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Prevalence and Trends in Suicidal Behavior Among US Military Veterans During the COVID-19 Pandemic

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IMPORTANCE The COVID-19 pandemic has raised considerable concerns about increased risk for suicidal behavior among US military veterans, who already had elevated rates of suicide before the pandemic.

OBJECTIVE To examine longitudinal changes in suicidal behavior from before the COVID-19 pandemic to nearly 10 months into the pandemic and identify risk factors and COVID-related variables associated with new-onset suicide ideation (SI).

DESIGN, SETTING, AND PARTICIPANTS This population-based prospective cohort study used data from the first and second wave of the National Health and Resilience in Veterans Study, conducted from November 18, 2019, to December 19, 2020. Median dates of data collection for the prepandemic and peripandemic assessments were November 21, 2019, and November 14, 2020, nearly 10 months after the start of the COVID-19 public health emergency in the US. A total of 3078 US military veterans aged 22 to 99 years were included in the study.

MAIN OUTCOMES AND MEASURES Past-year SI and suicide attempts.

RESULTS In this cohort study of 3078 US veterans (mean [SD] age, 63.2 [14.7] years; 91.6% men; 79.3% non-Hispanic White veterans, 10.3% non-Hispanic Black veterans, and 6.0% Hispanic veterans), 233 (7.8%) reported past-year SI, and 8 (0.3%) reported suicide attempts at the peripandemic assessment. Past-year SI decreased from 10.6% prepandemic (95% CI, 9.6%-11.8%) to 7.8% peripandemic (95% CI, 6.9%-8.8%). A total of 82 veterans (2.6%) developed new-onset SI over the follow-up period. After adjusting for sociodemographic and military characteristics, the strongest risk factors and COVID-19-related variables for new-onset SI were low social support (odds ratio [OR], 2.77; 95% CI, 1.46-5.28), suicide attempt history (OR, 6.31; 95% CI, 2.71-14.67), lifetime posttraumatic stress disorder and/or depression (OR, 2.25; 95% CI, 1.16-4.35), past-year alcohol use disorder severity (OR, 1.06; 95% CI, 1.01-1.12), COVID-19 infection (OR, 2.41; 95% CI, 1.41-5.01), and worsening of social relationships during the pandemic (OR, 1.47; 95% CI, 1.16-1.88).

CONCLUSIONS AND RELEVANCE The results of this cohort study suggest that despite grim forecasts that the COVID-19 pandemic would exacerbate suicidality among US military veterans, the rate of SI decreased at the population level nearly 10 months into the pandemic. Veterans who were infected with COVID-19 were more than twice as likely to report SI, which suggests the need for future research to examine the potential link between COVID-19 infection and suicidal behavior.

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Supplemental content

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Over the past year, the COVID-19 pandemic has upended the lives of individuals across the globe. At the time of this writing, more than 177 million people have been infected and 3.8 million have died as a result of COVID-19-related complications globally.[1] The pandemic has exacted a staggering toll on individuals, families, and societies and generated significant concerns about increased risk for poor mental and physical health. Indeed, the World Health Organization recently warned that the quarantining and social distancing measures enforced to reduce the spread of COVID-19—along with heightened financial hardship, unemployment, fear of contagion, and potential neurologic and psychiatric effects of COVID-19 infection—may have profound and long-lasting mental health effects.[2] In particular, given prior evidence demonstrating increases in suicidal behavior during the 1918 influenza pandemic and 2003 severe acute respiratory syndrome outbreak,[3,4] prominent scholars have issued concerns that the COVID-19 pandemic may create a perfect storm for suicidality due to the unique juxtaposition of sustained social isolation and loneliness among at-risk individuals.[5] To this end, there have been recent calls to action[5] to investigate longitudinal changes in and risk factors for suicidal behavior during the pandemic.

A notable limitation in the existing literature on the COVID-19 pandemic and suicidal behavior in the US is that nearly all studies have relied on nonrepresentative samples and cross-sectional data, which preclude the ability to examine change in suicidality before and during the pandemic. In fact, to our knowledge, only 1 population-based study to date has assessed longitudinal change in suicidality during the pandemic. In a representative sample of 5470 US civilian adults, Czeisler and colleagues[6] found that the prevalence of past 30-day suicide ideation (SI) increased slightly from 10.7% to 11.9% from June to September 2020. Thus, in addition to the paucity of research examining trends in SI before and during the pandemic, a significant gap in the literature is that no prior studies have examined changes in more severe forms of suicidal behaviors, such as suicide attempts, which are stronger risk factors of suicide mortality.[7] Such data are vital to understanding the population-based burden of the COVID-19 pandemic on suicidal behavior as well as for guiding intervention strategies and resource allocation.

Several lines of evidence suggest that US military veterans may be a population at disproportionately higher risk for suicidal behaviors during the pandemic. First, older veterans were already at high risk for loneliness—which has been implicated as a robust correlate of SI and attempts—before the pandemic.[8] Second, veterans have high rates of preexisting mental illness (eg, posttraumatic stress disorder [PTSD], depression) and suicidal behavior relative to the general population, which may predispose them to deteriorations in mental health during the pandemic.[9] Indeed, recent data collected before the pandemic indicated that the age- and sex-adjusted suicide rate among veterans had risen nearly 30% since 2010 and was at its highest recorded point in US history.[10] Third, veterans are significantly more likely to have multiple chronic physical health conditions relative to nonservice members,[11] which may lead to heightened distress about potentially deadly complications from contracting COVID-19. However, despite veterans' heightened suicide risk, no known study has examined longitudinal trends in suicidal behavior over the course of the pandemic in a population-based sample of US veterans.

To address these gaps, we analyzed data from the National Health and Resilience in Veterans Study (NHRVS), which surveyed a prospective population-based cohort of US military veterans to evaluate the following 3 aims: (1) examine the change in the prevalence of past-year SI from prepandemic to peripandemic; (2) estimate the prevalence of new-onset past-year suicide attempts during the peripandemic period; and (3) identify factors most strongly associated with new-onset SI during the pandemic. Informed by the vulnerability-stress model of suicidal behavior,[12] we examined a broad range of factors that have been empirically demonstrated to increase risk for suicidal behavior among service members, with the overarching goal of better understanding prepandemic factors associated with heightened risk for suicidality. Furthermore, consistent with prior work,[13] we additionally examined COVID-19–associated variables of new-onset SI.

Key Points

Question What is the population-based burden of the COVID-19 pandemic on suicidal behavior among US military veterans?

Finding In this cohort study of 3078 US military veterans, rates of suicide ideation and suicide attempts did not significantly increase from prepandemic to peripandemic at the population level. However, a small proportion of veterans (2.6%) developed new-onset suicide ideation during the pandemic.

Meaning These results suggest that despite grim forecasts about the COVID-19 pandemic possibly creating a perfect storm for suicidal behavior, the prevalence of suicidality did not appear to increase among military veterans nearly 10 months into the pandemic.

Methods

For this cohort study, data were analyzed from the NHRVS, which was conducted from November 18, 2019, to December 19, 2020, and surveyed a population-based, prospective cohort of US military veterans. The sampling methodology of the NHRVS has been described previously.[14] The NHRVS sample was drawn from KnowledgePanel (Ipsos Inc), a research panel of more than 50 000 households. KnowledgePanel is a probability-based, online, nonvolunteer access survey panel of a population-based sample of US adults that covers approximately 98% of US households. A total of 7860 veterans were invited to participate in the NHRVS study from November 18, 2019, to March 1, 2020, and 4069 (51.8%) completed it; of these 4069 veterans, 3929 (96.6%) remained in the survey panel and 3078 (78.3%) completed the follow-up survey. To permit generalizability of study results to the entire population of US veterans, Ipsos statisticians computed poststratification weights using

the benchmark distributions of sociodemographic characteristics of US military veterans from the most recent (August 2019) Current Population Survey Veterans Supplement of the US Census Bureau's American Community Survey.[15] Demographic data of survey panel members are assessed regularly by Ipsos using the same set of questions used by the US Census Bureau. Race/ethnicity was assessed via self-report using a standard set of questions used by the US Census Bureau. Additional information about the methodology of the NHRVS is available in the eMethods in the Supplement. The NHRVS study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and American Association for Public Opinion Research (AAPOR) reporting guidelines for cohort studies. All participants provided written informed consent, and the Human Subjects Committee of the Veterans Affairs Connecticut Healthcare System approved the study.

Assessments

At the prepandemic assessment, sociodemographic, military, psychiatric, psychosocial, and suicide-related variables were assessed.[16-27] At the peripandemic assessment, past-year suicide-related variables were reassessed, and COVID-19 infection stressors and pandemic-related stressors were assessed. Study measures are displayed in **Table 1**.

Data Analysis

Statistical analyses were performed using SPSS, version 27 (IBM Corp) software. Missing data (<3%) were multiply imputed using chained equations. Analyses proceeded in 5 steps. First, McNemar tests were conducted to examine differences in past-year SI between the prepandemic and peripandemic waves. Second, we estimated the prevalence of past-year SI and attempts at the peripandemic period. Third, we conducted χ^2 and independent-samples *t* tests to compare characteristics that differentiated veterans without past-year SI at baseline who did and did not develop new-onset past-year SI at the peripandemic assessment. Fourth, we conducted a multivariable logistic regression analysis to identify factors independently associated with new-onset SI at follow-up among veterans who did not report SI at the prepandemic assessment (2746 of 3078 [89.2%]). Variables that differed at the $P < .05$ level in bivariate analyses were entered into this analysis, and a backward elimination (Wald) method was used to identify significant risk factors or variables associated with peripandemic SI. Fifth, to determine the relative contribution of each significant risk factor to the model explained variance (R^2), a relative importance analysis[28] was conducted using the relaimpo R statistical package (R Foundation). This analysis partitioned the variance in SI that was explained by each significant variable while accounting for intercorrelations among these variables. Statistical significance was set at $P < .05$, and all *P* values were 2-sided.

Results

A total of 4069 veterans completed a prepandemic survey (median completion date, November 21, 2019; 10th percentile, November 20, 2019; 90th percentile, December 10, 2019; range, November 18, 2019, to March 8, 2020), and 3078 (75.6%) completed a peripandemic follow-up assessment (median completion date, November 14, 2020; 10th percentile, November 13, 2020; 90th percentile, November 19, 2020; range, November 9, 2020, to December 17, 2020). These 3078 veterans were aged 22 to 99 years (mean [SD] age, 63.2 [14.7] years), were mostly male (2734 [91.6%]), and included 2541 non-Hispanic White veterans (79.3%), 212 non-Hispanic Black veterans (10.3%), 216 Hispanic veterans (6.0%), and 109 veterans (4.4%) of a mixed or other race/ethnicity (including Asian, American Indian and Alaska Native, Native Hawaiian and other Pacific Islander, and multiracial veterans). The sample included all branches of the US military (1198 Army [47.3%], 673 Navy [20.8%], and 733 Air Force [18.9%]); 2331 veterans (79.6%) had enlisted, and 1052 (35.0%) were combat veterans. Attrition analyses did not reveal a significant difference in the prevalence of past-year SI in those who did (298 [9.5%]) vs did not (98 [10.0%]) complete the peripandemic follow-up survey; likewise, follow-up survey completion rates did not differ between veterans with and without suicide attempt histories (95 [70.0%] vs 2952 [75.9%]). Relative to veterans who did not complete the follow-up, those who did were slightly older (mean [SD] age, 67.0 [12.3] years vs 65.2 [15.4] years) and more likely to be male (2734 [88.8%] vs 830 [83.8%]), but age- and sex-adjusted odds of lifetime PTSD, major depressive disorder, alcohol use disorder (AUD), and drug use disorder, as well as lifetime mental health treatment history at the prepandemic assessment, did not significantly differ.

Table 2 presents the prevalence of past-year SI at the prepandemic and peripandemic waves. Past-year SI significantly decreased from 10.6% (285 veterans) prepandemic (95% CI, 9.6%-11.8%) to 7.8% (233 veterans) peripandemic (95% CI, 6.9%-8.8%) in the full sample ($P < .001$), as well as among male veterans (10.0% [229 veterans] prepandemic; 95% CI, 8.9%-11.2% vs 7.3% [189 veterans] peripandemic; 95% CI, 6.4%-8.4%; $P < .001$), veterans aged 18 to 44 years (21.6% [42 veterans]; 95% CI, 17.6%-26.1% vs 15.4% [32 veterans]; 95% CI, 11.9%-19.4%; $P = .002$) and veterans aged 45 to 64 years (15.7% [138 veterans]; 95% CI, 13.5%-18.0% vs 10.3% [98 veterans]; 95% CI, 8.5%-12.3%; $P < .001$). Eight veterans (0.3%) reported attempting suicide at the peripandemic follow-up; given this low number, we did not pursue additional analyses of this group. Supplementary post hoc analyses revealed that veterans aged 18 to 64 years reported a significantly greater increase in perceived social support from the prepandemic to peripandemic period relative to veterans aged 65 years or older (Cohen $d = 0.22$; $P < .001$).

Eighty-two veterans (weighted percentage, 2.6%; 95% CI, 2.0%-3.3%) developed new-onset SI at follow-up. **Table 3** displays characteristics of veterans with and without new-onset SI. Veterans who reported a Veterans Affairs hospital as their primary source of health care were more likely to report new-onset SI vs reporting no SI (22 veterans [30.0%] vs 457 veterans [18.3%]; $\chi^2 = 6.19$; $P = .01$). Veterans who screened positive for lifetime PTSD and/or major depressive disorder (34 veterans [52.9%] vs 387 veterans [16.3%]; $\chi^2 = 61.86$; $P < .001$), AUD and/or a drug use disorder (52 veterans [63.8%] vs 1017 veterans [39.7%]; $\chi^2 = 16.21$; $P < .001$), and current insomnia

Table 1. Suicidal Behaviors and Study Measures

Suicidal behavior	Study measure
Past-year suicide ideation	Past-year SI was assessed at prepandemic and peripandemic waves via endorsement on question 2 of the SBQ-R[16]: "How often have you thought about killing yourself in the past years?" Response options: Rarely (1 time) to very often (5+ times). New-onset (ie, incident) suicide ideation was operationalized as participants who did not report SI at the prepandemic assessment and endorsed SI at the peripandemic assessment.
Past-year suicide attempt	Past-year suicide attempt was assessed at the peripandemic assessment via endorsement of either of 2 items on question 1 of the SBQ-R[16]: "I have attempted to kill myself, but did not want to die" and "I have attempted to kill myself, and really hoped to die."
Sociodemographic characteristics	Age (continuous), sex (male, female), race/ethnicity (White, non-White participant), education (college graduate or higher, up to high school diploma), marital status (married/living with partner, not), household income ($60 000 or more, less than $60 000), retirement status (retired, not).
Military characteristics	Combat status (previously deployed, not), primary health care (VA, other), enlistment status (enlisted, not).
Prepandemic psychiatric risk factors	
Lifetime PTSD and/or MDD	Score of ≥33 on PTSD Checklist for the *DSM-5*,[17] modified to include lifetime ratings of all PTSD symptoms in relation to "worst" criterion A trauma on the LEC-5.[18] Lifetime MDD was assessed using the Mini International Neuropsychiatric Interview[19] for *DSM-5*. Veterans who met criteria for either disorder were coded positive for lifetime PTSD/MDD.
Lifetime AUD and/or DUD	Lifetime AUD/DUD was assessed using a modified self-reported version of the Mini International Neuropsychiatric Interview[19] per *DSM-5* diagnostic criteria. Positive screen for either disorder was coded positive for lifetime AUD/DUD.
Current insomnia	Score on Insomnia Severity Index,[20] with a cutoff score of 22 or higher indicating a positive screen.
Prepandemic psychosocial risk factors	
Adverse childhood experiences	Adverse Childhood Experiences Questionnaire total score.[21]
Military sexual trauma	Endorsement on either of 2 items, which asked, "When you were in the military, did you ever receive unwanted, threatening, or repeated sexual attention?" and "When you were in the military, did you have sexual contact against your will or when you were unable to say no?"
Number of lifetime traumas	Life Events Checklist for *DSM-5*[18] total score.
Lifetime nonsuicidal self-injury	Positive endorsement of item asking, "Have you ever purposely hurt yourself without wanting to die?"
Past-year alcohol use disorder severity	Alcohol Use Disorders Identification Test total score.[22]
Trait impulsivity	Barratt Impulsiveness Scale-Brief total score.[23]
Suicide attempt history	Endorsement on either of 2 items: "I have attempted to kill myself, but did not want to die" and "I have attempted to kill myself, and really hoped to die."
Physical health problems	Sum of number of medical conditions: "Has a doctor or health care professional ever told you that you have any of the following medical conditions?" (eg, arthritis, cancer).
ADL and/or IADL disability	Endorsement of needing help from another person to perform activities of daily living (eg, bathing) or instrumental activities of daily living (eg, preparing meals).
Loneliness	UCLA Loneliness Scale[24] total score.
Low social support	Medical Outcome Study Social Support Scale-5,[25] with score of <1 SD below sample mean.
Change in psychosocial risk factors from pre- to peripandemic	Increase in alcohol consumption (AUDIT consumption),[22] increase in alcohol use problem severity (AUDIT consequences),[22] increase in days of non-prescription drug use (Screen of Drug Use),[26] increase in loneliness.[24]
COVID-19 infection stressors	Endorsement of personal prior COVID-19 infection, someone in the home contracting COVID-19, or knowing someone who died of COVID-19.
COVID-19 pandemic stressors	CRISIS,[27] which assessed for COVID-19-related disease worries, social restriction stress, financial stress, worsening relationships, social engagement during the pandemic, and hours of COVID-19-related media consumed per week. The CRISIS has been psychometrically validated to have high reliability and construct validity.[27]

Abbreviations: ADL, activities of daily living; AUD, alcohol use disorder; AUDIT, Alcohol Use Disorders Identification Test; CRISIS, Coronavirus Health Impact Survey; DUD, drug use disorder; IADL, instrumental activities of daily living; LEC-5, Life Events Checklist 5; MDD, major depressive disorder; PTSD, posttraumatic stress disorder; SBQ-R, Suicide Behaviors Questionnaire-Revised; SI, suicide ideation; UCLA, University of California, Los Angeles; VA, Veterans Affairs.

(17 veterans [24.6%] vs 196 veterans [8.1%]; $\chi^2 = 23.39$; $P < .001$) were more likely to report new-onset SI vs no SI. Number of adverse childhood experiences (mean [SD], 1.8 [1.9] vs 1.2 [1.7]; $t = 4.38$; $P = .03$), more lifetime traumas (mean [SD], 11.7 [9.4] vs 8.4 [7.9]; $t = 7.42$; $P = .006$), nonsuicidal self-injuries (10 veterans [13.0%] vs 40 veterans [1.9%]; $\chi^2 = 38.79$; $P < .001$), past-year AUD severity (scores on the AUD Identification Test [range = 0-40], 4.0 [5.1] vs 2.8 [3.8]; $t = 8.94$; $P = .003$), suicide attempt history (14 veterans [22.9%] vs 49 veterans [2.3%]; $\chi^2 = 106.19$; $P < .001$), disability (18 veterans [20.0%] vs 28 veterans [11.1%]; $\chi^2 = 5.39$; $P = .03$), and low social support (30 veterans [46.4%] vs 378 veterans [14.1%]; $\chi^2 = 55.24$; $P < .001$) were associated with new-onset SI vs no SI. Increases in alcohol consumption (scores on items 1-3 on the AUD Identification Test, 0.4 [2.0] vs 0.3 [1.3]; $t = 11.43$; $P = .001$) and loneliness (scores on 3-item Loneliness Questionnaire adapted from the revised University of California, Los Angeles Loneliness Questionnaire, 0.1 [1.7] vs −0.1 [1.2]; $t = 9.67$; $P = .002$) between the prepandemic and peripandemic waves were associated with new-onset SI vs no SI. Veterans who reported being infected with COVID-19 (15 [19.4%] vs 178 [7.4%]; $\chi^2 = 13.07$; $P = .001$), greater levels of COVID-19–related social restriction (0.2 [1.2] vs 0.0 [0.9]; $t = 6.44$; $P = .01$), financial stress (0.3 [1.4] vs 0.0 [0.9]; $t = 18.52$; $P < .001$), and worsening social

Table 2. Trends in Past-Year Suicide Ideation From Prepandemic to Peripandemic Among 3078 US Military Veterans

	Prepandemic		Peripandemic		
Variable	No.	Percentage (95% CI)	No.	Percentage (95% CI)	*P* value
Suicide ideation	285	10.6 (9.6-11.8)	233	7.8 (6.9-8.8)	<.001
Sex					
Male	229	10.0 (8.9-11.2)	189	7.3 (6.4-8.4)	<.001
Female	56	17.1 (12.6-22.4)	44	13.0 (9.1-17.9)	.05
Age, y					
18-44	42	21.6 (17.6-26.1)	32	15.4 (11.9-19.4)	.002
45-64	138	15.7 (13.5-18.0)	98	10.3 (8.5-12.3)	<.001
≥65	105	4.4 (3.4-5.5)	103	4.2 (3.2-5.3)	.79

relationships (0.5 [0.9] vs 0.0 [0.9]; t = 1.44; P = .02) were significantly more likely to report new-onset SI vs no SI (previous 3 scores are standardized scores on a factor reflecting COVID-19–related social restriction stress [Table 3]).

Table 4 displays the results of a multivariable regression analysis examining longitudinal risk factors and COVID-19–associated variables of past-year SI at the peripandemic assessment. Results revealed that lifetime PTSD and/or depression (odds ratio [OR], 2.25; 95% CI, 1.16-4.35; P = .01), lifetime suicide attempt history (OR, 6.31; 95% CI, 2.71-14.67; P < .001), low social support (OR, 2.77; 95% CI, 1.46-5.28; P = .002), greater past-year AUD severity (OR, 1.06; 95% CI, 1.01-1.12; P = .03), COVID-19 infection (OR, 2.41; 95% CI, 1.16-5.01; P = .01), and greater COVID-19–related worsening of social relationships (OR, 1.47; 95% CI, 1.16-1.88; P = .002) were associated with significantly greater odds of new-onset SI. Results of a relative importance analysis (**Figure**) revealed that the majority of the explained variance in new-onset SI at the peripandemic assessment was accounted for by low social support (21.4%), lifetime suicide attempt history (20.4%), lifetime PTSD and/or depression (18.3%), COVID-19–associated worsening social relationships (15.5%), COVID-19 infection (12.2%), and past-year AUD severity (12.0%).

Discussion

To our knowledge, this is one of the first population-based studies in the US to examine longitudinal changes in suicidal behavior before and during the COVID-19 pandemic in either a civilian or veteran sample. Results of this cohort study suggest that the prevalence of past-year SI in the overall sample decreased from 10.6% in November 2019, before the first documented cases of COVID-19 in the US, to 7.8% approximately 1 year later in the midst of the ongoing pandemic. This downward trend was observed among veterans aged 18 to 44 years and 45 to 64 years, yet not among those aged 65 years or older, consistent with findings from other longitudinal studies during the pandemic, which indicated that age may be an important moderator.[29] Furthermore, 8 veterans (0.3%) reported attempting suicide during the follow-up period. These results align with converging lines of evidence from the general population, suggesting that despite grim forecasts about the COVID-19 pandemic creating a perfect storm for suicidal behavior,[5] the prevalence of suicidality did not appear to increase at the population level.[6,13] For example, in a general population survey of adults conducted from March to April 2020,[13] past-month SI or suicide attempts were not elevated among civilians under stay-at-home orders, nor were prevalence estimates elevated compared with prepandemic epidemiologic data of suicidality among US adults.[30] Interestingly, study findings were similar to the most contemporaneous data from the US National Center for Health Statistics,[31] which indicate that the number of deaths by suicide in the general US population decreased by approximately 15% from January to April 2020, before returning to prepandemic levels in August 2020.

Several potential explanations may underlie the decrease in past-year SI observed from prepandemic to peripandemic periods among veterans. First, despite greater risk for COVID-19 mortality and social isolation, emerging evidence suggests that older adults (eg, veterans) may be more resilient to the deleterious mental health effects of the pandemic relative to younger populations, in part due to lower stress reactivity and better emotion regulation.[32,33] Second, post hoc analyses revealed that veterans aged 18 to 64 years reported a significantly greater increase in perceived social support from the prepandemic to peripandemic period relative to veterans aged 65 years or older (Cohen d, 0.22; P < .001), suggesting that younger veterans may have been better able to solicit support during the pandemic, perhaps related to this age cohort being more adept at using virtual technologies (eg, FaceTime, Zoom) to connect with others. Third, military veterans tend to have endured substantially more lifetime traumas and adversity relative to civilians, and therefore may be more accustomed to maneuvering through life's challenges and weathering periods of prolonged stress.[34] Third, contrary to media portrayals, emerging research suggests that the COVID-19 crisis may actually be associated with a silver lining, such as improvements in physical health and more time with family, as well as posttraumatic growth, which may buffer suicide risk.[35,36] Last, it is possible that the decrease in SI reflects a "pulling together" phenomenon, previously observed following natural disasters and periods of war.[37,38] This phenomenon posits that during times of national crisis, societies pull together and individuals' sense of belongingness increases, thereby reducing risk for suicidal behavior.[39] Indeed, numerous national

Table 3. Characteristics of 2746 US Military Veterans With and Without New-Onset Suicide Ideation From Prepandemic to Peripandemic[a]

Variable	No. (%)[b]		χ^2 or *t*	*P* value
	No suicide ideation	New-onset suicide ideation		
No. (weighted %)	2664 (97.4)	82 (2.6)	NA	NA
Sociodemographic characteristics				
Age, mean (SD), y	64.5 (14.2)	57.8 (14.8)	0.62	.42
Sex				
Male	2397 (92.3)	70 (91.4)	0.07	.78
Female	267 (7.7)	12 (8.6)		
Race/ethnicity				
White, non-Hispanic	2207 (79.1)	67 (82.9)	5.89	.12
Black, non-Hispanic	195 (11.2)	1 (2.9)		
Hispanic	175 (5.5)	8 (8.6)		
Other, mixed race[c]	87 (4.2)	6 (5.7)		
College graduate or higher education	1213 (33.7)	42 (39.1)	0.86	.35
Married or partnered	1942 (74.5)	59 (70.0)	0.72	.39
Household income ≥$60 000	1612 (60.8)	45 (49.3)	3.74	.05
Employed	1006 (45.7)	30 (48.6)	0.22	.63
Military characteristics				
Combat veteran	894 (34.5)	51 (38.6)	0.51	.47
VA primary source of health care	457 (18.3)	22 (30.0)	6.19	.01
Enlisted into military	2307 (86.8)	78 (94.3)	3.39	.07
Prepandemic psychiatric risk factors				
Lifetime PTSD and/or MDD	387 (16.3)	34 (52.9)	61.86	<.001
Lifetime AUD and/or DUD	1017 (39.7)	52 (63.8)	16.21	<.001
Current insomnia	196 (8.1)	17 (24.6)	23.39	<.001
Prepandemic psychosocial risk factors				
Adverse childhood experiences, mean (SD), No.	1.2 (1.7)	1.8 (1.9)	4.38	.03
Military sexual trauma	155 (5.2)	10 (8.7)	1.64	.19
Lifetime traumas, mean (SD), No.	8.4 (7.9)	11.7 (9.4)	7.42	.006
Lifetime NSSI	40 (1.9)	10 (13.0)	38.79	<.001
Past-year AUD severity, mean (SD), No.[d]	2.8 (3.8)	4.0 (5.1)	8.94	.003
Trait impulsivity[e]	14.1 (3.7)	15.7 (3.8)	0.20	.65
Lifetime suicide attempt	49 (2.3)	14 (22.9)	106.19	<.001
Physical health problems	2.9 (2.1)	3.1 (2.2)	0.37	.54
ADL and/or IADL disability	28 (11.1)	18 (20.0)	5.39	.03
Loneliness	4.3 (1.6)	5.9 (1.91)	1.03	.31
Low social support	378 (14.1)	30 (46.4)	55.24	<.001
Change in risk factors from prepandemic to peripandemic, mean (SD)				
Increase in alcohol consumption[d]	0.3 (1.3)	0.4 (2.0)	11.43	.001
Increase in alcohol-related problems[d]	0.6 (2.1)	0.5 (2.5)	3.43	.06
Increase in loneliness[f]	-0.1 (1.2)	0.1 (1.7)	9.67	.002
COVID-19 infection stressors				
Infected with COVID-19	178 (7.4)	15 (19.4)	13.07	.001
Someone in home infected with COVID-19	154 (6.9)	6 (6.1)	0.06	.79
Know someone who died of COVID-19	153 (5.6)	6 (7.1)	0.28	.59
COVID-19 pandemic stressors[g]				
COVID-19-related disease worries	0 (1.0)	0.2 (0.9)	0.77	.38

(continued)

Table 3. Characteristics of 2746 US Military Veterans With and Without New-Onset Suicide Ideation From Prepandemic to Peripandemic[a] (continued)

Variable	No. (%)[b]		χ^2 or t	P value
	No suicide ideation	New-onset suicide ideation		
COVID-19-related social restriction stress	0 (0.9)	0.2 (1.2)	6.44	.01
COVID-19-related financial stress	0 (0.9)	0.3 (1.4)	18.52	<.001
COVID-19-related worsening relationships	0 (0.9)	0.5 (0.9)	1.44	.02
Social engagement during pandemic	0 (1.0)	0 (1.0)	2.22	.13
Time exposed to COVID-19-related media per week, mean (SD), h	1.6 (2.2)	1.4 (1.7)	1.67	.19

Abbreviations: ADL, activities of daily living; AUD, alcohol use disorder; DUD, drug use disorder; IADL, instrumental activities of daily living; MDD, major depressive disorder; NA, not applicable; NSSI, nonsuicidal self-injury; PTSD, posttraumatic stress disorder; VA, Veterans Affairs.

[a] Sample includes veterans who denied past-year suicidal ideation at the prepandemic assessment (n = 2746).

[b] Data are presented as number and percentage unless otherwise indicated.

[c] Includes Asian, American Indian, Alaska Native, Native Hawaiian, Other Pacific Islander, and multiracial veterans.

[d] Scores on the Alcohol Use Disorders Identification Test; range = 0-40.

[e] Score on Barratt Impulsiveness Scale-Brief; range = 8-32.

[f] Scores on 3-item Loneliness Questionnaire adapted from the revised University of California, Los Angeles Loneliness Scale; range = 3-9.

[g] These are standardized scores derived from a factor analysis of items from the Coronavirus Health Impact Survey; 0 = mean and units are SD units.

organizations and public health experts, including Dr Anthony Fauci,[40] adopted and promoted the "we're in this together" public health message during the pandemic, which may have increased social cohesion on a broad societal level.

A small proportion of veterans (2.6%) developed new-onset SI during the pandemic, with low prepandemic social support emerging as one of the strongest risk factors. These results align with Joiner's interpersonal-psychological theory of suicide,[41] which posits that the development of SI stems in part from thwarted belongingness, a construct characterized by a perceived lack of social connection and support by others, as well as perceived burdensomeness, or the perception that one is a burden to loved ones. Prior research has found that social factors (eg, loneliness) are some of the most robust factors associated with SI among veterans and in the general population.[12] For example, in a study of veterans of Operations Enduring Freedom and Iraqi Freedom, low social support was a strong correlate of SI (Cohen d, 0.83), even after adjusting for sociodemographic and psychiatric characteristics.[42]

Veterans with prior suicide attempt histories were at 6-fold greater risk for new-onset SI, even after stringently controlling for the effects of lifetime depression, PTSD, and substance use disorders. This finding aligns with previous work linking history of suicidality with risk for future SI and behavior. For example, in a meta-analysis of 365 studies (3428 total risk factor effect sizes) spanning 50 years, history of suicidal thoughts or gestures was the single strongest risk factor for future SI relative to all other sociodemographic, clinical, and psychiatric variables.[43] Results of the current study also parallel previous research on veterans, observing that veterans with a lifetime suicide attempt are nearly 5 times more likely to endorse current SI relative to those without such histories.[44]

Preexisting history of PTSD and/or depression additionally emerged as one of the most robust risk factors associated with new-onset SI. These findings lend support to the vulnerability-stress model of suicidal behavior,[12] which posits that individuals with preexisting vulnerabilities (eg, mental illness) are at heightened susceptibility for experiencing SI after exposure to negative life events. Findings also converge with prior evidence among US veterans, which has found that PTSD and depression tend to be among the variables most strongly associated with suicidal ideation.[45,46] For instance, a recent nationally representative study found that US veterans who screened positive for lifetime PTSD or depression were approximately 2 and 3 times more likely, respectively, to report past 2-week SI relative to those without such histories after accounting for sociodemographic, clinical, and psychiatric characteristics.[45] Paralleling prior work, severity of AUD additionally emerged as a risk factor for new-onset SI, but this association was relatively modest compared with PTSD or depression.[47]

To our knowledge, the current study is one of the first population-based studies to suggest that COVID-19 infection is independently associated with new-onset SI. Veterans who reported prior infection were more than twice as likely to report past-year SI, even after adjusting for sociodemographic, psychiatric, and pandemic-related characteristics. It is notable that post hoc analyses revealed that 94% of veterans who reported being infected with COVID-19 reported that their symptoms were not severe, raising the possibility that even asymptomatic to moderate COVID-19 infection may be associated with elevated suicide risk. Several mechanisms have been suggested to mediate the association between COVID-19 infection and SI, including neuroinflammation, alterations in immune response, increased social isolation,

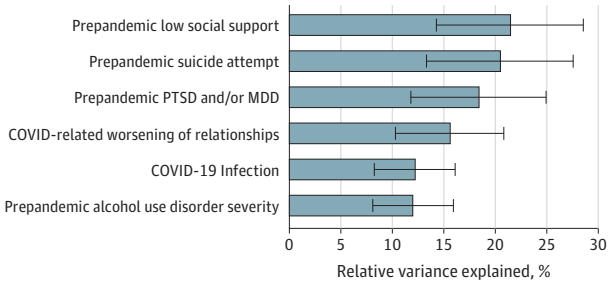
Table 4. Results of Multivariable Logistic Regression Analysis of Risk Factors and Correlates of New-Onset Suicide Ideation at Peripandemic Assessment (n = 2746)[a]

Variable	OR (95% CI)	*P* value
Sociodemographic characteristics		
Age	1.00 (0.98-1.02)	.96
Military characteristics		
VA primary source of health care	0.79 (0.42-1.50)	.48
Prepandemic psychiatric risk factors		
Lifetime PTSD and/or MDD	2.25 (1.16-4.35)	.01
Lifetime AUD and/or DUD	1.04 (0.57-1.90)	.88
Current insomnia	1.14 (0.56-2.34)	.70
Prepandemic psychosocial risk factors		
Adverse childhood experiences	0.86 (0.74-1.01)	.07
No. of lifetime traumas	1.00 (0.97-1.03)	.74
Lifetime suicide attempt	6.31 (2.71-14.67)	<.001
Loneliness	1.16 (0.98-1.38)	.08
Low social support	2.77 (1.46-5.28)	.002
Impulsivity	1.01 (0.93-1.08)	.82
Past-year AUD severity	1.06 (1.01-1.12)	.03
Lifetime NSSI	1.50 (0.52-4.25)	.44
Disability status	1.19 (0.56-2.51)	.63
COVID-19 infection stressors		
Infected with COVID-19	2.41 (1.16-5.01)	.01
Someone outside home infected with COVID-19	1.27 (0.73-2.23)	.39
COVID-19 pandemic stressors		
COVID-19-related financial stress	0.98 (0.79-1.21)	.85
COVID-19-related worsening relationships	1.47 (1.16-1.88)	.002

Abbreviations: AUD, alcohol use disorder; DUD, drug use disorder; MDD, major depressive disorder; NSSI, nonsuicidal self-injury; OR, odds ratio; PTSD, posttraumatic stress disorder; VA, Veterans Affairs.

[a] Sample includes veterans who denied past-year suicidal ideation at the prepandemic assessment (n = 2746).

Figure. Relative Importance of Significant Risk Factors and Correlates of New-Onset Suicide Ideation



Whiskers indicate 95% CIs. MDD indicates major depressive disorder; PTSD, posttraumatic stress disorder.

and stigma.[48] It is also important to note, however, that the current study used past-year measures of COVID-19 infection and SI, precluding the ability to establish temporal precedence. Furthermore, it is possible that other unmeasured physical and/or mental health comorbidities that may have predisposed veterans to increased risk of contracting COVID-19 may have also increased risk for SI, warranting caution in the interpretation of the results described herein and underscoring the need for future longitudinal studies to evaluate these associations.

Limitations

The current findings should be considered within the context of several limitations. First, estimates of suicidal behavior described here are likely an underestimate, given prior evidence that indicates that stigmatized behaviors are less likely to be reported.[49] Second, SI was assessed using a past-year measure, and therefore we were unable to establish whether ideation occurred before or after COVID-19 infection. Third, this study assessed for past-year suicidality at the peripandemic period, but it is possible that suicidal behavior may not emerge until later as a result of compounding problems. Last, participants in this study were all veterans, who were predominantly older adults, White, and male. Therefore, further research is needed to evaluate generalizability of the current findings to civilian samples and younger or more diverse veteran samples.

Conclusions

The results of this cohort study suggest that, contrary to expectations, the prevalence of suicidal behavior did not appear to increase among military veterans nearly 10 months into the COVID-19 pandemic. This study population may benefit from targeted suicide prevention and outreach efforts,[50] particularly those that aim to bolster social support. In the event of a future national public health crisis, the risk factors identified in the current study may serve as a preliminary template for identifying at-risk veterans and implementing strategies to mitigate risk of suicide.

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Concept and design: Nichter, Hill, Kline, Norman, Southwick, Pietrzak.
Acquisition, analysis, or interpretation of data: Nichter, Hill, Na, Krystal, Pietrzak.
Drafting of the manuscript: Nichter, Pietrzak.
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Boehringer Ingelheim International, Concert Pharmaceuticals, Inc, Epiodyne, Inc, Heptares Therapeutics, Limited (UK), Janssen Research & Development, L.E.K. Consulting, Otsuka America Pharmaceutical, Inc, Perception Neuroscience Holdings, Inc, Spring Care, Inc, Sunovion Pharmaceuticals, Inc, Takeda Industries, and Taisho Pharmaceutical Co, Ltd. Dr Krystal reported receiving income of greater than $10 000 per year from *Biological Psychiatry* as an editor. Dr Krystal reported receiving the drug Saracatinib for use in research studies from AstraZeneca and Mavoglurant from Novartis for research related to the National Institute on Alcohol Abuse and Alcoholism grant "Center for Translational Neuroscience of Alcoholism from AstraZeneca Pharmaceuticals." Dr Krystal reported having the following patents: (1) Seibyl JP, Krystal JH, Charney DS. Dopamine and noradrenergic reuptake inhibitors in treatment of schizophrenia. US Patent 5447948; September 5, 1995; (2) Coric V, Krystal JH, Sanacora G. Glutamate Modulating Agents in the Treatment of Mental Disorders. US Patent 8778979 B2. July 15, 2014. US Patent Application No. 15/695164; filing date, September 5, 2017; (3) Charney D, Krystal JH, Manji H, Matthew S, Zarate C. Intranasal Administration of Ketamine to Treat Depression. US application 14/197767 filed on March 5, 2014; US Application or Patent Cooperation Treaty International Application 14/306382 filed on June 17, 2014; (4) Zarate C, Charney DS, Manji HK, Mathew SJ, Krystal JH, Department of Veterans Affairs. Methods for Treating Suicidal Ideation, Patent Application 14/197.767 filed on March 5, 2014, by Yale University Office of Cooperative Research; (5) Arias A, Petrakis I, Krystal JH. Composition and methods to treat addiction. Provisional Use Patent Application 61/973/961 filed on April 2, 2014, by Yale University Office of Cooperative Research; (6) Chekroud A, Gueorguieva R, Krystal JH. Treatment Selection for Major Depressive Disorder, filed on June 3, 2016, USPTO docket Y0087.70116US00. Provisional patent submission by Yale University; (7) Gihyun Y, Petrakis I, Krystal JH. Compounds, Compositions and Methods for Treating or Preventing Depression and Other Diseases. US Provisional Patent Application 62/444552, filed on January 10, 2017, by Yale University Office of Cooperative Research OCR 7088 US01; and (8) Abdallah C, Krystal JH, Duman R, Sanacora G. Combination Therapy for Treating or Preventing Depression or Other Mood Diseases. US Provisional Patent Application 62/719935 filed on August 20, 2018, by Yale University Office of Cooperative Research OCR 7451 US01. Dr Krystal reported receiving provision of drug from Cerevel and Novartis; stock options from Biohaven Pharmaceuticals, RBNC, Sage, Epivario, Terran, Atai, and Spring Care; patent royalties from Janssen Pharmaceuticals; and personal fees from Biogen, Neurocrine, Takeda, Jazz, Aptinyx, Bionomics, Compass, Concert, Epiodyne, Sunovion, Taisho, BioXcel, Eisai, Psychogenics, Greenwich Biosciences, and Boehringer Ingelheim for advising on clinical trials. In addition, Dr Krystal reported having patent No. 8,778,979 with royalties paid from Biohaven for Use of Glutamate Modulating Agents in the Treatment of Mental Disorders, patent 9,592,207 with royalties paid from Janssen Intranasal for Administration of Ketamine to Treat Depression, and patent 15,379,013 with royalties paid from Janssen Methods for Treating Suicidal Ideation outside the submitted work. Dr Norman reported receiving grants from the Department of Defense, the US Department of Veterans Affairs, and Patient-Centered Outcomes Research Institute and personal fees from Elsevier Press and UptoDate outside the submitted work. No other disclosures were reported.

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