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Longitudinal courses of suicidal ideation in U.S. military veterans: a 7-year population-based, prospective cohort study

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Abstract

Background. Varied longitudinal courses of suicidal ideation (SI) may be linked to unique sets of risk and protective factors.

Method. A national probability sample of 2291 U.S. veterans was followed over four assessments spanning 7 years to examine how a broad range of baseline risk and protective factors predict varying courses of SI.

Results. Most veterans (82.6%) denied SI at baseline and all follow-ups, while 8.7% had new onset SI, 5.4% chronic SI, and 3.3% remitted SI. Compared to the no-SI group, chronic SI was associated with childhood trauma, baseline major depressive and/or posttraumatic stress disorder (MDD/PTSD), physical health difficulties, and recent traumatic stressors. Remitted veterans had the highest risk of a prior suicide attempt (SA) compared to no-SI [relative risk ratio (RRR) = 3.31] and chronic SI groups (RRR = 4.65); and high rates of MDD/PTSD (RRR = 7.62). New onset SI was associated with recent stressors and physical health difficulties. All symptomatic SI groups reported decrements in protective factors, specifically, social connectedness, trait curiosity/exploration, and purpose in life.

Conclusion. Nearly one-in-five veterans reported SI over a 7-year period, most of whom evidenced new onset or remitted SI courses. Chronic and remitted SI may represent particularly high-risk SI courses; the former was associated with higher rates of prospective SA, and psychiatric and physical distress, and the latter with increased likelihood of prior SA, and isolation from social and mental health supports. Physical disability, MDD/PTSD, and recent stressors may be important precipitating or maintaining factors of SI, while social connectedness may be a key target for suicide prevention efforts.

Introduction

Suicide rates have climbed 35% in the U.S. general population over the last 20 years (Hedegaard, Curtin, & Warner, 2020), even with the implementation of national goals to reverse this pattern (U.S. Department of Health and Human Services, 2010). Rates of suicide in U.S. military veterans have increased even more rapidly, and now exceed those of civilian populations by 41–60% (Kang et al., 2015), accounting for 13.5% of total U.S. suicides (U.S. Department of Veterans Affairs, 2019). These worrying trends persist despite a substantial scientific literature identifying risk factors for suicidal ideation (SI) and future suicidal behavior (Franklin et al., 2017; Nock et al., 2013). One challenge to suicide prevention is the heterogeneity in long-term courses of SI. More specifically, SI may not always take a stable longitudinal course (Witte, Fitzpatrick, Warren, Schatschneider, & Schmidt, 2006) but rather might intensify or remit over time, or fluctuate in response to changing circumstances (Allan, Gros, Lancaster, Saulnier, & Stecker, 2019). Variability in long-term patterns in SI might therefore be associated with unique constellations of risk factors and clinical presentations (Smith et al., 2016), thereby complicating the task of establishing descriptive profiles of SI risk to inform clinical interventions. The current study sought to characterize common courses of SI over a 7-year period and assess their relationship to a range of risk and protective correlates associated with SI and behavior.

Although the majority of those who experience SI do not go on to attempt or complete suicide (Nock et al., 2008), SI is the single-most common factor in attempted suicide (Baca-Garcia et al., 2011), much more so than prior suicidal behavior (Pagura, Cox, Sareen,

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& Enns, 2008). Moreover, the presence of SI is an indicator of severe distress (Have et al., 2009), and markedly increases likelihood of risk-taking behaviors, psychopathology, and non-suicidal self-injury (Nock et al., 2008; Witte et al., 2006), as well as eventual suicide (Franklin et al., 2017). Epidemiological frameworks (Mościcki, 1997) characterize suicide as the outcome of multiple interacting risk factors, both proximal (e.g. stressful life events, interpersonal losses, health deterioration, and physical pain) and distal [e.g. mental illness, prior suicide attempts (SAs), and childhood trauma exposure], as well as protective (e.g. adaptive coping, spirituality, and social support). Of note, many of these risk and protective factors are potentially modifiable, particularly those related to mental health, such as depression and post-traumatic stress disorder (PTSD), anxiety disorders, alcohol and substance use (Fuehrlein et al., 2016; Pietrzak et al., 2010; Sareen et al., 2005), impaired executive functioning (Bomyea, Stout, & Simmons, 2019), and engagement with mental healthcare. Historical risk factors such as prior SA (Franklin et al., 2017), childhood trauma (Bruffaerts et al., 2010), and combat trauma (Maguen et al., 2012), as well as age-related factors such as disability (Pietrzak, Pitts, Harpaz-Rotem, Southwick, & Whealin, 2017) and chronic health difficulties (Fanning & Pietrzak, 2013), may be additionally informative for suicide risk prediction and monitoring. However, despite recommendations to account for the complex interplay between risk and protective factors to understand vulnerability and resilience to SI and behavior (Mościcki, 1997, 2001), few studies examine how these factors are related to varying long-term trends in SI.

To date, only a handful of studies have examined longitudinal courses of SI in military and veteran populations, and these studies have demonstrated considerable fluctuation in SI over time. Using latent growth mixture modeling (LGMM), Allan et al. (2019) identified four distinct courses of SI in military servicemen over 12 months: stable-low, stable-moderate, stable-high, and rapidly declining-high SI. The moderate- and high-stable SI groups demonstrated the greatest likelihood of SA at follow-up, indicating that the course and stability of SI are not homogenous over time and may be important indicators of risk. Additionally, in large national veteran sample, only 35.0% of veterans who reported lifetime SI at baseline also reported SI over the subsequent 10 years (Borges, Angst, Nock, Ruscio, & Kessler, 2008), and 6.2% of veterans without prior SI/SA at baseline reported new onset SI during the follow-up period. Using LGMM, Wang et al. (2018) identified four longitudinal trajectories of SI in U.S. Reserve soldiers over 4 years – resilient, chronic, remitted, and new onset SI. A similar grouping method was used in a study of broadly-sampled U.S. veterans (Smith et al., 2016), wherein approximately 14% endorsed SI at baseline or after a 2-year follow-up period (8.7% and 9.9% at baseline and 2-years, respectively), and roughly half of SI cases at follow-up had new onset SI.

Although the aforementioned studies suggest heterogeneity in the long-term course of SI, few have examined risk and protective factors that are linked to SI courses, with the exception of Smith et al. (2016). This study assessed the relative likelihood of a range of baseline risk and protective correlates of suicidal thoughts and behavior in predicting varying patterns of SI over 2 years. Results revealed that greater psychiatric distress was related to reporting SI at any time point (i.e. baseline or follow-up), while physical health difficulties were associated with chronic SI and new onset SI. Furthermore, adaptive psychosocial traits and attitudes (e.g. resilience and gratitude) were associated with a lower likelihood of new onset SI. Other studies have examined SI courses in relation to a narrow range of potential risk factors, mostly limited to PTSD (Madsen, Karstoft, Bertelsen, & Andersen, 2014; Zerach, Levi-Belz, & Solomon, 2014). Thus, further research is needed to longitudinally characterize the nature of longer-term courses of SI (i.e. >3 years) and their associated risk and protective factors, in representative population-based samples of individuals at high risk for suicide, such as veterans. Such data can provide a more granular characterization of long-term suicide risk profiles, potentially identifying those at greater risk for transitioning from SI to attempt (Allan et al., 2019).

Toward this end, the current study aimed to build on prior literature by longitudinally following a large national sample of U.S. veterans over the course of four timepoints spanning 7 years and assessing a wide range of risk and protective factors associated with SI. Specifically, we aimed to: (1) characterize the prevalence of common courses of SI over a 7-year period; and (2) examine sociodemographic, military, trauma, health, and psychosocial factors associated with these courses.

Method

Sample recruitment

A national probability sample of U.S. military veterans were drawn from the 2011–2018 cohort of the National Health and Resilience in Veterans Study (NHRVS), a prospective cohort study of veterans aged 21 and older. A total of 2291 veterans completed the baseline assessment and at least one follow-up over a 7-year period, with assessments at baseline, and 2-, 4-, and 7-year follow-ups. The NHRVS sample was drawn from KnowledgePanel®, a probability-based, online non-volunteer survey panel of more than 50 000 U.S. households that is maintained by research firm GfK Knowledge Networks, Inc. (now Ipsos). To participate, individuals have to be randomly selected and invited, and KnowledgePanel therefore differs from most online panels (often called opt-in or consumer access panels) where participants volunteer or opt into studies.

Significant resources and infrastructure are devoted to KnowledgePanel's recruitment process so that it can accurately represent the adult population of the United States. Ipsos' recruitment process employs an address-based sampling methodology using the latest Delivery Sequence File, a database with all U.S. delivery point addresses serviced by the USPS, and they provide web-enabled tablets and free internet service to households without internet access. KnowledgePanel samples therefore cover all households regardless of their phone or internet status in effort to provide broadly representative online samples to the research community. To permit generalizability of study results to the entire population of U.S. veterans, post-stratification weights were applied (described by Fuehrlein et al., 2016) based on demographic distributions (e.g. age, gender, race/ethnicity, education, region, and metropolitan area) from the U.S. Census Bureau Current Population Survey (U.S. Census Bureau, 2011). All participants provided informed consent and the study was approved by the Human Subjects Subcommittee of the VA Connecticut Healthcare System.

The full panel recruitment rate in 2011 was 15.9% and the household profile rate was 62.3%, yielding a response rate of 9.9%. Of the 4750 veterans in the panel, 3188 participated in the baseline survey (67.1% participation rate). The final sample consisted of 2291 veterans who completed the baseline assessment

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and at least one follow-up over the course of 7 years. Follow-up assessments were conducted 2 (2013), 4 (2015), and 7 years (2018) after baseline. Veterans completed an average of 2.2 follow-ups (S.D. = 0.8, range = 1–3); 41.8% completed all three follow-ups, 31.1% completed two follow-ups, and 27.1% completed one follow-up. There were no significant differences in the number of completed follow-ups across groups (all pairwise contrasts p's >0.48). The average age of the sample at baseline was 61.5 (S.D. = 14.2, range = 22–93); most were male (91.5%), White/Caucasian (77.1%), and married/partnered (74.9%), with a minimum of some college or higher education (68.5%) and a yearly household income of less than $60 000 (53.8%). Veterans reported an average of 7.1 years in military service (S.D. = 7.7, range = 1–42), and most were non-combat veterans (67.3%).

Assessments

Sociodemographic and military variables

Table 1 describes measures used to assess sociodemographic and military characteristics.

Suicidal ideation

Current SI was assessed at baseline and all follow-up periods with two items adapted from the Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, and Williams, 2001) that assess the frequency with which veterans experienced thoughts of being better off dead (i.e. passive SI) or of hurting themselves (active SI) in the 2 weeks prior to assessment. Response options ranged from 0 ('not at all') to 3 ('nearly every day'), and responses of 1 ('several days') or higher were coded positive for the presence of SI.

Groups were stratified on the basis of SI endorsement during the 2 weeks prior to assessments at baseline and follow-up periods. Follow-up data were aggregated into a single timepoint to provide a stable and more statistically powered indication of the incidence or absence of SI over the follow-up period. Veterans who denied SI at baseline and all completed follow-up assessments were classified as 'no SI', while those who endorsed SI at baseline but denied SI at *all* completed follow-ups were classified as 'remitted SI'. Veterans who denied SI at baseline but endorsed SI at *any* completed follow-up were classified as 'new onset SI', while veterans who endorsed SI at baseline and *any* completed follow-up were classified as 'chronic SI'.

Risk and protective correlates

To minimize multicollinearity in multivariable analyses, exploratory factor analyses (EFAs) were conducted to reduce highly correlated, thematically related variables into factors. The following risk factors were assessed at baseline: lifetime SA, cognitive functioning, physical health difficulties (e.g. disability, medical diagnoses, and somatic symptoms), current depression [major depressive disorder (MDD)] and/or PTSD, current alcohol use disorder, and childhood and lifetime trauma exposure. Interim potentially traumatic events were also assessed at each follow-up assessment. The following protective correlates were examined at baseline: current mental health treatment, adaptive psychosocial traits (e.g. trait curiosity, resilience, and dispositional gratitude); social connectedness (e.g. supportive relationships, perceived support, and secure attachment style); and religiosity/spirituality. Table 1 provides a full description of component measures and assessment instruments of each of these measures.

Data analysis

One-way analyses of variance (ANOVA) and χ^2 analyses were conducted to compare sociodemographic and military characteristics, and baseline risk and protective factors, by the SI group variable. Post-hoc group comparisons were conducted with Fisher's least significant difference test and pairwise χ^2 tests. Variables that differed by SI group status at the $p < 0.05$ level in bivariate analyses were entered into a subsequent multinomial logistic regression examining differences in demographic, risk, and protective factors between those who endorsed SI at either baseline or follow-up compared to the no-SI reference group. The remitted and chronic SI groups were also compared. Finally, post-hoc analyses were conducted to identify component variables of composite factors that significantly differed by group in the multinominal regression.

Results

Sample characteristics

The majority of the sample, 1940 veterans (82.6%), denied SI at baseline and all follow-up assessments (i.e. 'no SI'), while 187 veterans (8.7%) denied SI at baseline but endorsed SI on at least one of three subsequent assessments (i.e. 'new onset SI'). Another 108 veterans (5.4%) were classified as 'chronic SI', having endorsed SI at baseline and on any of three follow-up assessment, and 56 veterans (3.3%) endorsed SI at baseline but denied SI at all follow-up assessments and were classified as 'remitted SI'.

One-way ANOVA and χ^2 analyses indicated that age, race, partnered status, education, income, combat veteran status, and years of military service differed significantly by SI group; these variables were therefore included as covariates in the multinomial regression analysis. Table 2 lists comparisons of sociodemographic and military characteristics by group, and group differences in risk and protective factors. Overall, the no-SI group was more likely than other groups to be older, White, and partnered, with higher income and educational attainment, and fewer years of military service. The chronic SI group was more likely than other groups to be younger, non-White, and not partnered. Prevalence of prior SA differed significantly by group, ranging from 3.5% in the no-SI group to 30.0% for remitted SI. Table 3 shows results of the multivariable analysis summarized below.

Predictors of remitted SI compared to no SI

The remitted SI group was the only group more likely than the no-SI group to report a prior SA. They were also nearly eight times more likely than the no-SI group to report current MDD/PTSD. Additionally, the remitted SI group scored lower than the no-SI group on measures of adaptive psychosocial traits and social connectedness. Specifically, post-hoc tests indicated that the remitted group scored lower on trait curiosity/exploration [relative risk ratio (RRR) = 0.74, 95% confidence interval (CI) 0.57–0.96, p = 0.025] and were less likely to endorse having a secure attachment style (RRR = 0.21, 95% CI 0.10–0.45, $p < 0.001$).

Predictors of new-onset SI compared to no SI

The new onset SI group scored higher than the no-SI group on a measure of physical health difficulties, and post-hoc tests indicated that this association was driven by greater likelihood of endorsing disability with instrumental activities, RRR = 2.49, 95% CI 1.53–4.03, $p < 0.001$. They also experienced more

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Table 1. Sociodemographic characteristics and risk and protective factors

Sociodemographic characteristics	The following characteristics were assessed: sex (dichotomous: male, female), age (continuous), marital status (dichotomous: unmarried, married or living with partner), race (dichotomous: non-White, White), education (dichotomous: high school diploma or less, more than high school), income (dichotomous: less than $ 60 000, $ 60 000 or more), and combat status (dichotomous: combat veteran, non-combat veteran).
Risk factors	
Lifetime SAs	Lifetime SA history was assessed with the question: 'Have you ever tried to kill yourself', with the response options 'No' or 'Yes'.
Cognitive functioning	Cognitive functioning in the past month was assessed at baseline using the Medical Outcomes Study Cognitive Functioning Scale (Stewart & Ware, 1992), a reliable and valid measure (Yarlas, White, & Bjorner, 2013). Higher scores on the MOS-CF indicate better functioning (Cronbach's $\alpha = 0.92$).
Physical health difficulties	A composite score of physical health difficulties was derived using an EFA of four physical health indicators: (1) sum self-reported physical health conditions, defined as the lifetime presence of physician- or other health professional-diagnosed medical conditions, including: arthritis, asthma, cancer, chronic pain, liver disease, diabetes, heart attack, heart disease, high cholesterol, high blood pressure, kidney disease, sleep disorder, migraine, multiple sclerosis, osteoporosis, rheumatoid arthritis, stroke, traumatic brain injury, HIV/AIDS, and other medical conditions; (2) any disability with activities of daily living (Hardy & Gill, 2004), such as requiring assistance with mobility or in the maintenance of daily hygiene; (3) any disability with instrumental activities of daily living, such as requiring regular assistance in meal preparation or payment of bills; and (4) current somatic symptoms assessed using the Somatization subscale of the Brief Symptom Inventory, e.g. pains in heart or chest (Derogatis & Spencer, 1993), Cronbach's $\alpha = 0.80$.
Current depression and PTSD	Current depressive symptoms were assessed using the Patient Health Questionnaire-2 (PHQ-2; Löwe, Kroenke, & Gräfe (2005); Cronbach's $\alpha = 0.91$). Current PTSD was assessed using the Posttraumatic Stress Checklist for DSM-IV (PCL-IV; Weathers, Huska, and Keane, 1991), a 17-item measure of PTSD symptom severity based on DSM-IV diagnostic criteria for PTSD. A total score of 50 or higher was indicative of probable PTSD (Terhakopian, Sinaii, Engel, Schnurr, & Hoge, 2008). The PCL-IV has shown good internal consistency, construct validity, and test-retest reliability (Weathers, Litz, Herman, Huska, & Keane, 1993) and had a Cronbach's $\alpha = 0.95$ in the current sample.
Current alcohol use disorder	Current alcohol use problems were assessed using the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C; Bush, Kivlahan, McDonell, Fihn, and Bradley, 1998). A score of 5 or higher was considered indicative of a positive screen for current alcohol use disorder.
Trauma exposure	The Trauma History Screen (THS; Carlson et al., 2011) was used to assess lifetime trauma exposure, including childhood, and was assessed at baseline as well as at follow-up periods in order to capture interim traumatic events. The THS is a self-report measure that assesses the lifetime occurrence of 14 potentially traumatic events; the NHRVS additionally assessed exposure to life-threatening illness or injury. The sum of potentially traumatic events endorsed, ranging from 0–15, was used as an index of lifetime trauma burden.
Protective factors	
Current mental health treatment	Current mental health treatment was assessed using the questions: 'Are you currently taking prescription medication for a psychiatric or emotional problem?' and 'Are you currently receiving psychotherapy or counseling for a psychiatric or emotional problem?' Affirmative endorsement of one or both items was indicative of current engagement in mental health treatment.
Adaptive psychosocial traits	A composite score of adaptive psychosocial traits (Pietrzak & Cook, 2013; Smith et al., 2016) was used to assess dispositional attitudes and capacities for coping that are associated with more positive mental health outcomes, including qualities such as resilience; a sense of life purpose; dispositional gratitude, optimism, and curiosity/exploration; and perceived community integration. Resilience was measured using the Connor–Davidson Resilience Scale (Campbell-Sills & Stein, 2007), a 10-item scale with items such as 'I am able to adapt when changes occur', measured on a scale from 1 ('not at all') to 5 ('nearly true all the time'); Cronbach's $\alpha = 0.93$. The Purpose in Life Test, Short Form (Schulenberg, Schnetzer, & Buchanan, 2011), a 4-item scale, was used to index sense of meaning and purposefulness in life, assessed on a scale from 1 ('no goals/purpose/progress/meaning') to 7 ('very clear goals/purpose/progress/meaning'; Cronbach's $\alpha = 0.89$). Dispositional gratitude, optimism, and curiosity were each assessed using single 7-point Likert scale items adapted from the Gratitude Questionnaire (GQ-6; McCullough, Emmons, & Tsang, 2001), the Life Orientation Test-Revised (LOTS-R; Glaesmer et al., 2012), and the Curiosity and Exploration Inventory-II (CEI-II; Kashdan et al., 2009), respectively. Sense of community integration and acceptance was assessed with a single item, 'I feel well integrated in my community'.
Social connectedness	The social connectedness factor, derived using an EFA, consisted of three indices of social support (Pietrzak & Cook, 2013; Smith et al., 2016), including (1) number of close friends and supportive relatives, which was assessed with the question, 'How many close friends and relatives do you have? People you feel at ease with and can talk to about what is on your mind', and required a numeric response; (2) attachment style, specifically, secure adult attachment (Hazan & Shaver, 1990), and inquired into veterans' relative comfort with relationship intimacy and giving/receiving support from others; and (3) perceived social support using a 5-item version of the Medical Outcomes Study – Social Support Scale (Sherbourne & Stewart, 1991). Veterans rated their availability of social support (e.g. 'someone to confide in or talk to about your problems') on a scale from 1 ('none of the time') to 5 ('all of the time'); Cronbach's $\alpha = 0.91$.
Religiosity/spirituality	Religiosity/spirituality was assessed using the Duke University Religion Index (DUREL; Koenig & Büssing, 2010), which assesses frequency of engagement in organized religious services and private spiritual activities, as well as intrinsic religiosity [e.g. 'In my life, I experience the presence of the Divine (i.e. God)']; Cronbach's $\alpha = 0.92$. An EFA of DUREL items was conducted to generate factor scores reflecting religiosity/spirituality.

Table 2. Sociodemographic, military, trauma, and clinical characteristics by SI status

	1 No SI $n = 1940$ (82.6%)	2 Remitted SI $n = 56$ (3.3%)	3 New onset SI $n = 187$ (8.7%)	4 Chronic SI $n = 108$ (5.4%)	Test of difference	p	Pairwise contrasts
Variables	Mean (s.d.) or n (%)						
Demographic and military factors							
Age	62.4 (14.3)	58.1 (15.3)	61.4 (14.0)	50.6 (14.2)	24.16	<0.001	1,2,3 > 4
Male sex	1768 (92.0%)	51 (91.3%)	166 (90.2%)	91 (85.0%)	7.17	0.067	–
White/Caucasian race	1650 (78.7%)	49 (81.4%)	155 (72.7%)	79 (59.6%)	25.21	<0.001	1,2 > 4
Some college/higher Ed	1664 (67.8%)	40 (50.0%)	163 (74.9%)	93 (78.9%)	20.67	<0.001	1,3,4 > 2
Married/partnered	1569 (76.8%)	40 (55.7%)	139 (74.5%)	71 (57.9%)	34.42	<0.001	1,3 > 2,4
Household income $60k+	1081 (48.0%)	22 (37.1%)	86 (37.2%)	41 (37.7%)	13.84	0.003	1 > 3
Years of military service	6.8 (7.4)	9.5 (11.2)	7.1 (7.0)	7.0 (7.8)	2.78	0.040	2 > 1
Risk factors							
Adverse life events							
Childhood trauma	391 (19.6%)	24 (32.8%)	45 (18.9%)	52 (56.1%)	88.91	<0.001	4 > 2>1,3
Combat exposure	662 (31.3%)	24 (44.3%)	64 (32.8%)	39 (41.2%)	9.50	0.023	–
Total traumas at baseline	2.9 (2.4)	4.5 (3.4)	3.5 (2.9)	6.9 (3.6)	89.04	<0.001	4 > 2>3 > 1
Total traumas post-baseline	1.9 (1.2)	2.8 (1.8)	2.9 (1.7)	4.8 (3.2)	136.81	<0.001	4 > 2,3 > 1
Health-related factors							
Lifetime suicide attempt	52 (3.5%)	12 (30.0%)	16 (8.8%)	21 (22.8%)	152.00	<0.001	2,4 > 3>1
Current MDD and/or PTSD	48 (2.7%)	26 (50.8%)	21 (11.7%)	63 (64.3%)	654.99	<0.001	4,2 > 3>1
Current alcohol use disorder	690 (35.2%)	22 (39.1%)	80 (38.8%)	33 (31.0%)	2.33	0.51	–
Current mental health treatment	107 (5.5%)	13 (20.0%)	24 (12.0%)	44 (43.0%)	208.44	<0.001	4 > 2,3 > 1
Cognitive functioning	92.7 (10.8)	84.0 (24.3)	85.4 (14.3)	65.7 (27.5)	157.36	<0.001	1 > 2,3 > 4
Physical health difficulties	−0.15 (0.80)	0.30 (0.94)	0.43 (1.19)	1.49 (1.88)	119.27	<0.001	4 > 2,3 > 1
Protective factors							
Adaptive psychosocial traits	0.16 (0.86)	−1.08 (1.09)	−0.45 (1.14)	−1.34 (1.41)	132.09	<0.001	1 > 3>2,4
Social connectedness	0.17 (0.93)	−1.07 (0.84)	−0.37 (1.04)	−1.20 (0.89)	112.93	<0.001	1 > 3>2,4
Religiosity/spirituality	0.05 (1.0)	−0.29 (0.93)	−0.13 (0.98)	−0.35 (1.02)	9.10	<0.001	1 > 2,3,4

SI, suicidal ideation; MDD, major depressive disorder; PTSD, posttraumatic stress disorder.

potentially traumatic events between baseline and follow-up assessments. The new onset SI also scored lower on a measure of adaptive psychosocial traits, which was driven by lower scores on measures of purpose in life (RRR = 0.93, 95% CI 0.89–0.98, $p = 0.004$) and trait curiosity/exploration (RRR = 0.85, 95% CI 0.72–0.99, $p = 0.040$); they also scored lower on a measure of social connectedness, which was driven by lower scores on measures of structural and perceived support (RRR = 0.96, 95% CI 0.93–0.99, $p = 0.021$ and RRR = 0.95, 95% CI 0.91– 0.99, $p = 0.013$, respectively).

Predictors of chronic SI compared to no-SI

The chronic SI group scored significantly higher than the no-SI group on a measure of physical difficulties, which was driven by greater likelihood of endorsing a disability with instrumental activities (RRR = 2.08, 95% CI 1.08–4.00, $p = 0.029$) and higher scores on a measure of somatic symptoms (RRR = 1.10, 95% CI 1.03–1.17, $p = 0.003$). They were more than five times more likely to screen positive for current MDD/PTSD. Chronic SI was the only group more likely than the no-SI group to report childhood trauma exposure and to have received mental health treatment. Experiencing a greater number of interim potentially traumatic events was also associated with chronic SI. The chronic SI group also scored lower on measures of adaptive psychosocial traits and social connectedness, which were driven by lower scores on dispositional optimism (RRR = 0.70, 95% CI 0.57–0.86, $p = 0.001$) and perceived social support (RRR = 0.89, 95% CI 0.84–0.95, $p < 0.001$), respectively.

Predictors of remitted SI compared to chronic SI

Compared to the chronic SI group, those with remitted SI were more likely to be younger and have lower educational attainment. The remitted SI was associated with a nearly five times greater likelihood of a prior SA compared to the chronic SI group. They also scored lower on a measure of physical health difficulties, although none of the component variables of this factor were significant after adjustment for multiple comparisons. The remitted SI group was less likely than those with chronic SI to be engaged

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Table 3. Results of multinomial logistic regression analysis predicting incident SI status

	Remitted SI *v.* No SI	New onset SI *v.* No SI	Chronic SI *v.* No SI	Remitted SI *v.* chronic SI
Variables	Adjusted RRRs (95% CI)			
Demographic and military factors				
Age	1.03 (1.00–1.05)†	1.01 (1.00–1.03)	0.98 (0.96–1.00)	**1.04 (1.01–1.08)****
Male gender	1.85 (0.61–5.61)	0.97 (0.52–1.83)	2.09 (0.90–4.87)†	0.89 (0.25–3.17)
White/Caucasian race/ethnicity	1.24 (0.60–2.58)	0.62 (0.41–0.93)	0.59 (0.33–1.04)†	2.12 (0.91–4.90)†
Some college/higher Ed	**0.36 (0.16–0.59)*****	**1.50 (1.00–2.23)***	1.26 (0.66–2.40)	**0.24 (0.10–0.57)*****
Married/partnered	0.63 (0.33–1.12)	1.51 (0.99–2.31)†	0.94 (0.53–1.67)	0.89 (0.40–1.97)
Household income $60k+	0.99 (0.52–1.92)	**0.66 (0.45–0.95)***	1.12 (0.64–1.98)	0.77 (0.40–1.97)
Years of military service	1.04 (1.00–1.07)†	1.01 (0.98–1.03)	0.99 (0.95–1.03)	1.05 (1.00–1.10)
Risk factors				
Adverse life events				
Childhood trauma	1.44 (0.72–2.91)	0.69 (0.42–1.12)	**2.91 (1.64–5.16)*****	0.50 (0.22–1.13)†
Combat exposure	1.33 (0.68–2.60)	0.88 (0.60–1.30)	0.66 (0.36–1.19)	2.03 (0.89–4.65)†
Total traumas at baseline	1.02 (0.89–1.18)	0.96 (0.88–1.05)	1.01 (0.90–1.13)	1.01 (0.86–1.20)
Total traumas post-baseline	1.19 (0.99–1.44)	**1.40 (1.23–1.58)*****	**1.37 (1.19–1.59)*****	0.87 (0.71–1.06)
Health-related factors				
Lifetime suicide attempt	**3.31 (1.48–7.38)****	1.0 (0.50–1.99)	0.71 (0.33–1.54)	**4.65 (1.81–11.97)*****
Current MDD and/or PTSD	**7.62 (3.70–15.66)*****	2.12 (1.329–3.40)	**5.37 (2.88–10.00)*****	1.42 (0.59–3.42)
Current alcohol use disorder	1.25 (0.59–2.68)	2.08 (1.35–3.21)	1.80 (0.94–3.48)†	0.70 (0.28–1.72)
Cognitive functioning	1.01 (0.99–1.03)	0.99 (0.98–1.00)†	0.99 (0.97–1.00)	0.12 (1.00–1.04)
Physical health difficulties	0.95 (0.67–1.36)	1.43 (1.19–1.72)***	**1.69 (1.33–2.15)*****	**0.57 (0.38–0.83)****
Protective factors				
Current mental health treatment	0.84 (0.37–1.94)	0.97 (0.55–1.73)	**2.48 (1.34–4.58)****	**0.34 (0.14–0.83)***
Adaptive psychosocial traits	**0.52 (0.37–0.73)*****	**0.60 (0.49–0.75)*****	**0.53 (0.39–0.70)*****	0.99 (0.66–1.47)
Social connectedness	**0.48 (0.33–0.70)*****	**0.78 (0.63–0.97)***	**0.63 (0.45–0.87)****	0.76 (0.48–1.22)
Religiosity/spirituality	1.14 (0.81–1.61)	1.02 (0.84–1.23)	1.07 (0.79–1.44)	1.07 (0.70–1.63)

SI, suicidal ideation; MDD, major depressive disorder; PTSD, posttraumatic stress disorder; 95% CI, 95% confidence interval.
Bold font indicates significant RRR: ***<0.001 level; **<0.01 level; *<0.05 level; †<0.10 level.

in mental health treatment but did not differ on other protective factors.

SI and SA during the follow-up period

We analyzed the likelihood of reporting SI in the chronic and new onset groups to further differentiate them. In the chronic SI group, 91.3% reported SI at wave 2, 71.0% at wave 3, and 76.8% at wave 4; with an 80% average probability of SI across follow-up assessments. In the new onset SI group, the average probability of SI at any follow-up was 55%; 58.7% at wave 2, 48.1% at wave 3, and 59.4% at wave 4.

We also examined the incidence of post-baseline SA in these groups. The chronic group had a 17.5% incidence of attempted suicide over the 7-year follow-up period, which was significantly higher than the other three groups ($p < 0.01$ for all comparisons). The new onset group had a 3.3% incidence of SA during this period, which did not differ significantly from the remitted and no-SI groups (0%, $p = 0.12$ and 2.3%, $p = 0.43$, respectively). Groups also did not differ in the number of years since their most recent SA prior to baseline, $F = 1.20$, $p = 0.31$ ($p > 0.39$ for all comparisons); no SI: $M = 23.6$ years, S.D. = 2.0; remitted SI: $M = 20.3$, S.D. = 3.1; new onset SI: $M = 22.2$, S.D. = 4.1; chronic SI: $M = 16.8$, S.D. = 3.1.

Discussion

The current study sought to characterize the nature of common courses of SI, and their associated risk and protective factors, over a 7-year period in a national probability sample of U.S. veterans. Results revealed a pattern of chronic SI in 5.4%, new onset SI in 8.7%, and remitted SI in 3.3% of the sample. The 7-year prevalence of SI was 17.4%, which is higher than previous estimates of lifetime SI in national studies of veterans (e.g. 10.0–13.9%, Herzog, Fogle, Harpaz-Rotem, Tsai, & Pietrzak, 2019; Nock et al., 2014), and twice that of cross-national studies of civilian adults (9.2%; Nock et al., 2008). Conceivably, longer-term longitudinal follow-up with multiple assessments may provide

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more accurate estimates of the prevalence of SI in the U.S. veteran population compared to cross-sectional or short-term follow-up designs. The current data suggest that the burden of SI in the general veteran population is quite high, with nearly one-in-five veterans endorsing SI at some point over 7 years. Of the veterans who reported SI at some point during the study period ($n = 351$), about half were new-onset cases, and only a third endorsed SI more than once. Consistent with prior literature (Smith et al., 2016), these results suggest that the course of SI in veterans is dynamic rather than static, with a considerable proportion exhibiting changes in SI over time (Allan et al., 2019).

This study is one of the first population-based longitudinal studies to identify risk and protective factors associated with long-term chronic SI in veterans. This group was three times more likely to endorse childhood trauma, even after controlling for lifetime trauma burden, psychiatric history, combat exposure, and sociodemographic characteristics. Indeed, childhood trauma has been found to be a distal independent risk factor for both SI and SA among veterans (Afifi et al., 2016; Nichter, Hill, Norman, Haller, & Pietrzak, 2020a). It has also been linked to greater stress sensitivity (Grasso, Ford, & Briggs-Gowan, 2013), lifetime trauma exposure (Desai, Arias, Thompson, & Basile, 2002), and psychopathology (Molnar, Berkman, & Buka, 2001) in adulthood. Chronic SI was also associated with MDD/PTSD, physical health difficulties, and a greater interim trauma. Thus, ongoing traumatic stressors may serve as a maintaining factor of SI among veterans who experience chronic SI, particularly when coupled with elevated psychiatric distress and health difficulties. Notably, 17.5% of those with chronic SI reported attempting suicide during the follow-up period compared to 0–3.3% in the other groups. The chronic SI group is therefore demonstrably at highest risk for prospective SA. Of note, the chronic SI group was the only group with greater likelihood of current mental health treatment engagement. Specifically, veterans with chronic SI were 2.5 times more likely to report mental health treatment utilization relative to those in the no-SI group. This finding accords with prior literature demonstrating that history of suicidality is a strong predictor of treatment engagement among high-risk veterans (Nichter, Hill, Norman, Haller, & Pietrzak, 2020b). Taken together, the chronic SI group may reflect a longitudinal pattern of suicidality characterized by a propensity for self-harm or non-lethal suicidal behavior, and greater help-seeking behavior.

A total of 3.3% of the sample had a remitted SI course. Relative to those with no SI, this group had the highest likelihood of a past SA and baseline MDD/PTSD. They were also nearly five times more likely to have had a prior SA compared to the chronic SI group. Although high rates of MDD/PTSD in the remitted group are consistent with past findings (Smith et al., 2016), the high rate of SA in this group is unexpected, and contrasts with Smith et al.'s findings of lower prior SA rates in remitted veterans. Prior SA is considered one of the most robust risk factors for future SA and completed suicides [Joiner et al., 2005; World Health Organization (WHO), 2019], even more so than the presence of SI (Ribeiro et al., 2016) or chronicity or duration of SI from onset (Nock et al., 2018). However, despite the high-risk history in the remitted group, these veterans did not exhibit elevated prospective risk of SA over the study period relative to those with new onset SI or no SI. Remitted veterans were, however, nearly eight times more likely than those with no SI to screen positive for baseline MDD/PTSD, and had 66% lower odds than the chronic SI group to be currently engaged in mental health treatment. One interpretation of this finding is that individuals with a history of suicidal behavior may be less willing to disclose SI or approach mental health treatment for fear of consequences such as hospitalization. Inadequate treatment engagement in this group might also serve to maintain high levels of psychological distress. Thus, the remitted group may potentially reflect a 'closeted' high-risk group of veterans that are both more likely to experience psychiatric distress and have a history of SA, but less likely to seek mental health treatment.

New onset SI was associated with greater physical health difficulties and exposure to a greater number of potentially traumatic events post-baseline, similarly to those with chronic SI. Previous study has likewise found that new onset SI is associated with physical health difficulties (Smith et al., 2016). In fact, physical illness and disability constitute a major risk factor for suicide in older adults, and in aging veterans specifically (Fanning & Pietrzak, 2013; Pietrzak & Cook, 2013; Russell, Turner, & Joiner, 2009; Thompson et al., 2014). For example, Thompson et al. (2014) found evidence of a 'dose–response' relationship between number of physical health problems and past-year SI among a sample of Canadian veterans, wherein each condition increased risk for past-year SI by 22%. Collectively, this finding underscores the importance of assessing, monitoring, and treating suicidality in veterans with physical health difficulties.

In addition to risk factors, the current study identified a number of protective psychosocial variables associated with different courses of SI. Specifically, the remitted and new onset groups scored lower on a measure of trait curiosity/exploration, and the latter group also reported lower purpose in life. Curiosity and sense of purpose might both reflect an openness or enthusiasm for novel or rewarding experiences that constitutes an important attitudinal factor that may distinguish individuals at increased risk for SI. Indeed, greater purpose in life, as well as the search for meaning, are both associated with lower risk of SI/SA (Corona, Van Orden, Wisco, & Pietrzak, 2019; Kleiman & Beaver, 2013). In addition to adaptive psychosocial traits, decrements in social connectedness and support were observed in all symptomatic SI groups. Specifically, the chronic and new onset SI groups reported lower perceived support, while the latter group additionally reported fewer structural supports (i.e. number of supportive individuals), and the remitted SI group was less likely to endorse having a secure attachment style. Consistent with interpersonal theories of suicide (Van Orden et al., 2010), poor social integration or thwarted belongingness are important risk factors for suicidality, and the current data suggest that reductions in social connectedness may be particularly implicated in the development of SI in veterans. Relatedly, loneliness is quite pervasive in older veterans, and has been linked to higher rates of depression, PTSD, and suicidality (Kuwert, Knaevelsrud, & Pietrzak, 2014; Teo et al., 2018). Social connectedness might therefore be an important clinical target in the prevention of SI in veterans.

A number of limitations of the current study warrant mention. First, SI at each measurement period, including baseline, was only assessed in relation to the past 2 weeks – a relatively narrow 'snapshot' – and it is therefore possible that individuals who denied SI still experienced relatively recent ideation that was not captured in our outcome assessment. Second, we do not have data on SI prior to the 2-week baseline assessment timeframe (i.e. lifetime SI), and group categorization is based only on the 2-week cross-sections at each follow-up assessment. Third, the relatively homogeneous sociodemographic composition of the U.S. national veteran

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population sampled here may limit generalizability to more diverse veteran subpopulations (e.g. specific regional or cohort samples), or civilian populations. Fourth, as is often the case in survey panels, enrollment response rates in the current study were low, possibly limiting the generalizability of results. However, low response rates are not necessarily indicative of biased data (Groves et al., 2009). Additionally, post-stratification weights were applied in inferential analyses to promote generalizability to the general U.S. veteran population.

Despite these limitations, to our knowledge, the current study represents the longest population-based prospective study to investigate courses of SI in a large national probability sample of U.S. veterans. Findings indicate that SI is substantially more prevalent among older veterans than previously conceptualized (Fanning & Pietrzak, 2013), with nearly one-in-five veterans experiencing SI over a 7-year period. Results further underscore the heterogeneity of long-term courses of SI and suggest that unique profiles of risk and protective factors predict different SI courses. Of particular public health importance, results of the current study suggest that older veterans with chronic SI are at significantly elevated risk for future SA, as nearly 20% attempted suicide over the 7-year study period. Additionally, veterans with a remitted course of SI may represent a covertly high-risk group, with an almost five-fold greater likelihood of prior SA relative to those with chronic SI, and greater isolation from social and mental health supports. Further research is needed to identify more proximate changes and transitions in SI in relation to suicidal planning, attempts, and fatalities; and evaluate the efficacy of interventions targeting empirically derived risk and protective factors to mitigate suicide risk in veterans and other populations at increased risk for suicide.

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Conflict of interest. All authors declare no conflicts of interest.

Ethical standards. The authors assert that all procedures contributing to this study comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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