of findings for VHA-utilizing and non-VHA-utilizing veterans, overall and gender-stratified SMRs for VHA-utilizing veterans were also computed by using non-VHA-utilizing veteran suicide rates as the standard. A sensitivity analysis computing gender-specific direct age-adjusted rate ratios was conducted for veterans compared with nonveterans. All procedures were approved by the Syracuse (New York) VA Medical Center Institutional Review Board.

## RESULTS

Of the 173,969 suicide decedents included in the data, 25% were veterans; 20% did not have a history of VHA service use, and 5% were VHA-utilizing veterans. Veteran suicide decedents were older than nonveteran suicide decedents, and a larger proportion was male. From 2000 to 2010, the proportion of veteran suicide decedents with a recent history of VHA service use increased marginally (17% to 19%), and the proportion of all veterans using VHA services nearly doubled (from 14% to 25%) (Table 1). Due primarily to an influx of younger veterans and an increase in VHA service use among veterans over age 60, the number of VHA-utilizing veterans increased by approximately one million during the study period despite a decrease in the overall veteran population of nearly two million.

From 2000 to 2010, both the crude and age-adjusted veteran suicide rates increased by approximately 25% while the comparable nonveteran rates increased by approximately 12% (Table 2 and Figure 1). Of note, a 13% increase was observed for nonveteran females (4.8 to 5.4 per 100,000 lives)

**TABLE 1. Changes in the distribution (%) of demographic characteristics among persons in 23 states, by veteran status and use of Veterans Health Administration (VHA) services, 2000–2010<sup>a</sup>**

Characteristic	Nonveterans		All veterans		VHA-utilizing veterans		Non-VHA-utilizing veterans	
	2000	2010	2000	2010	2000	2010	2000	2010
Age								
18–29	24.4	23.6	4.0	4.6	2.8	4.6	4.2	4.6
30–39	21.7	17.8	10.2	8.2	6.3	5.8	10.8	9.0
40–49	21.1	18.8	14.2	13.9	13.5	9.4	14.3	15.4
50–59	13.7	18.0	23.9	17.1	22.2	16.8	24.2	17.3
60–69	8.6	11.4	19.4	25.7	18.4	29.9	19.5	24.3
70–79	6.3	6.3	20.7	17.0	25.6	17.7	19.8	16.8
≥80	4.2	4.1	7.7	13.4	11.2	15.9	7.2	12.6
Gender								
Male	41.5	43.8	94.1	92.1	90.5	91.3	94.7	92.4
Female	58.5	56.2	5.9	7.9	9.5	8.7	5.3	7.6
Use of VHA services	—	—	14.1	25.2	—	—	—	—
Population total	92,360,633	107,236,975	13,278,669	11,299,133	1,877,407	2,844,529	11,401,262	8,454,604

<sup>a</sup> Percentages represent the population of veterans and nonveterans; thus the population total indicates the total population at risk of suicide in a given group and year in 23 states (Alabama, Alaska, Arkansas, Florida, Idaho, Iowa, Kansas, Louisiana, Michigan, Minnesota, Montana, Nebraska, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Washington, and West Virginia).

while a 40% increase was observed for veteran females (24.7 to 34.6 per 100,000). Although VHA-utilizing veterans experienced a higher suicide rate in 2000 than non-VHA-utilizing veterans (34.5 versus 27.6 per 100,000), the suicide rate among VHA-utilizing veterans declined over the study period, and by 2010, the rate among VHA-utilizing veterans was lower than the rate among non-VHA-utilizing veterans (27.6 versus 38.7 per 100,000).

After accounting for age and gender differences using SMRs, the number of observed suicides among veterans was significantly higher than expected had suicide rates been the same as those observed for nonveterans. Specifically, in 2000 the number of observed veteran suicides was approximately 20% higher than expected, and the number increased to over 60% higher than expected in 2010. Findings for males followed the same pattern. Observed suicides among female veterans, however, were 390% higher than expected in 2000, increasing to nearly 490% higher than expected in 2010 (Figure 2).

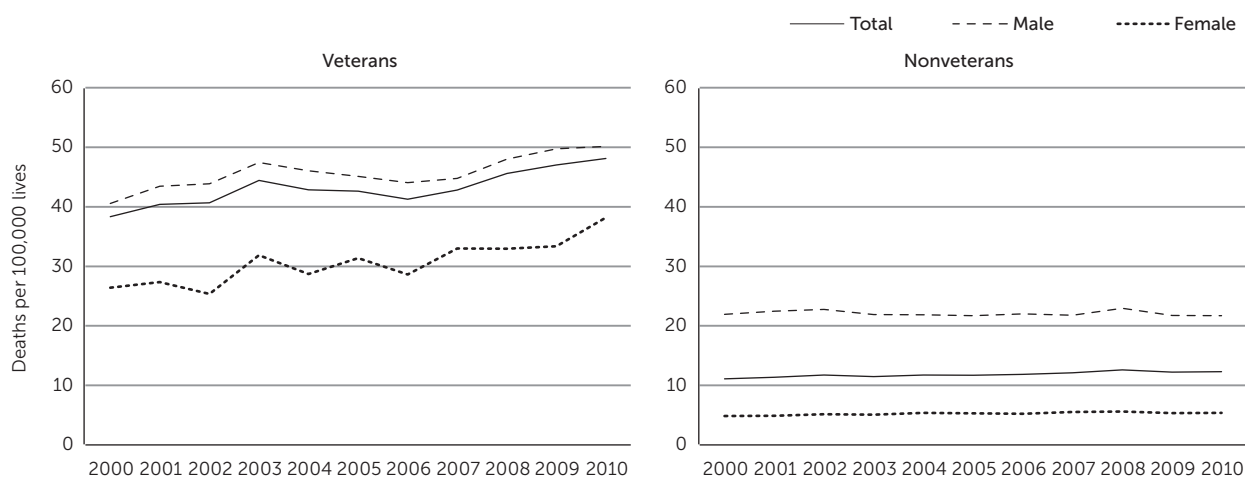
In addition to gender differences, meaningful differences emerged when VHA service utilization was examined. Although the magnitudes and time trends for non-VHA-utilizing veterans mirrored those of the veteran population as a whole, this was not the case for VHA-utilizing veterans (Figure 2). In 2000, the age- and gender-adjusted SMR for VHA-utilizing veterans compared with nonveterans was greater than that for non-VHA-utilizing veterans, but it declined considerably over the next three years. From 2003 to 2010, SMRs for VHA-utilizing veterans compared directly with non-VHA-utilizing veterans were significantly less than 1 (Figure 2), indicating that the observed number of suicides for VHA-utilizing

veterans was less than expected had their suicide rates been the same as for non-VHA-utilizing veterans. The sensitivity analysis [see online supplement] suggests that these SMRs provide conservative estimates of the relative risks of interest, which may be slightly higher.

Finally, considering gender and VHA service utilization simultaneously, the decline in SMRs among VHA veterans was primarily observed for males (Figure 2). In 2000, male VHA-utilizing veterans experienced 36% more suicides than expected compared with their nonveteran peers; this declined to a low of 16% in 2003 and increased slightly to 23% by 2010. Conversely, no clear period of change emerged for female VHA-utilizing veterans, who experienced approximately one-and-a-half to two times the number of suicides expected compared with nonveteran females. Estimates for female VHA-utilizing veterans were less precise due to the small number of annual suicides in some age groups. When female VHA-utilizing

**TABLE 2. Crude suicide rates (deaths per 100,000 lives at risk) among veterans and nonveterans and by use of Veterans Health Administration (VHA) services, 2000–2010**

Year	Nonveterans			Veterans				
	Total	Male	Female	Total	Male	Female	VHA-utilizing	Non-VHA-utilizing
2000	11.1	20.1	4.8	28.6	28.8	24.7	34.5	27.6
2001	11.4	20.5	4.9	29.4	29.6	26.4	32.4	28.8
2002	11.8	21.0	5.1	30.1	30.5	24.3	32.1	29.6
2003	11.5	20.4	5.0	31.3	31.4	29.3	29.2	31.8
2004	11.8	20.5	5.4	30.8	31.1	26.6	30.1	31.0
2005	11.8	20.4	5.3	31.8	32.0	28.5	29.9	32.3
2006	11.9	20.9	5.2	31.5	31.9	26.9	29.8	32.0
2007	12.2	21.0	5.5	33.1	33.2	30.7	28.8	34.3
2008	12.7	22.0	5.6	33.9	34.2	30.4	30.9	34.8
2009	12.3	21.4	5.3	35.7	36.0	31.7	30.1	37.4
2010	12.4	21.4	5.4	35.9	36.0	34.6	27.6	38.7

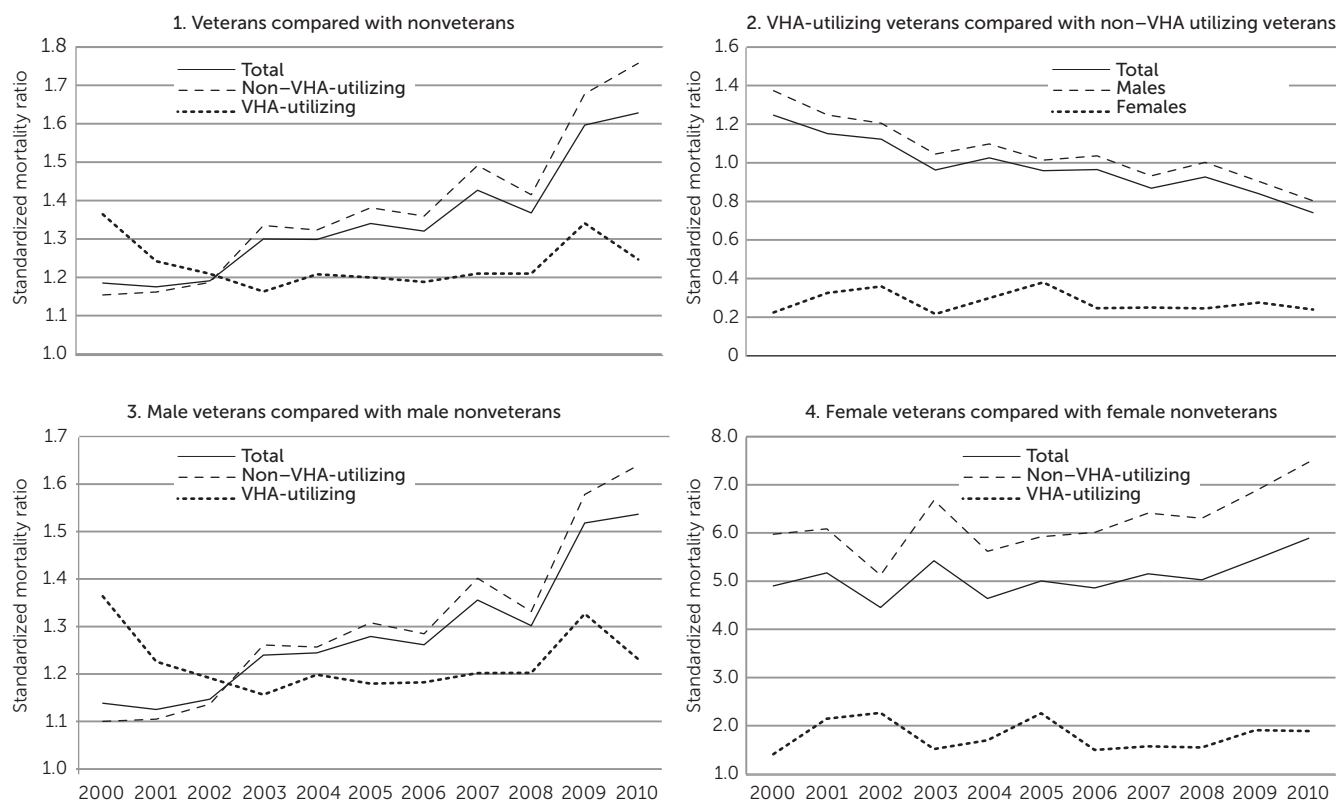
**FIGURE 1. Direct age-adjusted suicide rates (per 100,000 lives) among adult veterans and nonveterans, overall and by gender, 2000–2010**

veterans were compared directly with female non-VHA-utilizing veterans, however, SMRs were consistently and significantly less than 1, indicating that female VHA-utilizing veterans experienced fewer suicides than expected if their rates had been similar to veterans who did not use VHA services (Figure 2 and online supplement). Female veterans who did not use VHA services experienced the greatest

number of excess suicides compared with their nonveteran peers throughout the study period (Figure 2).

## DISCUSSION

Evidence of increasing suicide risk among select U.S. subgroups is mounting (20). Most notably, significant increases

**FIGURE 2. Standardized veteran suicide mortality ratios, 2000–2010<sup>a</sup>**

<sup>a</sup> All lines in panel 1 and the total line in panel 2 are age and gender standardized. All other SMRs are gender stratified and age standardized. An SMR of 1 indicates that the number of observed deaths equals the number of expected cases.

have been observed among middle-aged men and women since 1999 (21). The question of how veterans contribute to this change has received considerable attention in recent years (5–7). Prior SMR estimates using indirect estimation methods for VHA-utilizing veterans compared with the general population have been published (13,14). Suicide SMRs for VHA patients by fiscal year were previously reported to have decreased from 1.7 in 2000 to 1.4 in 2007 (14). To the best of our knowledge, however, ours is the first study to directly compare veteran and nonveteran suicide risk using a validated variable for veteran status while documenting differences in suicide rates between veterans who were VHA service users and those who were not. On the basis of these analyses, veterans appear to be another select U.S. subpopulation experiencing greater than average increases in suicide rates. Importantly, however, such increases were not observed uniformly across the veteran population. Crude suicide rates declined among veterans using VHA services from 2000 to 2010, and, even after the analysis accounted for age and gender, the excess risk among VHA-utilizing veterans compared with their nonveteran peers decreased as well. Conversely, increases in suicide rates among veterans without a history of VHA service use were occurring alongside, and more rapidly than, increases among U.S. adults without a history of military service. It is reasonable to assert, therefore, that factors within the veteran population may make this group particularly susceptible to stressors and subsequent mental health conditions associated with increased risk of suicide (22), which may be partially mitigated by use of VHA services.

Combat-related exposures have been suggested as one factor contributing to increases in veteran suicide risk compared with nonveterans; however, recent research indicates that this may not fully explain observed differences (3). Alternatively, increased suicide risk among some veteran groups may be related to characteristics that are not unique to veterans but that may be associated with selection into military service. For example, adverse childhood experiences have been shown to increase the risk of a suicide attempt (23) and may serve as motivating factors for selecting military service (24)—essentially providing an escape route from suboptimal family environments. Additional research is needed on factors differentially associated with selection of U.S. military service that may explain differences in suicide risk. It is also possible that veterans are overrepresented in populations that are particularly vulnerable to stressors related to suicide, such as the recent economic downturn (25), that affect the U.S. population as a whole. These may include marginally employed populations or those with greater economic vulnerability (26) and homeless populations (27).

Study findings clearly suggest that veterans without a history of VHA service use are at particularly high risk of suicide. However, it is likely that this group is quite heterogeneous, and national data on clinical characteristics and risk exposures are not readily available. Although some veterans who do not use VHA services may be healthy or may have private health insurance, others may choose not to use VHA services

for reasons related to difficulties accessing care, misconceptions regarding quality of care, a lack of knowledge about eligibility for services, or perceived stigma surrounding seeking mental health care. Research is warranted to better understand suicide risk among veterans who do not use VHA services and whether characteristics related to VHA service eligibility and use are related to suicide risk.

In addition, despite overall improvements, clear gender differences emerged for veterans who used VHA services. SMRs for VHA-utilizing and non-VHA-utilizing female veterans were substantially higher than those observed for males. Although female veterans who used VHA services consistently experienced fewer suicides than expected relative to female veterans who did not use VHA services, there was no meaningful change in this estimate over time. Conversely, SMRs decreased over time among male VHA-utilizing veterans. Research on risk and protective factors unique to female veterans is needed.

Finally, although most of the decline in SMRs among VHA-utilizing veterans in this study occurred prior to the onset of activities in support of current VHA suicide prevention programs (28), this does not suggest that prevention programs have been ineffective. Rather, the plateau observed among VHA-utilizing veterans from 2004 to 2009 occurred in contrast to a rising suicide rate among non-VHA-utilizing veterans. One possible reason for this relative stability could be that VA's Mental Health Enhancement Initiative and Suicide Prevention Program are successfully countering rising veteran suicide rates. That said, gender differences discussed above suggest possible gender-based differences in the effectiveness of VA suicide prevention initiatives. There may also be differences in health and demographic factors among male and female veterans who use VHA services, or there may be a difference in baseline risk of suicide related to eligibility for or self-selection into VHA services that may vary by gender. These results further support continued efforts to better understand health disparities, including suicide, among women veterans and the most effective clinical and public health strategies to prevent suicide among this fastest-growing subgroup of veterans.

Although this study is a novel and important contribution to the literature, it had limitations. The data source was limited to suicides. Because information was not available on other causes of death, particularly undetermined causes and accidental overdoses, it was not possible to account for potential misclassification of suicides as other causes of death. Such misclassification likely differs by age and gender (29). Misclassification may also differ by veteran status given that the availability of information to classify cause of death might vary by veteran status and veterans are more likely to use firearms for suicide, a mechanism that is less likely to lead to misclassification. At this time, however, death certificates are the gold standard for documenting the cause of death and were used as such in this study. In addition, although this study reported only on the first 23 states that provided complete data to the VA's suicide mortality database, it appears



that the first 23 states are representative of the United States as a whole in terms of geographic distribution and the range of state-specific suicide rates. As the database expands, analyses will continue to extend information and improve precision for female veterans who use VHA services. Finally, for this initial analysis, SMRs were chosen to estimate the true standardized rate ratios. The utility of this measure for dealing with sparse data while providing valid estimates to compare mortality between populations makes this approach preferable to other methods such as direct standardization (30). Specifically, a relatively small number of suicides for a single year within certain age groups of VHA-utilizing female veterans made direct age-adjustment of suicide rates in this group infeasible at this time. However, given that SMRs only estimate the true rate ratio of interest, we conducted a sensitivity analysis computing gender-specific direct age-adjusted rate ratios for all veterans compared with nonveterans; the results demonstrated that the SMR truly does provide a conservative estimate, and time trends observed were very similar [see online supplement]. Likewise, it is safe to assume that the SMR is an appropriate, conservative estimate to compare veterans who do and do not use VHA services.

In summary, these novel findings indicate a decline in the relative risk of suicide among VHA-utilizing veterans compared with their nonveteran peers despite continued increases among veterans who did not use VHA services. The VA Mental Health Enhancement Initiative launched in 2005 and the Suicide Prevention Program launched in 2007 are designed to provide readily available, integrated care through awareness and education campaigns, a 24-hour Veterans Crisis Line, and placement of suicide prevention coordinators to track and follow up with high-risk patients in each VA medical center, with evidence-based treatments available for high-risk patients. Research is needed to directly evaluate the impact of these programs overall on veteran suicide rates in recent years and to identify which components of the program are or are not effective. For example, a recent evaluation of Denmark's suicide prevention clinics demonstrates a possible approach to evaluating national VA suicide prevention initiatives (31). In addition, parallel research is needed to determine how to best engage eligible, at-risk veterans not currently utilizing VHA services.

## CONCLUSIONS

In 2009, suicide became the most common cause of violent (32) and injury-related (33) deaths in the United States, which has drawn considerable and renewed attention to the need for enhanced prevention efforts. This report offers new, valuable insight into changes in suicide among veterans during this period of national increase. Consistent with previous analyses, our results indicate that suicide is a complex outcome, with risk mediated by individual and service-related characteristics, such as gender, age, and VHA service use. Combating veteran suicide is certainly a high priority within the VHA, and veterans should continue to be recognized as a high-priority suicide research population. On the basis of the 2010 veteran suicide

rate observed in this study (35.9 per 100,000 lives) and the fact that there are approximately 22 million living veterans in the United States (11), the potential exists to save approximately 800 lives annually by reducing veteran suicide rates by 10%. Such a reduction would be a considerable step toward reaching our nation's overall suicide reduction goal of 4,000 lives annually over the next five years.

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