Characteristics and Injury Mechanisms of Veteran Primary Care Suicide Decedents with and without Diagnosed Mental Illness

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BACKGROUND: In the United States, suicide rates are increasing among nearly all age groups. Primary care is a critical setting for suicide prevention, where interventions often rely on identifying mental health conditions as indicators of elevated suicide risk.

OBJECTIVE: Quantify the proportion of suicide decedents within primary care who had no antecedent mental health or substance use diagnosis.

DESIGN: Retrospective cohort study.

PARTICIPANTS: Veterans who received Veterans Health Administration (VHA) primary care any time from 2000 to 2014 and died by suicide before 2015 ($n = 27,741$).

MAIN MEASURES: We categorized decedents by whether they had any mental health or substance use diagnosis (yes/no) using ICD-9 codes available from VHA records. We compared sociodemographic, clinical, and suicide mechanism characteristics between groups using chi-square, Student's *T*, or Wilcoxon tests.

RESULTS: Forty-five percent of decedents had no mental health or substance use diagnosis. Decedents without such a diagnosis were older (68 vs. 57 years, $p < 0.001$), and more likely to be male (98.3% vs. 95.8%, $p < 0.001$), non-Hispanic White (90.6% vs. 87.9%, $p < 0.001$), married/partnered (50.4% vs. 36.6%, $p < 0.001$), and without military service-connected disability benefits (72.6% vs. 56.9%, $p < 0.001$). They were also more likely to die from firearm injury (78.9% vs. 60.7%, $p < 0.001$). There were statistically significant differences in physical health between groups, but the magnitudes of those differences were small. Decedents without a mental health or substance use diagnosis had significantly shorter durations of enrollment in VHA healthcare, less healthcare utilization in their last year of life, and had little utilization aside from primary care visits.

CONCLUSIONS AND RELEVANCE: From 2000 to 2014, of nearly thirty thousand VHA primary care patients who died by suicide, almost half had no antecedent mental health or substance use diagnosis. Within VHA primary care settings, suicide risk screening for those with and without such a diagnosis is indicated.

KEY WORDS: suicide; firearm; primary care; veteran.

INTRODUCTION

Suicide is the tenth leading cause of death in the United States (US).[1] The suicide rate is approximately 20% higher among veterans in comparison with age and sex-matched non-veterans.[2] Many suicide prevention interventions within the Veterans Health Administration (VHA) and elsewhere rely on identification and treatment of individuals with mental health conditions that are established risk factors for suicide (e.g., depression).[4]

Investigations conducted within non-VHA and military settings have found that 36–54% of those with suicidal behavior had no prior mental health diagnosis.[3–7] Those studies relied on psychological autopsy to establish mental health diagnoses post-mortem,[5] were conducted in systems without widespread mental health screening protocols,[4, 6–8] or focused

on commercially-insured[3, 9] or relatively young populations (most were under 50).[3, 4, 6, 7] Military servicemembers also have other important risk factors for suicide (e.g., physical and/or psychological traumas) and may underreport mental health issues due to privacy concerns.[10, 11]

Understanding what proportion of veterans have recognized mental health or substance-related conditions prior to their suicide is critical for informing suicide risk screening strategies. Veterans have a higher prevalence of mental health and substance-related conditions in comparison with other US adults, and one-fourth of VHA primary care patients have established mental health or substance-related conditions.[12,13] However, of 968 veterans who died by suicide in Oregon from 2000 to 2005, 57% had no recognized mental health condition prior to their death.[14] In that study, investigators used state death certificate data to ascertain decedents' veteran status which is a method prone to misclassification.[15] That study was also conducted before a significant expansion of VHA's mental health screening procedures.

Primary care is a critical setting for the identification and management of suicide risk. Nearly half of suicide victims have contact with a primary care provider within one month of their death and more than five million veterans are seen in VHA primary care clinics annually.[16,17] However, within primary care populations, the proportion of suicide decedents who have mental health diagnoses prior to their death is unknown. The aim of this study was to quantify what proportion of suicide decedents who received primary care within VHA had antecedent mental health or substance use diagnosis, and compare characteristics between those with and without such diagnoses. Because suicide risk, risk factors, and methods differ between groups, we stratify analyses by race, sex, and ethnicity.

METHODS

Study Design

We conducted a retrospective cohort study of veterans who received VHA primary care from 2000 to 2014 and died by suicide before 2015. We used data from the VHA Corporate Data Warehouse (CDW) to identify all veterans who were assigned a primary care provider at any time during the study period. Using social security numbers, we identified those who died by suicide from the Department of Veterans Affairs (VA) and Department of Defense Joint Mortality Data Repository (MDR).[18–20] The MDR includes information from the National Death Index (NDI), including cause of death classified by ICD-10 codes (suicide: X60-X84, Y87.0).[21] We excluded veterans whom we could not match to MDR records (0.1% of sample). Further details regarding matching veterans to NDI data are published elsewhere.[19]

Mental Health Diagnoses

Using ICD-9 codes available in the VHA CDW from 1999 to 2014, we categorized decedents by whether they had any mental health diagnosis (yes/no). Diagnoses of interest included depression, post-traumatic stress disorder (PTSD), anxiety disorder, serious mental illness (SMI; schizophrenia or bipolar disorder), or substance use disorder (SUD). Veterans were considered to have SUD if records revealed one inpatient or outpatient encounter that included a diagnostic code for a drug or alcohol use disorder (excluding tobacco use). All other diagnoses were considered present if relevant diagnostic codes were present during one inpatient or two outpatient encounters. We used different thresholds because VA administrative records have low sensitivity for identifying substance-related disorders in comparison with other mental health diagnoses.[22, 23]

Measures

We abstracted sociodemographic characteristics from the CDW including age, sex, race, ethnicity, marital status, and percent service connection; a marker of military service-connected disability. We characterized each veteran's rurality (using Rural-Urban Continuum Codes) and US census region using address data, and county-level unemployment percentage using Bureau of Labor & Statistics data.[24, 25] We calculated the Gagne comorbidity index for each veteran using ICD-9 codes.[26] The Gagne index predicts one-year mortality based on the presence of certain mental and physical health diagnoses (e.g., malignancy, depression).[26] Scores were calculated for decedents who had at least one Gagne condition. To assess physical health, we calculated a limited Gagne score in which we excluded mental health diagnoses. We used enrollment and encounter data to assess VHA enrollment duration and clinical encounters within one year of death.[26] To assess recent changes in physical health, we identified Gagne conditions that were newly recorded within one year of death. Veterans have a high prevalence of traumatic brain injury (TBI), a condition associated with increased suicide risk.[27–29] As such, a veteran was identified as having a history of TBI if relevant diagnostic codes were present during one inpatient or two outpatient encounters (ICD-9 codes 800.0–801.9, 803.0–804.9, 850.0–854.1). We identified mechanism of suicide (e.g., firearm) using ICD-10 codes available from the MDR.

Statistical Analysis

We summarized sociodemographic, clinical, and mechanism of death characteristics for the overall sample and compared differences between those with and without any mental health diagnosis using chi-square, Student's *T*, or Wilcoxon tests. We repeated analyses stratifying by sex, race, and ethnicity. Findings are reported consistent with Sex and Gender Equity in Research guidelines.[30] We used SAS (version 9.4; SAS

Table 1 Sociodemographic characteristics of VHA-enrolled suicide decedents with and without mental health diagnoses, 2000–2014

	Total n=27,741	No MH diagnosis n=12,480 (45.0%)	MH diagnosis n=15,261 (55.0%)	p value
Age, mean years (SD)	62 (16)	68 (16)	57 (15)	< 0.001
Age groups, n (%)				< 0.001
18–34 years	1906	561 (4.5%)	1345 (8.8%)	
35–54 years	6818	1841 (14.8%)	4977 (32.6%)	
55–64 years	6448	2021 (16.2%)	4427 (29.0%)	
65–79 years	7872	4543 (36.4%)	3329 (21.8%)	
80+ years	4692	3511 (28.1%)	1181 (7.7%)	
Male sex, n (%)	26,883	12,267 (98.3%)	14,616 (95.8%)	< 0.001
Race/ethnicity, n (%)				< 0.001
Non-Hispanic, White	19,938	8255 (90.6%)	11,683 (87.9%)	
Non-Hispanic, Black	1164	423 (4.6%)	741 (5.6%)	
Non-Hispanic, other	586	190 (2.1%)	396 (3.0%)	
Hispanic	717	241 (2.7%)	476 (3.5%)	
Marital status, n (%)				< 0.001
Married/partnered	11,730	6183 (50.4%)	5547 (36.6%)	
Separated/widowed/divorced	11,561	4673 (38.1%)	6888 (45.4%)	
Never married	4134	1407 (11.5%)	2727 (18.0%)	
Service connection, n (%)				< 0.001
None	17,735	9056 (72.6%)	8679 (56.9%)	
< 50%	5283	2386 (19.1%)	2897 (19.0%)	
≥ 50%	4719	1034 (8.3%)	3685 (24.2%)	
Local unemployment rate, mean % (SD)	7.0 (2.8)	6.9 (2.7)	7.1 (2.8)	< 0.001
US Census region, n (%)				< 0.001
Northeast	3103	1421 (11.5%)	1682 (11.2%)	
Midwest	5726	2576 (20.9%)	3150 (20.9%)	
South	11,616	5336 (43.2%)	6280 (41.6%)	
West	6985	3011 (24.4%)	3974 (26.3%)	
Rurality, n (%)				< 0.001
Rural	2122	979 (7.9%)	1143 (7.5%)	
Urban	10,712	4663 (37.6%)	6049 (39.9%)	
Suburban	14,743	6757 (54.5%)	7986 (52.6%)	

Abbreviations: VHA, Veterans Health Administration; MH, mental health; US, United States
Denominators for column percentages include only those with non-missing data

Institute, Inc., Cary, NC) for all analyses. These evaluation efforts are part of ongoing quality improvement efforts at VHA and are not considered research activity or subject to institutional review board review or waiver.

RESULTS

Of 9,550,726 veterans enrolled in VHA primary care from 2000 to 2014, 2,724,002 died (28.5%) and 27,741 (1.0%) died by suicide. Of those, 15,261 (55.0%) met criteria for at least one mental health or substance use diagnosis (Table 1).

The mean age of the suicide decedent sample was 62 years, 96.9% were male, 89.0% were non-Hispanic White, and 42.8% were married or partnered (Table 1). Thirty-six percent of the sample had service-connected disability benefits, and 7.7% and 53.5% lived in rural and suburban areas, respectively. In comparison with those who had a mental health or substance use diagnosis, decedents without such a history were more likely to be older (68 vs. 57 years, $p < 0.001$), male (98.3% vs. 95.8%, $p < 0.001$), non-Hispanic White (90.6% vs. 87.9%, $p < 0.001$), married or partnered (50.4% vs. 36.6%, $p < 0.001$), and without disability benefits (72.6% vs. 56.9%, $p < 0.001$). Although statistically significant, only small differences were observed between groups in geographic characteristics (e.g., unemployment rate, rurality).

Of those who had at least one mental health or substance use diagnosis, 73.2% had a depressive disorder, 25.5% had PTSD, 32.9% had an anxiety disorder, 22.0% had an SMI, and 50.4% had an SUD (Table 2). Those without mental health diagnoses were less likely to have a history of TBI (0.4% vs. 2.5%, $p < 0.001$) and at least one Gagne comorbidity condition (57.5% vs. 86.2%, $p < 0.001$). Among those with at least one Gagne condition, decedents without a mental health or substance use diagnosis had lower Gagne comorbidity scores (0.8 vs. 1.1, $p < 0.001$) and fewer total Gagne conditions (2.7 vs. 3.4, $p < 0.001$). Decedents without a mental health or substance use diagnosis had higher limited Gagne comorbidity scores (0.8 vs. 0.7, $p < 0.01$) in which only physical health diagnoses were considered. In the year prior to death, decedents without a mental health or substance use diagnosis were less likely to be diagnosed with a Gagne condition (34.7% vs. 56.9%, $p < 0.001$) or physical health Gagne condition (31.8% vs. 41.2%, $p < 0.001$).

In comparison with those who had a mental health or substance use diagnosis, decedents without such a history had significantly shorter durations of enrollment in VHA (7.1 vs. 7.7 years, $p < 0.001$) and VHA primary care (4.0 vs. 5.0 years, $p < 0.001$). In their last year of life, they had significantly fewer primary care (2.3 vs. 4.3), mental health (0.1 vs. 7.7), and emergency department visits (0.2 vs. 0.6), and were

Table 2 Clinical characteristics and healthcare utilization of VHA-enrolled suicide decedents with and without mental health diagnoses, 2000–2014

	Total *n* = 27,741	No MH diagnosis *n* = 12,480 (45.0%)	MH diagnosis *n* = 15,261 (55.0%)	*p* value
Mental health diagnoses, *n* (%)				
Depression	11,171	-	11,171 (73.2%)	
PTSD	3886	-	3886 (25.5%)	
Anxiety disorder	5014	-	5014 (32.9%)	
SMI	3354	-	3354 (22.0%)	
SUD	7692	-	7692 (50.4%)	
Comorbidities				
TBI, *n* (%)	428	48 (0.4%)	380 (2.5%)	< 0.001
Patients with at least 1 Gagne condition, *n* (%)	20,329 (73.3%)	7172 (57.5%)	13,157 (86.2%)	< 0.001
Gagne comorbidity score, mean (SD)[a]	0.97 (1.85)	0.83 (1.98)	1.05 (1.76)	< 0.001
Gagne limited comorbidity score,[b] mean (SD)	0.78 (1.90)	0.84 (1.99)	0.74 (1.83)	< 0.01
Total Gagne conditions, mean (SD)	3.17 (2.03)	2.68 (1.76)	3.44 (2.11)	< 0.001
Total limited Gagne conditions,[b] mean (SD)	2.62 (1.77)	2.64 (1.72)	2.61 (1.80)	0.24
Prior year new diagnoses by Gagne conditions				
Prior year new Gagne diagnoses, *n* (%)	13,013 (46.9%)	4336 (34.7%)	8677 (56.9%)	< 0.001
Prior year new limited Gagne diagnoses,[a] *n* (%)	10,268 (37.0%)	3974 (31.8%)	6294 (41.2%)	< 0.001
Mental health	5496 (19.8%)	756 (6.1%)	4740 (31.1%)	< 0.001
Pulmonary disorder	1787 (6.4%)	670 (5.4%)	1117 (7.3%)	< 0.001
Malignancy	1197 (4.3%)	667 (5.3%)	530 (3.5%)	< 0.001
Cardiac disease	2766 (10.0%)	1209 (9.7%)	1557 (10.2%)	0.16
Neurologic disease	1410 (5.1%)	505 (4.0%)	905 (5.9%)	< 0.001
Diabetes	1290 (4.7%)	594 (4.8%)	696 (4.6%)	0.44
Renal	500 (1.8%)	245 (2.0%)	255 (1.7%)	0.07
Rheumatologic	186 (0.7%)	66 (0.5%)	120 (0.8%)	0.01
Dementia	139 (0.5%)	34 (0.3%)	105 (0.7%)	< 0.001
Liver disease	587 (2.1%)	106 (0.8%)	475 (3.1%)	< 0.001
Miscellaneous[c]	5299 (19.1%)	1995 (16.0%)	3304 (21.6%)	< 0.001
Length of VHA enrollment, mean years (SD)	7.5 (4.2)	7.1 (4.2)	7.7 (4.2)	< 0.001
Length of primary care enrollment, mean years (SD)	4.5 (3.4)	4.0 (3.3)	5.0 (3.4)	< 0.001
Prior year utilization				
Primary care visits, mean (SD)	3.4 (4.7)	2.3 (3.6)	4.3 (5.3)	< 0.001
Mental health visits, mean (SD)	4.3 (14.1)	0.1 (1.0)	7.7 (18.3)	< 0.001
Emergency department visits, mean (SD)	0.4 (1.3)	0.2 (0.8)	0.6 (1.7)	< 0.001
Hospitalizations, mean (SD)	0.3 (0.8)	0.1 (0.4)	0.4 (1.0)	< 0.001
Any hospitalization, *n* (%)	3771 (13.6%)	643 (5.2%)	3128 (20.5%)	< 0.001

Abbreviations: VHA, Veterans Health Administration; MH, mental health; PTSD, post-traumatic stress disorder; SMI, serious mental illness; SUD, substance use disorder; TBI, traumatic brain injury; SD, standard deviation
[a]*Gagne score only calculated among patients with at least one Gagne condition*
[b]*Limited Gagne score excludes depression, psychosis, and drug and alcohol-related conditions*
[c]*Includes various conditions, such as hypertension, electrolyte abnormalities, anemia, weight loss, human immunodeficiency virus infection, ulcer, and coagulopathy*
Denominators for column percentages include only those with non-missing data

less likely to be hospitalized (5.2% vs. 20.5%) ($p < 0.001$ all comparisons, Table 2).

In stratified analyses, 19.8% of 803 female decedents and 45.6% of 26,883 male decedents had no history of a mental health or substance use diagnosis (ESM Tables 1a-b). In comparison with females who had a mental health or substance use diagnosis, female decedents without such a history had significantly lower Gagne comorbidity scores (0.1 vs. 0.8, $p < 0.001$) and fewer Gagne conditions (1.8 vs. 3.1, $p < 0.001$) (overall and limited to physical health diagnoses). They were also significantly less likely to receive a new mental or physical health diagnosis in their last year of life (23.3% vs. 51.7%, $p < 0.001$). In comparison with females who had a mental health or substance use diagnosis, female decedents without such a history had significantly shorter durations of enrollment in VHA (5.9 vs. 7.8 years, $p < 0.001$) and VHA primary care (2.8 vs. 5.0 years, $p < 0.001$). In the year prior to death, female decedents without a mental health or substance use diagnosis

had significantly fewer primary care (1.5 vs. 5.6), mental health (0.3 vs. 12.7), and emergency department visits (0.2 vs. 0.9), and were less likely to be hospitalized (2.5% vs. 25.5%) ($p < 0.001$ all comparisons).

Forty-one percent of non-Hispanic White decedents, 36.3% of non-Hispanic Black decedents, 32.4% of non-Hispanic decedents of other races, and 33.6% of Hispanic decedents did not have a mental health or substance use diagnosis prior to their death (ESM Tables 2a-d). Additional comparisons among racial and ethnic groups are shown in ESM Tables 2a-d.

Of 27,741 suicide decedents, 68.9% died by firearm injury; 13.0% died by poisoning; 12.1% died from hanging, strangulation, or suffocation; and less than 5% died by drowning, jumping from a height, or laceration (Fig. 1). In comparison with those who had a mental health or substance use diagnosis, decedents without such a history were more likely to die by firearm injury among the full sample (78.9% vs. 60.7%,
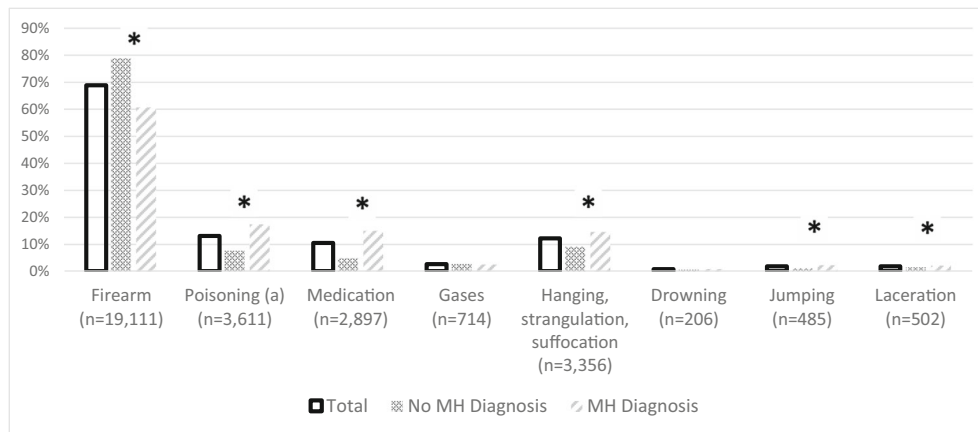
Figure 1 Injury mechanisms of VHA-enrolled suicide decedents with and without mental health diagnoses, 2000–2014. VHA Veterans Health Administration, MH mental health. Denominators for column percentages include only those with non-missing data. (a) Medications and gases are subcategories of poisoning. *p value < 0.05, comparing suicide mechanism between those with and without diagnosed mental health conditions.

$p < 0.001$), both sexes, and all races and ethnicities (ESM Tables 1c-d, 2e-h).

CONCLUSIONS

From 2000 to 2014, of nearly thirty thousand veteran primary care patients who died by suicide, almost half had no evidence of an antecedent mental health or substance use diagnosis. Despite differences in data sources, populations, healthcare systems, and time periods, this estimate is similar to those reported in prior studies.[5, 28, 31] Notably, the proportion of decedents who had a mental health diagnosis was substantially higher among female in comparison with male veterans (80.2% vs. 54.4%). Among the full sample, both sexes, and all races and ethnicities, veterans without a mental health diagnosis were more likely to die from firearm injury.

Nearly half of all suicide decedents had no mental health diagnosis, and those without such a diagnosis had lower healthcare utilization and little utilization aside from that received in primary care. These findings have important implications for suicide prevention strategies within primary care. VHA is expanding its screening procedures to assess suicidal ideation among veterans seeking care in outpatient, inpatient, and specialty care settings regardless of their mental health history.[32] A key question is whether this initiative will be successful in identifying and intervening with at-risk veterans who would not have come to attention through routine mental health and substance use screening procedures. Future research could also be helpful in determining whether more frequent screening or screenings using different methodologies (e.g., telehealth, phone visits) might identify more at-risk individuals.

Suicide decedents without a mental health or substance use diagnosis were more likely to be male, older, non-Hispanic White, married or partnered, and without service-connected disabilities. These findings are consistent with a 2015

investigation of nearly 21,000 suicide decedents from 27 US states.[5] Those without mental health conditions were more likely to be male, older, and have served in the military. Not having a service-connected disability has practical implications within VHA, as those veterans bear a greater financial responsibility for their healthcare. Some of the sociodemographic differences between groups could in part be explained by disparities in screening practices or performance of screening measures among racial, ethnic, or sex groups. That is, veterans may have been miscategorized as lacking a diagnosis if screening or diagnostic measures underperform or are underutilized among their specific group.[33]

Suicide decedents with mental health histories had a six-fold higher prevalence of TBI; a condition associated with elevated suicide risk and other mental health and substance use conditions.[34, 35] Aside from this finding, we observed statistically significant, but overall small differences between groups in physical health, including comorbidity risk scores and prevalences of specific disease categories.

The physical health differences we observed between groups are unlikely to solely account for the suicide risk among those without mental health histories, nor are each of the physical diagnoses we identified clearly associated with increased suicide risk (e.g., anemia). Notably, those with a mental health history had substantially greater healthcare utilization in their last year of life, providing more opportunities for physical and mental health conditions to be identified. Forty-one percent of those with mental health histories received a physical health diagnosis in their last year of life in comparison with 32% of those without such histories. An important question for future investigations is whether physical health diagnoses contribute differentially to suicide risk among those with mental illness, or among specific sexes, races, or ethnicities.

Consistent with other studies, suicide decedents without a mental health diagnosis were substantially more likely to die

from a firearm injury in comparison with those with such a diagnosis.[5, 28] This relationship was observed among both sexes and all races and ethnicities. However, a higher proportion of non-Hispanic White veterans died from firearm injury (69.4%) in comparison with decedents of other races and those of Hispanic ethnicity. Firearm access is an independent risk factor for suicide.[36, 37] Some of the suicide risk among those without mental illness could be explained by a greater prevalence of firearm access. However, it seems unlikely that differences in firearm access solely explain this finding. A prior study found that those dying by firearm suicide have different physical health histories than those dying by other means.[3] Taken together, these findings may suggest the presence of different suicide risk phenotypes, some of which may be in part defined by the presence of certain physical health diagnoses, personal and environmental stressors, and access to specific lethal means. Importantly, the VA's National Strategy for Preventing Veteran Suicide recommends addressing firearm access among "at-risk" veterans.[38] Considering that those with elevated suicide risk may not be identified as such, our findings suggest that it may be important to address firearm-related suicide risk among a broader population.

Future work is needed to improve our understanding of factors driving suicide risk among primary care patients, particularly those who may not be identified as at-risk by routine mental health screenings. Prior work investigating suicide risk factors among Army servicemembers has shown that 84% of decedents had at least one "environmental stressor" prior to their death, including legal or relationship problems, abuse victimization or perpetration, and work stressors.[4] Other investigations have identified similar stressors prior to suicide, stressors that were slightly more prevalent among decedents without mental health histories.[5] Of those without a mental health history who received postmortem toxicology testing in one study, 71% tested positive for at least one substance (e.g., marijuana). Collecting similar stressor and toxicologic data will be critical for future research aiming to explain suicide risk among those without mental illness.

VHA must consider that certain diagnoses may increase suicide risk (e.g., malignancy) and draw patients into specialty care (i.e., oncology, palliative care), and possibly away from mental health or primary care services.[39] For example, 5% of decedents in our sample without mental health diagnoses received a new malignancy diagnosis within one year of their death. Prior studies have shown that veterans living with cancer have an elevated risk of suicidal ideation, suicide, and firearm-related suicide.[40, 41] In some cases, given increasing opportunities for veterans to access community-based services,[42] such diagnoses may even draw patients away from VHA-centric suicide prevention programs. Additional work is needed to evaluate the obstacles and impact of expanding suicide risk screening to other clinical settings, including those in non-VHA settings.

In comparison with prior work, this study benefited from the availability of diagnostic information from the health record, a large sample size, and NDI information which is considered the gold standard for ascertaining vital status and cause of death.[4, 5, 28] However, there are limitations of this study. First, we may have miscategorized individuals as lacking a mental health diagnosis if they received care outside of the VHA system. Second, we categorized veterans as having a mental health diagnosis using all data within the record which may not reflect their actual risk profile just prior to their death. For example, administrative data may not capture severity of illness, and a veteran diagnosed with depression in 2004 may not have depressive symptoms in 2010. This approach was taken because even remote mental health diagnoses are risk factors for future suicide. Further, if this approach miscategorized veterans with respect to their suicide risk just prior to death (i.e., because they have symptom remission), our estimate of the proportion of veterans without mental illness would be an underestimate. Third, we limited the conditions included within the Gagne index to physical health conditions which may limit generalizability to other cohorts with respect to physical health comparisons. Fourth, the bivariate relationships presented in this study may be confounded by other factors.

Nearly half of VHA primary care patients who died by suicide from 2000 to 2014 did not have a mental health or substance use diagnosis, and those decedents had limited healthcare utilization aside from primary care services in their last year of life. These findings suggest that suicide prevention efforts relying solely on the identification of mental illness as an indicator for suicide risk may be insufficient in preventing a large proportion of suicides among veterans. Additional work is needed to better understand factors driving suicide risk among this group, why they are more likely to use firearms in their death, and how to identify individuals without mental illness who are at risk of suicide.

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Compliance with Ethical Standards:

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