It is illegal to post this copyrighted PDF on any website. Shorter- and Longer-Term Risk for Suicide Among Male US Military Veterans in the Year After Discharge From Psychiatric Hospitalization

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ABSTRACT

Objective: Risk for suicide is highest in the first 3 months (days 1–90) after discharge from acute psychiatric hospitalization yet remains elevated for the remainder of the year (days 91–365). The purpose of this study was to compare risk factors for suicide in the first 90 days to those over the remainder of the year to identify changes across time frames.

Methods: The study included 316,707 male veterans discharged from Veterans Health Administration acute psychiatric inpatient units from 2008 through 2013. Proportional hazard regression models were used to identify predictors of suicide death in the first 90 days and in days 91–365, defined via *ICD-10* codes. Adjusted piecewise proportional hazard regression was used to compare risk across time frames.

Results: Among the 1,037 veterans (<1%) who died by suicide, 471 (45%) died between days 1 and 90 and 566 (55%) died between days 91 and 365. There was little change regarding the strength of risk factors over time, with two exceptions: risk increased among those aged 18–29 years compared to those aged \geq 65 years (days 1–90: hazard ratio [HR] = 0.83; 95% CI, 0.57–1.20 vs days 91–365: HR = 1.42; 95% CI, 1.03–1.97; *P* < .05), whereas, risk associated with suicidal ideation decreased (days 1–90: HR = 1.89; 95% CI, 1.57–2.28 vs days 91–365: HR = 1.40; 95% CI, 1.17–1.66, *P* < .05).

Conclusions: The strength of association between common risk factors and suicide remains relatively stable during the year following psychiatric hospitalization. However, risk among veterans aged 19–29 years increased over time, whereas risk among those with suicidal ideation decreased.

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^bDepartment of Psychiatry, University of Rochester School of Medicine and Dentistry, Rochester, New York

^cDepartment of Veterans Affairs Center for Clinical Management Research, VA Ann Arbor Healthcare System, Ann Arbor, Michigan ^dDepartment of Psychiatry, University of Michigan Medical School, Ann Arbor, Michigan

*Corresponding author: Peter C. Britton, PhD, VISN 2 Center of Excellence for Suicide Prevention at the Department of Veterans Affairs Medical Center, Finger Lakes Healthcare System, 400 Fort Hill Ave, Canandaigua, NY 14424 (peter.britton@va.gov). A consistent finding from research across nations and health care systems is that individuals are at elevated risk for suicide after discharge from psychiatric hospitalization.^{1–5} Although risk is higher in the 90 days following discharge than across days 91–365, it remains elevated over the remainder of the first year.⁶ Research suggests that risk factors may change over time, indicating a need for more time-based research,⁷ but few studies compare specific risk factors for suicide across the time periods (ie, days 1–90 vs days 91–365). Such comparisons are critical to differentiating shorter-term from longer-term risk factors for suicide,⁸ as both types of risk factors may need to be addressed in prevention efforts.

Prior research directly comparing shorter and longer-term risk^{2,9,10} generally suggests that the same risk factors are associated with both time periods and that the strength of association for these risk factors decreases over time. There are, however, exceptions, as risk did not decrease among patients diagnosed with psychotic disorders (eg, schizophrenia or affective psychosis) in two studies,^{2,9} nor did it decrease among men aged 65 years and older in another study.¹⁰ Despite contributing to the evidence base regarding suicide following psychiatric hospitalization, these studies have some important limitations, including that they did not compare risk across empirically derived periods of higher shorter- (1–90 days) and lower longer-term risk (91–365 days),⁶ and their samples were too small for multivariable analyses to take into account other covariates.

Veterans have been shown to be at greater risk for suicide than the general population after accounting for age and sex.¹¹ History of suicide attempts has the strongest association with suicide,¹² and risk is elevated among those with psychiatric disorders.¹³ Similar to civilians, veterans who receive care from the Veterans Health Administration (VHA) are also at high risk for suicide in the year after discharge from psychiatric hospitalization,^{14–16} with risk significantly higher in the first 90 days, but remaining high over the remainder of the year.^{15–17} In veterans, who are predominantly male, the extent to which common risk factors are associated with risk decreases over time.^{18–20} Nonetheless, little is known about time-related changes in specific risk factors among veterans discharged from VHA facilities, and subpopulations who continue to be at risk after the first 90 days may require continued prevention efforts.

The purpose of this study is to compare shorter-term risk factors for suicide in days 1–90 after discharge with longer-term risk factors for suicide in days 91–365 among male veterans discharged from VHA acute psychiatric inpatient units. The

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Clinical Points

- Suicide risk is highest in the first 90 days after discharge from acute psychiatric hospitalization and plateaus between days 91 and 365, but research examining how specific risk factors change over these time periods is limited.
- Risk associated with most suicide risk factors remains relatively stable after discharge and may increase in subpopulations such as younger veterans, indicating that continued surveillance and treatment are needed.

comparison tests the hypothesis that the strength of risk factors associated with suicide falls significantly over time after discharge from acute psychiatric hospitalization. Moreover, the study builds on prior time-based reports by utilizing empirically derived time periods in a sample large enough for multivariable analyses.

METHODS

The sample for this study included all male veterans who were discharged from all VHA acute psychiatric inpatient units from calendar years 2008 through 2013. Female veterans (n = 30,176) were not included in this study due to the small number (n = 66) who died by suicide in the year after discharge. The index stay was defined as the last acute inpatient stay of the index year, with the index hospitalization defined as the uninterrupted period of inpatient care, including direct transfers to other inpatient settings. For veterans with multiple hospitalizations, the last hospitalization was used as the index stay. The study was approved by the Syracuse VA Medical Center Institutional Review Board.

Data Sources

Data were culled from VHA's Corporate Data Warehouse (CDW) and Mortality Data Repository (MDR). The CDW is a VHA administrative database that was used to identify veterans discharged from VHA acute inpatient facilities and obtain demographic, diagnostic, and treatment data for analyses. Veterans who were psychiatrically hospitalized from 2008 to 2013 were identified using procedures approved by the VA Information and Resource Center.²¹ Admissions related to suicide attempts were identified using discharge diagnoses. Suicide deaths were obtained from the MDR, a VHA database that includes all known veteran suicides recorded in the National Death Index (NDI). The NDI uses death records completed by medical examiners and coroners that are compiled by state vital statistics offices, provides the greatest sensitivity in determining mortality among population-level sources of death in the United States, and is currently considered the "gold standard" for cause of death data.²² Social security numbers were used to match the discharges to the full MDR database. Use of MDR data for this project was approved by the MDR Boards of Governance.

Suicide, suicide attempts, and suicidal ideation. Deaths reported in MDR within 365 days after discharge were identified as deaths from any cause, with deaths with an *ICD-10* code of X60–X84 and Y87.0 counted as suicides. A total of 704 deaths by non-suicide causes and 18 suicides with a discharge disposition of death indicating that the individuals died during their hospital stay were excluded from analyses, as suicides following discharge were the focus of our primary analyses. Other deaths on the date of discharge were assumed to be after discharge and included in the analysis. Suicide attempts and suicidal ideation during hospitalization were identified using diagnostic data from the medical records.

Demographics. Demographic variables included sex; age in categories of 18–29, 30–39, 40–49, 50–64, and 65 years and older; urban or rural residence; homelessness; and percent disability for service-connected mental health conditions.

Psychiatric diagnoses. Select diagnoses (per *ICD-9*) were defined as present or absent using principal and secondary diagnoses on the discharge abstract for the index stay, including major depressive disorder, other depression, bipolar disorder, schizophrenia, other psychoses, posttraumatic stress disorder (PTSD), other anxiety, alcohol use disorder, other substance use disorders, and dementia.

Somatic diagnoses. Sleep, pain, traumatic brain injury (TBI), and hearing loss were defined (per *ICD-9*) as present or absent using principal and secondary diagnoses from the discharge abstract. Sleep diagnoses included insomnia-related conditions, sleep-related breathing conditions, and nightmare disorder. Pain diagnoses included back pain, arthritis, migraines, headache or tension headache, psychogenic pain neuropathy, and fibromyalgia. TBI diagnoses included concussion, intracranial hemorrhage, other intracranial injuries, and fracture of the skull. Hearing loss diagnoses included tinnitus, noise-induced hearing loss, and other abnormal auditory perception. Multidiagnostic indexes were used because somatic diagnoses are rarely the target of treatment in such settings and were expected to be underdiagnosed.

Physical comorbidity. The Gagne Index, a comorbidity measure that has been shown to predict mortality in elderly patients, was used and included 14 diagnoses.²³ The original index had 18 conditions, but dementia, alcohol use, and psychoses were excluded because they were used as separate indicator variables. Polymyalgia rheumatica was excluded because it was included in the pain index. Physical comorbidity was examined as an index because it is usually not the target of treatment and is often underdiagnosed in this setting.

Inpatient treatment. Length of stay, discharge against medical advice, and bed section were also included in analyses.

Statistical Analyses

Basic descriptive statistics were used to calculate the size of the population and the number of veterans who were

Table 1. Shorter- and Longer-Term Risk for Suicide After Discharge From Acute Psychiatric Hospitalization (2008–2013)

	Total	Days 1–90			Days 91–365			P Value.
	Discharged	Suicide	Unadjusted	Adjusted	Suicide	Unadjusted	Adjusted	Adjusted HR
	(N=316,707),	(n=471),	HR	HR	(n=566),	HR	HR	Days 1–90 vs
Variable	n (%)	n (%)	(95% CI)	(95% CI)	n (%)	(95% CI)	(95% CI)	Days 91–365
Age, y								
18–29	25,883 (8.17)	45 (9.55)	0.90 (0.63-1.30)	0.83 (0.57-1.20)	76 (13.43)	1.48 (1.08–2.02)	1.42 (1.03–1.97)	.03
30–39	31,849 (10.06)	66 (14.01)	1.08 (0.78–1.49)	0.98 (0.71–1.36)	71 (12.54)	1.12 (0.82–1.54)	1.06 (0.76–1.47	.75
40-49	53,255 (16.82)	76 (16.14)	0.74 (0.54-1.01)	0.68 (0.49-0.93)	100 (17.67)	0.95 (0.71–1.27)	0.90 (0.66-1.21)	.21
50-59	110,542 (34.90)	132 (28.03)	0.62 (0.47-0.82)	0.59 (0.45-0.78)	165 (29.15)	0.76 (0.58–0.99)	0.75 (0.57–0.99)	.23
60–64	50,931 (16.08)	68 (14.44)	0.70 (0.51–0.96)	0.67 (0.65-0.97)	72 (12.72)	0.73 (0.53-1.00)	0.74 (0.54-1.02)	.69
≥65 (reference)	44,247 (13.97)	84 (17.83)			82 (14.49)			
Residence								
Rural	126,063 (39.80)	220 (46.71)	1.33 (1.11–1.59)	1.27 (1.06–1.52)	289 (51.06)	1.58 (1.34–1.86)	1.50 (1.27–1.78)	.17
Homeless	52,948 (16.72)	52 (11.04)	0.62 (0.46-0.82)	0.63 (0.47–0.84)	62 (10.95)	0.61 (0.47-0.79)	0.63 (0.48–0.82)	.99
Diagnosis								
MDD	67,458 (21.30)	162 (34.39)	1.93 (1.60–2.34)	1.69 (1.37–2.07)	162 (28.62)	1.47 (1.23–1.77)	1.39 (1.14–1.68)	.17
Bipolar disorder	51,219 (16.17)	85 (18.05)	1.14 (0.90–1.44)	1.27 (0.99–1.61)	118 (20.85)	1.36 (1.11–1.66)	1.42 (1.15–1.74)	.50
PTSD	93,195 (29.43)	131 (27.81)	0.92 (0.75–1.13)	0.75 (0.61–0.93)	150 (26.50)	0.85 (0.71–1.03)	0.68 (0.56–0.83)	.50
Schizophrenia	54,170 (17.10)	54 (11.46)	0.63 (0.47–0.83)	0.78 (0.57–1.03)	63 (11.13)	0.61 (0.47-0.79)	0.70 (0.53–0.91)	.62
Dementia	7,562 (2.39)	<11	0.36 (0.13–0.96)	0.32 (0.10–0.76)	<11	0.59 (0.28–1.24)	0.58 (0.24–1.15)	.35
Pain	107,278 (33.87)	142 (30.15)	0.84 (0.69–1.02)	0.80 (0.65–0.97)	193 (34.10)	1.00 (0.84–1.20)	0.98 (0.82–1.16)	.14
Suicidality								
Ideation	94,284 (29.77)	217 (46.07)	2.01 (1.68–2.41)	1.89 (1.57–2.28)	217 (38.34)	1.45 (1.23–1.72)	1.40 (1.17–1.66)	.02
Attempt	4,596 (1.45)	19 (4.03)	3.01 (1.93–4.72)	2.51 (1.55–3.83)	28 (4.95)	3.54 (2.42–5.17)	3.04 (2.02–4.36)	.53
Treatment								
AMA ^a	9,833 (3.10)	17 (3.61)	1.24 (0.77–1.99)	1.35 (0.81–2.11)	31 (5.48)	1.80 (1.26–2.59)	1.81 (1.23–2.55)	.34
Abbreviations: AMA = left against medical advice, HR = hazard ratio, MDD = major depressive disorder, PTSD = posttraumatic stress disorder.								

discharged from acute psychiatric hospitalization. Separate unadjusted proportional hazard regression models were calculated to estimate risk for suicide within 1-90 days and 91-365 days of discharge, with analyses yielding hazard ratios (HRs) with 95% confidence intervals (CIs) as the estimates of suicide risk. Variables that were significantly associated with suicide at P < .05 in unadjusted models were included in adjusted models. Adjusted models were trimmed using backward selection with P > .05 set as the cutoff for removal. Multicollinearity was tested using an ordinary least squares model with the dependent variable being an indicator of suicide and variance inflation factors and matrix proportions, without indication of multicollinearity. All variance inflation factors were below 2.5. Risk across time fames was tested using an adjusted piecewise proportional hazard regression model, with linear comparison of risk across time frames. In sensitivity analyses, death by nonsuicide causes was modeled as a competing risk.²⁴

In 99.6% of index stays, the period of risk evaluation began with discharge from the index acute hospital stay. For the 115 patients (0.04%) that were identified as directly transferring to another inpatient VHA setting (eg, community living center), the period of risk evaluation began once they were discharged from the subsequent hospital setting. For all proportional hazard models, subjects were censored in the analysis at their date of death or at the end of the observation period.

RESULTS

The database comprised data for 316,707 veterans. Among those, 1,034 veterans (<1%) died by suicide within the year (365 days) of discharge, of whom 471 (45%) died between days 1 and 90 and 566 (55%) died between days 91 and 365.

Risk for Suicide With 90 Days

Variables that were associated with higher risk for suicide in the 90 days following discharge included rural status, major depressive disorder, suicidal ideation, and a suicide attempt (Table 1). Variables that were associated with lower risk for suicide included being aged 50–59 years versus \geq 65 years, homelessness, PTSD, dementia, and a pain diagnosis. Examining death by non-suicidal causes as a competing risk did not significantly impact findings.

Risk for Suicide Days 91–365

Variables that were associated with higher risk of suicide for days 91–365 following discharge included being aged 18–29 years versus \geq 65 years, rural status, major depressive disorder, bipolar disorder, suicidal ideation, suicide attempt, and discharge against medical advice. Variables that were associated with lower risk for suicide included being aged 50–59 years versus \geq 65 years, homelessness, PTSD, and schizophrenia. Examining death by non-suicidal causes as a competing risk did not significantly impact findings.

Change in Risk Over Time Periods

Most risk estimates did not change at a statistically significant level over time periods, with two exceptions (Figure 1): Being aged 18–29 years was associated with significantly higher risk for suicide over days 91–365 than during the first 90 days when compared to being aged ≥ 65 years, and suicidal ideation was elevated across both time periods but was significantly higher in the first 90 days than it was in days 91–365.

Britton et al It is illega to post this convrighted PDE on any website. Figure 1. Short- and Long-Term Risk After Discharge



Abbreviations: AMA = left against medical advice, MDD = major depressive disorder, PTSD = posttraumatic stress disorder.

Supplemental Analyses

To explain our finding that being aged 18-29 years was associated with greater risk for suicide over days 91-365 than the first 90 days when compared to being aged ≥ 65 years, we examined it further. On the basis of the premise that risk associated with alcohol and drug use disorders may be delayed due to relapsing after treatment, we hypothesized that the delay among younger veterans may be a result of alcohol and drug use disorders and included them as correlates and tested their interaction with age groups. However, these disorders were not significantly associated with shorter or longer-term risk and did not impact age-related findings.

DISCUSSION

Contrary to our expectations, findings show that risk and protective factors for suicide do not change significantly across the first year of discharge, with two notable exceptions. First, male veterans aged 18–29 years were at higher risk for suicide over days 91–365 than they were in the first 90 days as compared to those aged \geq 65 years. Importantly, analyses limited to the first 90 days would have missed the increased risk in this population subgroup and the increased years of potential life lost due to their younger age. This finding is also noteworthy because suicide among veterans aged 18–29 years has increased substantially from 2005 to 2017, whereas it has remained relatively stable among older veterans.¹¹ As of 2017, veterans aged 18–29 years had the highest suicide rate in VHA.¹¹

Research suggests that older adults are at greater risk to die on their first attempt than younger adults, which may explain why younger veterans' risk for suicide increased over time when compared to older veterans.^{25,26} Older adults may be more likely to use firearms than younger adults, which have a greater likelihood of lethality than other methods.²⁷ Older adults are also more isolated, which reduces the likelihood of rescue; more frail, which makes nonviolent attempts such as overdose more lethal; and more planful and determined than younger adults.²⁸ Younger adults who survive early nonfatal attempts and remain intent on dying may increase the lethality of their attempts over time, increasing the probability of a later death. Nonetheless, this greater delay in risk does provide an important opportunity for intervention efforts to reduce the likelihood of suicide among younger veterans. An alternative explanation is that an increasing risk trajectory could reflect an interaction with alcohol or drug use disorders such that relapses after treatment could increase later risk²⁹; however, this explanation was not supported in sensitivity analyses. It is also possible that increased longerterm risk among younger veterans could be explained by factors immediately preceding suicide events (eg, changes in psychopathology, social and economic variables), which future research should examine.

Second, presence of suicidal ideation assessed during hospitalization had a significantly stronger shorter-term than longer-term association with risk, indicating that it may be an indicator of state-based risk.⁸ This explanation is supported by a prior study¹⁸ showing that suicide decedents who died within a week of treatment were more likely to disclose their suicidal thoughts to health care providers than those who died later. The decreasing strength of the estimates associated with suicidal ideation is not surprising given that cognitions are transient and subject to change.³⁰ However, it is also possible that successful linkage with outpatient mental health treatment following discharge has a greater impact on longer-term than on shorter-term risk.^{31,32} Thus, assessing suicidal ideation at discharge may be more helpful in evaluating shorter-term than longer-term risk, and clinicians should continue to assess for suicidal thinking in this high-risk population to continue to provide information on risk. Medications with an immediate effect on suicidal ideation, such as ketamine, may be particularly useful in addressing the suicidal state and reducing shortterm risk after discharge in some patients.³³ Behavioral interventions that can be implemented in inpatient units may also be helpful for reducing short-term risk, although more research is needed, as most relevant interventions have been examined in pilot studies.³⁴⁻³⁷

It is illegal to post this copy Suicide attempt history had the strongest association with suicide across both time periods as expected. Rural residence, major depressive disorder, and bipolar disorder were associated with increased risk across time periods, whereas homelessness, PTSD, schizophrenia, and dementia were associated with lower risk across time periods, replicating what we found in a prior report.¹⁴ Although pain was associated with lower short-term but not long-term risk, the difference was not statistically significant.

Next steps should include conducting similar analyses for nonfatal suicide attempts, as risk for nonfatal attempts is also elevated in the weeks and months following discharge.³⁸ Although nonfatal attempts are an important outcome because they are robust predictors of suicide death,^{14,39} they are important also because they are associated with injury and distress for the patient⁴⁰ and distress for family, friends, and clinicians.⁴¹ Despite the association of nonfatal attempts with suicide death, similar analyses for such attempts are not expected to replicate the current findings because there are critical differences in attempt method, demographics, diagnostics, and other factors for the two outcomes.⁴²⁻⁴⁴ Nevertheless, such analyses are needed and could have implications for the current findings. If younger adults are at greater risk for nonfatal attempts in the first 90 days than older adults, it would suggest that their reduced risk for suicide in the first 90 days in this study may be a result of their surviving their first attempt after discharge.

Data were based on administrative medical records rather than research interviews. Variables are therefore limited, and clinical diagnoses may reflect clinical presentation or diagnostic practices rather than the presence or absence of disorders. Data were also limited to male veterans hospitalized in VHA facilities and may not be generalizable to female veterans. However, given the small number of suicides following psychiatric discharge in female veterans, it is unlikely that the exclusions impacted the findings. Findings may also not generalize to veterans hospitalized outside the VHA and to non-veterans. Suicide determination was based on the NDI, which is the current gold standard; however, it likely underestimates suicides in veterans.⁴⁵ Additionally, it is difficult to compare these findings with those of previous studies^{2,9} that used the month after discharge (28 days) as the high-risk period, as they cover different time periods. Nevertheless, this study was the first to compare shorter- to

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These findings also indicate that additional research on risk across different populations and time frames is needed. Studies comparing risk factors for suicide postdischarge to risk factors for non-hospitalized decedents could be useful, as such approaches have identified important differences between different groups of suicide decedents.⁴⁶ Studies should also examine whether the findings generalize to related outcomes such as death by all causes, nonfatal suicide attempts, and rehospitalization. Additional treatment factors such as linkage with care following discharge should also be included.⁴⁷

These findings have implications for reducing shorterand longer-term risk for suicide after discharge from acute psychiatric hospitalization. Although risk is highest in the first 90 days after discharge and many prevention efforts focus on this time, as many—in fact, slightly more—veterans died during days 91-365 after discharge. Approaches limited to the first 90 days may not address risk in all populations, including younger veterans who are at greater risk during days 91-365 and may account for more years of potential life lost due to suicide. Efforts targeting risk in the first 90 days are therefore more likely to have an impact on rates if they are maintained through the full year. In addition to increasing treatment linkage efforts, health care systems may need to attend to quality of care over the first year after discharge to ensure that treatment is effective, nonresponders receive additional care, patients remain engaged in care, and disengaged patients are re-engaged.

Understanding the difference between factors associated with shorter- and longer-term risk may also provide critical information for short-term prevention efforts. Most predictive models use administrative data, which provide greater information on factors associated with longer-term risk.¹² Interestingly, machine learning–based predictive models have been found to more accurately predict shortterm than long-term risk.⁷ State-based variables could potentially be added to inpatient assessment batteries to further improve prediction of short-term risk. Interventions that target the suicidal state and can be implemented in inpatient units may also be helpful for reducing short-term risk after discharge.

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Additional information: Information regarding accessing data from the Military Data Repository (MDR) is available to interested readers at https://www.mirecc.va.gov/suicideprevention/Data/data_index.asp.

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Editor's Note: We encourage authors to submit papers for consideration as a part of our Focus on Suicide section. Please contact Philippe Courtet, MD, PhD, at pcourtet@psychiatrist.com.