

## ORIGINAL RESEARCH

# Suicide Attempts and Self-Inflicted Injury Among a National Cohort of Veterans with Post-Traumatic Stress Disorder and Traumatic Brain Injury

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**Abstract**

**Background:** Suicide rates are on the rise globally. Many suicide completers are previous attempters. Risk identification of attempters will provide an opportunity for prompt and targeted intervention towards suicide prevention. The aim of this study was to determine the incidence of suicide attempt and self-inflicted injury (SASI), and its associations with deployment-related PTSD and/or TBI and attempted suicide among a large national cohort of Veterans deployed pre and post-9/11 2001 who received care from the Veterans Health Administration (VHA) between 1998 - 2014.

**Methods:** Clinical data from over 1,400 VHA establishments provided by the Veterans Administrations Informatics and Computing Infrastructure (VINCI) were used for descriptive and Cox regression analyses.

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**Conflict of interests:** None

**Results:** There were 1,327,604 patients in the study - PTSD only (1,121,818), TBI only (100,033), both PTSD and TBI (105,753). The incidence of SASI in the entire cohort was 351 per 100,000 person years; PTSD only (323), TBI only (181), both PTSD and TBI (835). Compared to

TBI only group, the adjusted risk for SASI was higher in the PTSD only group (HR=1.129; 95% CI =1.063 - 1.200) and much higher in those with both PTSD and TBI (HR=2.283; 95% CI =2.136 - 2.441). The risk of SASI was higher if they were younger than 50 years, divorced or separated, non-Hispanic females, homeless, suffered adult abuse and neglect, had substance use, generalized anxiety and antisocial personality disorders, and if they were in the Pre-9/11 service period. Proportion of people attempting suicide increased every year post-diagnosis of PTSD and/or TBI.

**Conclusion:** We recommend prioritizing resources to prevent suicide among at risk groups. *Keywords:* suicide attempt, self-inflicted injury, post-traumatic stress disorder, traumatic brain injury, Veterans

## Introduction

Suicide rates are on the rise globally and in the United States. According to the World Health Organization, 800,000 people die annually due to suicide, and many more people attempt suicide [1]. In the US general population, suicide is a leading cause of death with rates escalating from 1999 to 2016, and accounting for 45,000 deaths in 2016. There were 47,173 suicide related deaths and an estimated 1.4 million suicide attempts that cost the US \$69 billion in 2015 and 2017 [2, 3, 4]. Suicide attempt is “a nonfatal, self-directed, potentially injurious action with an intent to die. It may or may not result in injury” [3].

Data collected by Centers for Disease Control (CDC) through National Violent Death Reporting System in the year 2015 outlined many factors that might contribute to suicide with and without mental health conditions known to be associated with suicide. They include relationship problem, physical health problem, past or upcoming crisis, substance abuse, job/financial problem, criminal/legal problem and housing problem [5]. Strategies for identifying individuals at suicide risk include demographic identification, diagnostic identification, and treatment response

[6]. Researchers have implicated depression, post-traumatic stress disorder (PTSD), traumatic brain injury (TBI), concussion and other mental health problems as risk factors in suicide [7, 8, 9]. Depression and PTSD independently or in combination contributed towards increased risk of suicide [10]. Recent publication by Centers for Disease Control (CDC), however, concluded that more than half of people who died due to suicide did not have mental health diagnosis [11].

A large proportion of suicidal people have been found to have untreated or undiagnosed mental health problems, so it is uncertain if some of the individuals in CDC report belonged to the group with undiagnosed mental health conditions [12, 13]. Some researchers have opined that those who attempted suicide previously are more likely to attempt again [14], and that the single most important risk factor for suicide in the general population is a previous history of suicide attempt [1]. However, only 10.9% of previous attempters eventually completed suicide according to a report by Boggs et. al [15].

Previous studies with conflicting results have suggested an association between PTSD and/or TBI, and the risk or patterns of suicide attempt and self-inflicted injury (SASI) [16, 17, 18, 19]. Some of the previous studies focused on completed suicide while a number of them included relatively small samples spanning a shorter period of service. The goal of this study is to establish an association between deployment-related PTSD and/or TBI, psychiatric diagnoses, and attempted suicide among a large national cohort of Veterans deployed pre and post-9/11 2001 who received care from the Department of Veterans Affairs during the period of years 1998 – 2014.

## Methods

### Study design

A retrospective cohort study was conducted using national data obtained using the Veterans Administrations Informatics and Computing Infrastructure (VINCI) workspace. Specifically, data were extracted from Veterans Administrations Corporate Data Warehouse (CDW) and National Patient Care Database [20]. The study was approved by the Institutional

Review Board of and work was supported by resources from both Kansas City VA Medical Center and Midwest Biomedical Research Foundation.

### Study setting and population

The Veterans Health Administration (VHA) provides care to Veterans at over 1,400 establishments across the United States organized in a system of 21 Veterans Integrated Service Networks (VISN). In the longitudinal and relational database, each Veteran has a unique identifier. The quality of data from these sources is well documented, and the data have been widely used by many investigators for retrospective studies. This analysis includes Veterans who received care through these VA establishments during the period of December 1998 to May 2014.

The three diagnosis groups identified were:

1. PTSD only cohort – having ICD-9 code for PTSD (309.81) without the ICD-9 codes for TBI.
2. TBI only cohort – having at least one of ICD-9 code(s) for TBI (850.0 to 859.9; v15.52) without the ICD-9 code for PTSD.
3. PTSD & TBI cohort – having ICD-9 code for PTSD and at least one of ICD-9 codes for TBI. This cohort excludes those in cohorts 1 and 2.

### Key exposure and outcome measures

The main exposures for this study were the diagnosis of PTSD, diagnosis of TBI, or anyone having a combination of both diagnoses. Primary outcome was suicide attempt and self-inflicted injury (SASI) occurring after the diagnosis of PTSD and/or TBI. An individual was determined to have SASI if they carried at least one of ICD-9 codes E950-E959. As the focus of this study was suicide attempts occurring after PTSD/TBI, previous attempters were excluded leaving only a prior diagnosis of PTSD and/or TBI as the baseline criteria for inclusion into this study.

### Data analysis

Patients' characteristics and the frequencies of SASI were described using absolute numbers, proportions and means. The incidence of SASI was determined for each of the diagnosis groups previously defined. Rates of SASI every year for each of the five years post diagnosis of

PTSD and/or TBI were determined and plotted in a bar chart.

Cox proportional hazard regression analysis was conducted to determine the adjusted risk of SASI with the diagnosis of PTSD/TBI as main effect. Covariates in the model included age, gender, marital status, homelessness (where 'PatientType' was reported as 'Homeless Veteran' and/or where 'BadAddressIndicator' was reported as 'Homeless'), ethnicity, service period (Pre-9/11 - those that entered and left service prior to September 1, 2001; Post-9/11 - those that first entered after September 1, 2001; Overlap-9/11 - those that entered prior to 2001 and left service after September 1, 2001; Re-entered - those that first entered and left service prior to September 1, 2001). Other covariates included in the model were depression, adult abuse and neglect, substance use disorder, generalized anxiety disorder, and antisocial personality disorder which were determined using their respective ICD 9 codes.

Kaplan-Meier curve was plotted to depict and compare the time to SASI among the diagnosis groups. Other results were presented in tables, figures and charts as appropriate. Analyses were done using SAS Enterprise Guide 7.1 supported on SAS 9.4. All hypotheses were 2-sided at 95% confidence interval.

## Results

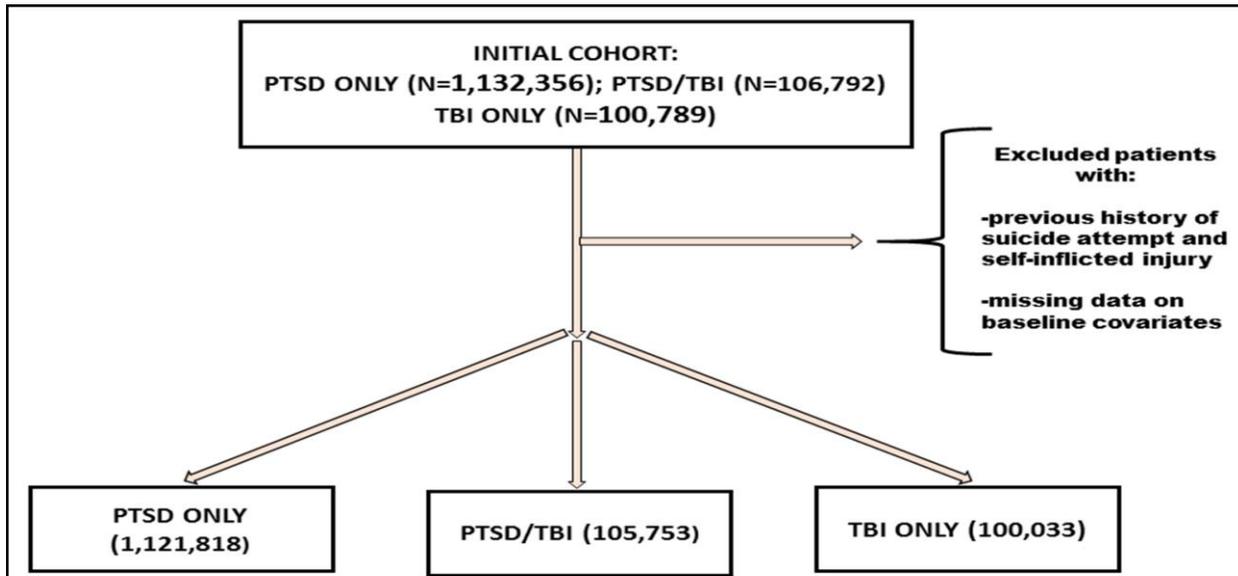
### Cohort description

As shown in Figure 1, the initial cohort consisted 1,339,937 patients (PTSD only - 1,132,356; TBI only - 100,789; both PTSD and TBI - 106,792). Of these, individuals with (1) previous history of SASI before PTSD/TBI diagnosis (2) missing data on matching baseline variables, were excluded. Final cohort comprised of 1,327,604 patients (PTSD only - 1,121,818; TBI only - 100,033; both PTSD and TBI - 105,753).

### Baseline Characteristics of the Patients

Table 1 presents the characteristics of patients in the study. The mean age of the entire cohort was 59.2 years (SD 16.2), and for PTSD only (60.1 years, SD 15.4), TBI only (63.7 years, SD 18.4) and both PTSD and TBI (46.0 years, SD

**Figure 1.**  
Patients' selection for the study



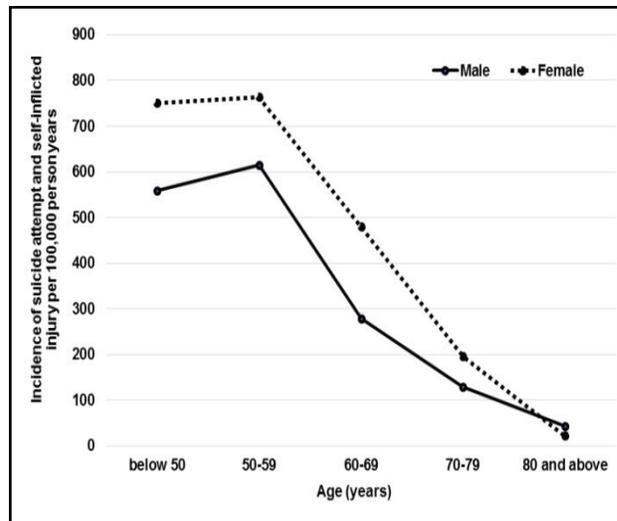
16.0). The larger proportion was older than 60 years while the rate of SASI was higher in the 50-60 years age category. In this predominantly male population (1,228,484; 92.5%), more males attempted suicide. However, a higher proportion of female patients attempted suicide in the combined groups (3.4% vs 1.8%,  $P < .001$ ). In the diagnosis groups, the proportions of female versus male with SASI were: PTSD only (female vs. male: 1.7% vs 3.2%,  $P < .001$ ), TBI only (1.24% vs 1.22%,  $P = .90$ ), PTSD and TBI (4.5% vs 7.0%,  $P < .001$ ). Many (50%) of the patients in this study were married. However, a significantly lower proportion of the married had SASI. Higher proportions of SASI were also found among the homeless, not Hispanic or Latino, those with both PTSD and TBI, the depressed, abused, reentered service group; and those with diagnosis of substance use disorder, generalized anxiety disorder and antisocial personality disorder.

**Incidence and rates of suicide attempt and self-inflicted injury**

The incidence of SASI in the entire cohort was 351 per 100,000 person years (py). In the PTSD/TBI diagnosis groups, incidences per 100,000 py were: PTSD only (323), TBI only (181), both PTSD and TBI (835). In the age-stratified analysis of incidence of SASI (Figure 3), for both male and female, the incidence increased

from below age 50, peaked at the 50-59 age category, and thereafter declined as age increased. The incidence was consistently higher in the female across all age categories, except among those aged 80 and above.

**Figure 2.**  
Incidence of suicide attempts and self-inflicted injury by age and sex



As shown in Figure 2, in the immediate five years post-diagnosis of PTSD/TBI, there was sustained increase in the rate of SASI in each

**Table 1.**  
**Characteristics of patients in the study**

	<b>Overall N (%)</b> <b>N=1327604</b>	<b>Having at least one episode of suicidal attempt N (% in category) (% of total population)</b>
Age		
<50	352323 (26.5)	8704 (2.5) (0.7)
50 - 60	433400 (32.7)	12716 (2.9) (1.0)
>60	541580 (40.8)	4515 (0.8) (0.3)
Gender		
Male	1228484 (92.5)	22622 (1.8) (1.7)
Female	99100 (7.5)	3315 (3.4) (0.3)
Marital status		
Single	184230 (14.2)	5129 (2.8) (0.4)
Married	671615 (51.8)	7546 (1.1) (0.6)
Divorced	327159 (25.2)	10001 (3.1) (0.8)
Separated	54907 (4.2)	1937 (3.5) (0.2)
Widowed	59696 (4.6)	942 (1.6) (0.1)
Homelessness		
Yes	841 (0.1)	75 (8.9) (0.01)
No	1326763 (99.9)	25862 (2.0) (2.0)
Ethnicity		
Hispanic or Latino	89275 (7.4)	1540 (1.7) (0.1)
Not Hispanic or Latino Vs Hispanic	1125976 (92.7)	23347 (2.1) (1.9)
Service period		
Pre-9/11	1020297 (76.9)	20086 (2.0) (1.5)
Overlap-9/11	203005 (15.3)	3970 (1.7) (0.3)
Post-9/11	89310 (6.7)	1553 (2.0) (0.1)
Re-entered	14992 (1.1)	328 (2.2) (0.02)
PTSD/TBI diagnosis		
PTSD only	1121818 (84.5)	19808 (1.8) (1.5)
PTSD and TBI	105753 (8.0)	4894 (4.6) (0.4)
TBI only	100033 (7.5)	1235 (1.2) (0.1)
Depression		
Yes	452989 (34.1)	13867 (3.1) (1.0)
No	874615 (65.9)	12070 (1.4) (0.9)
Adult abuse and neglect		
Yes	23553 (1.8)	1571 (6.7) (0.1)
No	1304051 (98.2)	24366 (1.9) (1.8)
Substance use disorder		
Yes	763492 (57.5)	23381 (3.1) (1.8)
No	564112 (42.5)	2556 (0.5) (0.2)
Generalized anxiety disorder		
Yes	159972 (12.0)	5844 (3.7) (0.4)
No	1167632 (88.0)	20093 (1.7) (1.5)
Antisocial personality disorder		
Yes	24510 (1.9)	3904 (15.9) (0.3)
No	1303094 (98.1)	22033 (1.7) (1.7)

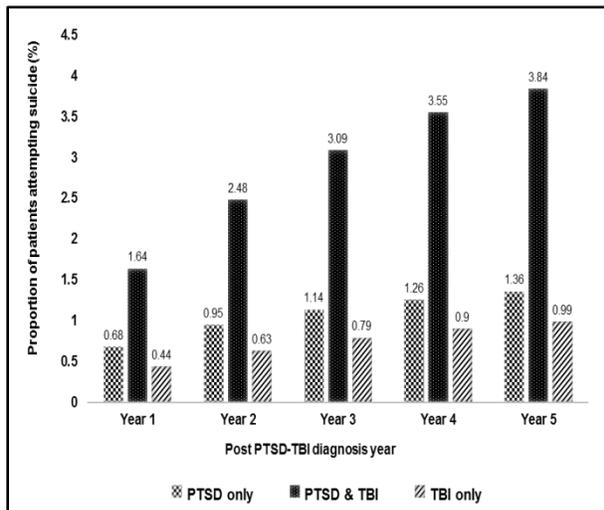
Chi square P-value for each covariate <0.001

diagnosis group. Further, there was consistently higher proportion of individuals with SASI every year for the first five post-diagnosis years in both PTSD and TBI group compared to the other two groups. TBI only group has the lowest proportion of individuals attempting suicide in each and all the immediate five post-diagnosis years.

**Risk of suicide attempt and self-inflicted injury among PTSD/TBI patients**

As presented in Table 2, when compared to TBI only group, the adjusted risk for SASI was higher in the PTSD only group (HR=1.129; 95% CI =1.063 - 1.200) and much higher in those with both PTSD and TBI (HR=2.283; 95% CI =2.136 - 2.441). Similar pattern is observed in the Kaplan Meier curve (Figure 4) which showed that SASI free survival probability was higher in the TBI only group as compared to the other diagnosis groups (Log rank *p* <.001). Older patients (>60 years), were least likely to attempt suicide compared to other age categories. The risk was particularly higher among those younger than 50 years (HR=2.993; 95% CI =2.850 - 3.143).

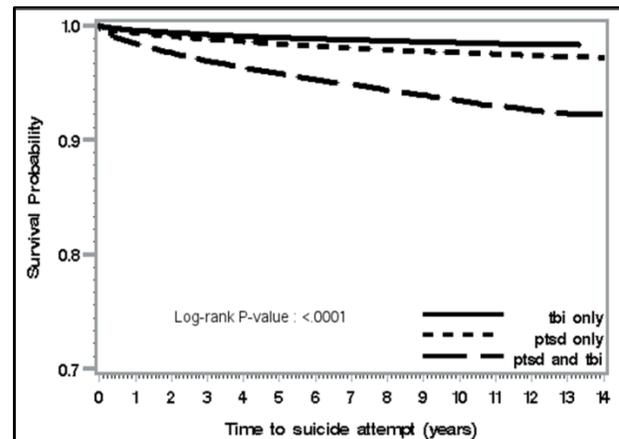
**Figure 3.**  
**Proportion of patients attempting suicide in the first 5 years post PTSD/TBI diagnosis**



Other attributes found to correlate positively with the risk of SASI were depression (HR=1.775; 95% CI =1.727 - 1.825), being female (HR=1.294; 95% CI 1.239 - 1.351); homelessness

(HR=1.576; 95% CI =1.235 - 2.012), not Hispanic/Latino ethnicity (HR=1.103; 95% CI =1.045 - 1.165), adult abuse and neglect (HR=1.871; 95% CI =1.765 - 1.984), substance use disorder (HR=4.294; 95% CI =4.100 - 4.498), generalized anxiety disorder (HR=1.480; 95% CI =1.434 - 1.527), and antisocial personality disorder (HR=4.315; 95% CI =4.157 - 4.479).

**Figure 4.**  
**Kaplan Meier curve comparing the time to suicide attempt by PTSD/TBI diagnosis groups.**



Being married was protective against SASI compared to single patients (HR=0.690; 95% CI =0.664-0.717). However, compared to the singles, the risk of SASI was higher among the divorced (HR=1.131; 95% CI =1.091 - 1.173), and separated (HR=1.219; 95% CI =1.153 - 1.288). Those that entered and left service before September 1, 2001 (Pre-9/11 group) were more likely than others to attempt suicide.

**Discussion**

In this cohort, the incidence and risk of SASI is highest among those with both PTSD and TBI. The risk of SASI was higher if they were younger than 50 years, divorced or separated, non-Hispanic females, homeless, suffered adult abuse and neglect, had substance use, generalized anxiety and antisocial personality disorders, and if they were in the Pre-9/11 service period. Every passing year post-diagnosis of PTSD and/or TBI, the proportion of people attempting suicide increased, more so among those with dual diagnosis of PTSD and TBI. Before answering the

**Table 2.**  
**Risk of suicide attempt and self-inflicted injury**

	<b>Hazard Ratio</b>	<b>95% CI</b>	<b>p-value</b>
PTSD/TBI diagnosis (ref: TBI only)			
PTSD only	1.129	1.063 - 1.200	< 0.001
PTSD and TBI	2.283	2.136 - 2.441	< 0.001
Age (ref: >60 yrs.)			
<50	2.993	2.850 - 3.143	< 0.001
50 - 60	2.117	2.037 - 2.200	< 0.001
Depression (Yes vs No)	1.775	1.727 - 1.825	< 0.001
Female vs. Male	1.294	1.239 - 1.351	< 0.001
Service period (ref: Pre-9/11)			
Overlap-9/11	0.749	0.704 - 0.798	< 0.001
Post-9/11	0.831	0.792 - 0.873	< 0.001
Re-entered	0.874	0.776 - 0.984	0.026
Marital status (ref: single)			
Divorced	1.131	1.091 - 1.173	< 0.001
Married	0.690	0.664 - 0.717	< 0.001
Separated	1.219	1.153 - 1.288	< 0.001
Widowed	1.051	0.975 - 1.133	0.195
Homelessness	1.576	1.235 - 2.012	< 0.001
Not Hispanic or Latino vs Hispanic	1.103	1.045 - 1.165	< 0.001
Adult abuse and neglect (Yes vs No)	1.871	1.765 - 1.984	< 0.001
Substance use disorder (Yes vs No)	4.294	4.100 - 4.498	< 0.001
Generalized anxiety disorder (Yes vs No)	1.480	1.434 - 1.527	< 0.001
Antisocial personality disorder (Yes vs No)	4.315	4.157 - 4.479	< 0.001

question whether suicide can be prevented, behavioral scientists must first address the complexity of identifying individuals with risk for suicide.

A recently released VA Office of Public and Intergovernmental Affairs veteran suicide statistics report of 2017 outlined that age and sex adjusted risk for suicide was 22% higher among Veterans as compared to US non-Veteran male and that after adjusting for differences in age, risk for suicide was 2.5 times higher among female Veterans as compared to US non-Veteran women [21]. The rates of SASI in this PTSD/TBI cohort are exceedingly higher than those reported in other national studies involving the emergency department visits [22, 23]. The rates in this study are comparable to rates among enlisted active-duty regular Army soldiers from January 1, 2004, through December 31, 2009 (377 per 1000,000 py), but the rates among active-duty regular army

officers were lower (27.9 per 1000,000 py) [24]. The incidence of SASI observed in this and other studies do not necessarily translate to the incidence of completed suicide. This is because it has been estimated that there were 25 attempts for every suicide death in the US general population [25].

Results of many previous studies suggest that though a higher proportion of females attempt suicide, more males complete and die of suicide [22, 26]. Recent study published in 2017 suggested that though females attempted 3 times more than males, for each female death by suicide an estimated 3.5 male died because of suicide [25]. In addition, the odds of suicide attempts were significantly higher among women reporting sexual assault [27]. Younger and non-Hispanic people were most at risk for suicide attempts in most studies, including ours. In both sexes, the rates peaked in the 50-60-year old's and then

declined with age. This is a major challenge to the VHA resources as one-thirds of people in this cohort were in the age category and ethnicity group, and the same is true for many Veterans in VHA care [28, 29]. Some have hypothesized gender differences in the risk factors for suicide attempt, while others found that suicide attempters are younger than completers. Whether these are true across board or in certain populations warrant further research [30, 31].

It is important to mention that marital statuses do change over time, especially in this study population. With such a long follow up time, it is possible that their marital statuses could have changed at one time or the other. However, marital statuses used in this study were those obtained in the records at the time data were accessed. Being married is generally protective against suicidality, though some say that completers tend to be married or separated/divorced compared to attempters; others say that multiple attempters tend to be married compared to first attempters [31, 32, 33]. These distinctions were not included in our study.

The proportion of homelessness captured in the data accessed for this study appears unexpectedly small, and may be an underestimate, considering results from others [34]. A systematic review did not find a strongly positive association between PTSD and homelessness among Veterans, which may explain the low proportion of homelessness in this predominantly PTSD population [35]. Homeless Veterans were more likely to attempt suicide. The rate of suicide attempt among homeless Veterans was 7.8 times higher than non-homeless Veterans. The rate was higher among veterans as compared to US non-Veterans [36]. It is possible that other factors might be contributing to suicide rates among Veterans. Other contributing factors that have been positively correlated with an increase in incidence of SASI include adult abuse and neglect, substance use disorder, generalized anxiety disorder, and antisocial personality disorder [15, 37, 38, 39, 40].

A randomized controlled trial among a highly suicidal self-harming adolescents group upheld dialectical behavior therapy for reducing self-harm and suicide attempts. It nevertheless admitted that the benefit seemed to weaken over time [41]. Perhaps a more definitive claim to

reduction in suicide attempts was the youth suicide prevention program among the White Mountain Apache of Arizona where a general downward trend in suicide attempts was observed in both male and female between 2001 and 2014 [42]. The cost of care for PTSD/TBI at the VA is very high [43]. High incidence of SASI observed in this group seems to provide more justification for the expenses. However, soaring costs also raise questions about the effectiveness of current therapies. Attempters should be provided increased access to mental health treatments [44]. Modifiable factors that are positively associated with increased risk of SASI are opportunities for intervention.

This retrospective study relies on data collected at different times by different providers in various locations throughout the VHA healthcare system. Although criteria (e.g. ICD-9 codes) used to ascertain diagnosis and other exposure/outcome measures in this study are standardized, it is possible that data could be missing, incomplete, or deviate in interpretation across providers. Large databases with real time entry of data, provide data not previously available. While sampling error, sampling bias, and duplication can be avoided with data extracted through VINCI, issues of veracity particularly when using dynamic data must be addressed. Questions as to how to address missing data is a key example of a confounding or hidden bias that may or may not be present. Thus, while unmeasured, confounding, or hidden biases might be present, nevertheless, key factors relevant to policy making and clinical practice were included in this study.

Suicidal behaviors have far-reaching effects on family members, friends, and the community [3]. Suicide attempters provide helpful data and should not be overlooked given they share an intent to die with those who are completers [45]. Identifying the changing characteristics of those in a high-risk group for suicide requires continued research [46]. The goal of this longitudinal study of a nationally representative sample of US Veterans diagnosed with PTSD and/or TBI is to shed light on the risk and patterns of SASI. The independent and relative associations between SASI and other clinical or demographic variables in this study population are explored, as a step towards

formulating a predictive model for suicide attempters [47].

The relatively high incidence of suicide attempt and self-inflicted injury found in this PTSD/TBI cohort suggests a high rate of completed suicide in this population. Every policy or clinical resource that would mitigate this high incidence should be implemented without further delay. In these days of limited resources, risk identification would help to prioritize interventions. Not only has this study shown an increasingly high incidence of suicide attempt with every additional mental health diagnosis, important risk factors that are amenable to intervention have been identified. Findings provide opportunity for stakeholders in healthcare to provide targeted care.

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### Disclosures

The contents of this article are those of authors and do not necessarily reflect the position and policy of the Department of Veterans Affairs.

### References

1. World Health Organization. "Suicide." <https://www.who.int/news-room/fact-sheets/detail/suicide>. Accessed February 27, 2019.
2. American Foundation for Suicide Prevention. "Suicide Statistics." <https://afsp.org/about-suicide/suicide-statistics/>. Accessed February 27, 2019.
3. Centers for Disease Control and Prevention. "Data & Statistics Fatal Injury Report for 2017." 2019. <https://www.cdc.gov/injury/wisqars/index.html>. Accessed February 27, 2019.
4. Gebremariam EH, Reta MM, Nasir Z, Amdie FZ. Prevalence and Associated Factors of Suicidal Ideation and Attempt among People Living with HIV/AIDS at Zewditu Memorial Hospital, Addis Ababa, Ethiopia: A Cross-Sectional Study. *Psychiatry J*. 2017; 2017:2301524.
5. Centers for Disease Control and Prevention. "National Violent Death Reporting System (NVDRS)." 2015. <https://www.cdc.gov/violenceprevention/datasour>

- ces/nvdrs/index.html. Accessed February 27, 2019.
6. Schwartz-Lifshitz M, Zalsman G, Giner L, Oquendo MA. Can we really prevent suicide? *Curr Psychiatry Rep*. 2012;14(6):624-33.
7. Bach SL, Molina MAL, Jansen K, da Silva RA, Souza LDM. Suicide risk and childhood trauma in individuals diagnosed with posttraumatic stress disorder. *Trends Psychiatry Psychother*. 2018;40(3):253-7.
8. Fralick M, Thiruchelvam D, Tien HC, Redelmeier DA. Risk of suicide after a concussion. *CMAJ*. 2016;188(7):497-504.
9. Stone DM, Simon TR, Fowler KA, et al. Vital Signs: Trends in State Suicide Rates - United States, 1999-2016 and Circumstances Contributing to Suicide - 27 States, 2015. *MMWR Morb Mortal Wkly Rep*. 2018;67(22):617-24.
10. Bullman T, Schneiderman A, Gradus JL. Relative Importance of Posttraumatic Stress Disorder and Depression in Predicting Risk of Suicide among a Cohort of Vietnam Veterans. *Suicide Life Threat Behav*. 2018.
11. Centers for Disease Control and Prevention. "Suicide rising across the US." *vitalsigns* [Internet]. 2018. <https://www.cdc.gov/vitalsigns/pdf/vs-0618-suicide-H.pdf>. Accessed February 27, 2019
12. Ahmedani BK, Simon GE, Stewart C, et al. Health care contacts in the year before suicide death. *J Gen Intern Med*. 2014;29(6):870-7.
13. Leavey G, Rosato M, Galway K, Hughes L, Mallon S, Rondon J. Patterns and predictors of help-seeking contacts with health services and general practitioner detection of suicidality prior to suicide: a cohort analysis of suicides occurring over a two-year period. *BMC Psychiatry*. 2016;16:120.
14. Rosellini AJ, Street AE, Ursano RJ, et al. Sexual Assault Victimization and Mental Health Treatment, Suicide Attempts, and Career Outcomes Among Women in the US Army. *Am J Public Health*. 2017;107(5):732-9.
15. Boggs JM, Simon GE, Ahmedani BK, Peterson E, Hubley S, Beck A. The Association of Firearm Suicide With Mental Illness, Substance Use Conditions, and Previous Suicide Attempts. *Ann Intern Med*. 2017;167(4):287-8.
16. Barnes SM, Walter KH, Chard KM. Does a history of mild traumatic brain injury increase suicide risk in veterans with PTSD? *Rehabil Psychol*. 2012;57(1):18-26.
17. Brenner LA, Betthausen LM, Homaifar BY, et al. Posttraumatic stress disorder, traumatic brain

- injury, and suicide attempt history among veterans receiving mental health services. *Suicide Life Threat Behav.* 2011;41(4):416-23.
18. Fonda JR, Fredman L, Brogly SB, McGlinchey RE, Milberg WP, Gradus JL. Traumatic Brain Injury and Attempted Suicide Among Veterans of the Wars in Iraq and Afghanistan. *Am J Epidemiol.* 2017;186(2):220-6.
  19. Schneider AL, Hostetter TA, Homaifar BY, et al. Responses to Traumatic Brain Injury Screening Questions and Suicide Attempts among Those Seeking Veterans Health Administration Mental Health Services. *Front Psychiatry.* 2016;7:59.
  20. US Department of Veterans Affairs. "VHA Corporate Data Warehouse." [https://www.hsrd.research.va.gov/for\\_researchers/vinci/cdw.cfm](https://www.hsrd.research.va.gov/for_researchers/vinci/cdw.cfm). Accessed February 27, 2019.
  21. VA Office of Public and Intergovernmental Affairs. "VA Releases Veteran Suicide Statistics by State." <https://www.va.gov/opa/pressrel/pressrelease.cfm?id=2951>. Accessed February 27, 2019.
  22. Canner JK, Giuliano K, Selvarajah S, Hammond ER, Schneider EB. Emergency department visits for attempted suicide and self harm in the USA: 2006-2013. *Epidemiol Psychiatr Sci.* 2018;27(1):94-102.
  23. Ting SA, Sullivan AF, Boudreaux ED, Miller I, Camargo CA, Jr. Trends in US emergency department visits for attempted suicide and self-inflicted injury, 1993-2008. *Gen Hosp Psychiatry.* 2012;34(5):557-65.
  24. Ursano RJ, Kessler RC, Stein MB, et al. Suicide Attempts in the US Army During the Wars in Afghanistan and Iraq, 2004 to 2009. *JAMA Psychiatry.* 2015;72(9):917-26.
  25. Drapeau, CW., & McIntosh, JL. U.S.A. suicide 2017: Official final data., American Association of Suicidology <http://www.suicidology.org>. Accessed February 27, 2019.
  26. Olfson M, Blanco C, Wall M, et al. National Trends in Suicide Attempts Among Adults in the United States. *JAMA Psychiatry.* 2017;74(11):1095-103
  27. Rosellini AJ, Street AE, Ursano RJ, et al. Sexual Assault Victimization and Mental Health Treatment, Suicide Attempts, and Career Outcomes Among Women in the US Army. *Am J Public Health.* 2017;107(5):732-9.
  28. Naifeh JA, Ursano RJ, Kessler RC, Gonzalez OI, Fullerton CS, Herberman Mash HB, et al. Suicide attempts among activated soldiers in the U.S. Army reserve components. *BMC Psychiatry.* 2019;19(1):31.
  29. Ursano RJ, Kessler RC, Stein MB, et al. Risk Factors, Methods, and Timing of Suicide Attempts Among US Army Soldiers. *JAMA Psychiatry.* 2016;73(7):741-9.
  30. Boren EA, Folk JB, Loya JM, Tangney JP, Barboza SE, Wilson JS. The Suicidal Inmate: A Comparison of Inmates Who Attempt Versus Complete Suicide. *Suicide Life Threat Behav.* 2018;48(5):570-9.
  31. Sun L, Zhang J. Gender differences among medically serious suicide attempters aged 15-54 years in rural China. *Psychiatry Res.* 2017;252:57-62.
  32. Choi KH, Wang SM, Yeon B, et al. Risk and protective factors predicting multiple suicide attempts. *Psychiatry Res.* 2013;210(3):957-61.
  33. Ursano RJ, Kessler RC, Stein MB, et al. Risk Factors, Methods, and Timing of Suicide Attempts Among US Army Soldiers. *JAMA Psychiatry.* 2016;73(7):741-9.
  34. Jones AL, Hausmann LRM, Haas GL, et al. A national evaluation of homeless and nonhomeless veterans' experiences with primary care. *Psychol Serv.* 2017;14(2):174-83.
  35. Tsai J, Rosenheck RA. Risk factors for homelessness among US veterans. *Epidemiol Rev.* 2015;37:177-95.
  36. Tsai J, Cao X. Association between suicide attempts and homelessness in a population-based sample of US veterans and non-veterans. *J Epidemiol Community Health.* 2019.
  37. Blasco-Fontecilla H, Baca-Garcia E, Duberstein P, et al. An exploratory study of the relationship between diverse life events and specific personality disorders in a sample of suicide attempters. *J Pers Disord.* 2010;24(6):773-84.
  38. Britton PC, Bohnert KM, Ilgen MA, Kane C, Stephens B, Pigeon WR. Suicide mortality among male veterans discharged from Veterans Health Administration acute psychiatric units from 2005 to 2010. *Soc Psychiatry Psychiatr Epidemiol.* 2017;52(9):1081-7
  39. Dong X, Chen R, Wu B, Zhang NJ, Mui AC, Chi I. Association between Elder Mistreatment and Suicidal Ideation among Community-Dwelling Chinese Older Adults in the USA. *Gerontology.* 2015;62(1):71-80.
  40. Wu L, Shen M, Chen H, et al. The relationship between elder mistreatment and suicidal ideation in rural older adults in China. *Am J Geriatr Psychiatry.* 2013;21(10):1020-8.
  41. McCauley E, Berk MS, Asarnow JR, et al. Efficacy of Dialectical Behavior Therapy for Adolescents at High Risk for Suicide: A

- Randomized Clinical Trial. *JAMA Psychiatry*. 2018;75(8):777-85.
42. Cwik MF, Tingey L, Maschino A, et al. Decreases in Suicide Deaths and Attempts Linked to the White Mountain Apache Suicide Surveillance and Prevention System, 2001-2012. *Am J Public Health*. 2016;106(12):2183-9.
  43. Thakur H, Oni O, Singh V, et al. Increases in the Service Connection Disability and Treatment Costs Associated With Posttraumatic Stress Disorder and/or Traumatic Brain Injury in United States Veterans Pre- and Post-9/11: The Strong Need for a Novel Therapeutic Approach. *Epidemiology (Sunnyvale)*. 2018;8:353.
  44. Han B, Compton WM, Gfroerer J, McKeon R. Mental health treatment patterns among adults with recent suicide attempts in the United States. *Am J Public Health*. 2014;104(12):2359-68.
  45. Bhatt M, Perera S, Zielinski L, et al. Profile of suicide attempts and risk factors among psychiatric patients: A case-control study. *PLoS One*. 2018;13(2):e0192998.
  46. Matthey EC, Galin J, Ahern J. Changing Patterns in Rates and Means of Suicide in California, 2005 to 2013. *Am J Public Health*, 2017;107(3), 427-429.
  47. Lee J, Jang H, Kim J, Min S. Development of a suicide index model in general adolescents using the South Korea 2012-2016 national representative survey data. *Sci Rep*. 2019;9(1):1846.

