Journal of Affective Disorders 294 (2021) 430–440

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Temporal sequences of suicidal and nonsuicidal self-injurious thoughts and behaviors among inpatient and community-residing military veterans

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ARTICLE INFO

Keywords:
Suicide
Nonsuicidal self-injury
Military
Veterans
Suicide attempt

ABSTRACT

Background: Suicidal and nonsuicidal self-injurious thoughts and behaviors (SITBs) are major health concerns among military veterans yet little is known about the temporal relations among these outcomes. This study examined the temporal relations between suicidal and nonsuicidal SITBs among higher-risk veterans. Specifically, we identified when SITBs emerged and evaluated the role of nonsuicidal self-injury (NSSI) in the medical lethality of suicide attempts (SA), relative risk, and survival time of suicidal SITBs (i.e., suicide ideation [SI], suicide plan, SA).

Method: Cross-sectional data were collected from two samples examining suicide risk among veterans receiving inpatient psychiatric care ($n = 157$) and community-residing veterans with current depression and/or past month SI ($n = 200$). Participants completed an interview to assess SITBs.

Results: SITBs emerged between ages 14-28 years with behaviors emerging, on average, earlier among inpatient veterans. The time lag between SITBs was not significantly different between groups. Inpatient veterans had a significantly shorter time lag from SI to SA. NSSI history predicted an increase in relative risk for all suicidal SITBs and shorter survival time. There was no association between NSSI history and medical lethality of the most serious SA for both groups.

Limitations: Limitations included use of cross-sectional, retrospective self-report with age-of-onset endorsed in years and not all SITBs were assessed (e.g., passive SI).

Conclusions: Veterans with a NSSI history are at high risk for suicidal SITBs and have a shorter survival time. Results showed thoughts (i.e., NSSI thoughts, SI) emerged before behavior (i.e., NSSI, SA) and NSSI emerged before SA.

In the past two decades, suicide prevalence among United States (US) military veterans has increased and exceeded that observed in the general population with a mortality rate 1.5 times greater than the non-veteran adults (Department of Veterans Affairs [VA], 2019; Ramchand et al., 2011), making it a national priority for the VA. Lifetime prevalence of nonsuicidal self-injury (NSSI) among veterans–approximately 8% to 30.3% (Bryan et al., 2015; Bryan et al., 2015; Villatte et al., 2015)–closely parallels and, in some instances, surpasses the prevalence of NSSI among non-veterans (Klonsky, 2011; Swannell et al., 2014). Although many studies have examined suicidal thoughts and behaviors among veterans (e.g., Kang et al., 2015; Lee et al., 2018), less is known about NSSI thoughts and behaviors in this group. Similarly, we know

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https://doi.org/10.1016/j.jad.2021.07.088
Received 15 November 2020; Received in revised form 18 June 2021; Accepted 13 July 2021
Available online 21 July 2021

little about the temporal relations between suicidal and nonsuicidal self-injurious thoughts and behaviors (SITBs) among veterans. Additional research may provide valuable insights for risk assessment, prevention, and intervention efforts among veterans.

Suicidal SITBs include thoughts and actions with some desire to die. These include suicide ideation (SI; i.e., thoughts of killing oneself; Silverman et al., 2007), suicide plans (SP; i.e., selection of method, that can lead to self-injury, with some intent to use it; Silverman et al., 2007), and suicide attempts (SA; i.e., non-fatal self-directed injury with at least some intent to die; Silverman et al., 2007). Nonsuicidal SITBs include thinking about engaging in NSSI ('NSSI thoughts') or engaging in NSSI behavior ('NSSI') (Nock, 2010). Although suicidal and nonsuicidal SITBs are distinct in their characteristics (e.g., age of onset; Glenn et al., 2017) and presence of suicidal intent (i.e., lack of suicidal intent in NSSI; Muehlenkamp, 2005), research indicates that these phenomena are related (e.g., Franklin et al., 2011; Joiner, 2007; Whitlock et al., 2013). NSSI and SAs co-occur (Jacobson et al., 2008; Klonsky et al., 2013) and share risk factors (e.g., depression; Fox et al., 2015; Franklin et al., 2017). Further, evidence demonstrates that prior NSSI is a robust predictor of a SA (Franklin et al., 2017). Taken together, research suggests a link between suicidal and nonsuicidal SITBs yet the temporal relations between these phenomena remain unclear, particularly among veterans–a group at high-risk for suicide.

Research on the temporal relations and development of SITBs has focused primarily on suicidal SITBs among non-veterans. Findings suggest that SI emerges in the year before a SA (Nock et al., 2008), but little is known about when SITBs emerge in relation to one another among veterans. To date, two studies examined the temporal relations of suicidal and nonsuicidal SITBs. Glenn et al. (2017) examined age-of-onset and time lag of suicidal and nonsuicidal SITBs among adolescents and found that NSSI thoughts and SI had the earliest age-of-onset and, temporally, emerged before NSSI and SAs. In one of the only studies to explore these relations among service members and veterans, Bryan and colleagues (2015) examined temporal relations between SI, SA, and NSSI. They found that SI emerged before NSSI and, among those with an NSSI history (i.e., past engagement in NSSI), NSSI emerged before a SA. Further, the average length of time to transition from SI to SA was longer for individuals who had an NSSI history compared with individuals with no NSSI history. These studies suggest NSSI thoughts and SI precede NSSI and SA (Bryan et al., 2015; Glenn et al., 2017) and that NSSI history is associated with an increased likelihood of suicidal SITBs (Bryan et al., 2015), and a slower transition to SA (Bryan et al., 2015; Glenn et al., 2017).

The study by Bryan et al. (2015) was an important step in improving our understanding of the temporal relations between suicidal and nonsuicidal SITBs among veterans. It has notable strengths in its examination of time lag and age-of-onset, but was limited by its inclusion of a nonclinical sample attending college, reliance on single-item measurements of SITBs that may lead to misclassification (Millner et al., 2015), and limited assessment of SITBs. The study did not examine SA medical lethality or the role of NSSI in relation to risk for suicidal SITBs, both of which may provide insight into the relations among these phenomena.

1. Present study

To address these limitations, we examined suicidal and nonsuicidal SITBs separately among two samples of veterans–a moderate-risk community sample and a high-risk acute psychiatric inpatient sample.[2] Using two different samples allows us to examine the degree to which associations of interest generalize across samples ranging in clinical severity and suicide risk. Notably, this study will enhance our understanding of SITB development among veterans who have received acute inpatient psychiatric care–a group at high-risk for suicide following discharge (Britton et al., 2017). We identified age-of-onset, temporal sequence, and time lag between suicidal and nonsuicidal SITBs to understand: 1) *when* SITBs emerge; 2) *which* veterans are more likely to have a more medically serious SA; and 3) *what* role NSSI history has in lifetime relative risk and survival time of suicidal SITBs.

We hypothesized, in both samples, nonsuicidal SITBs would have an earlier age-of-onset relative to suicidal SITBs. Consistent with Glenn et al. (2017), NSSI thoughts and SI would have an earlier age-of-onset compared to NSSI and SAs and, temporally, NSSI would precede a SA. Consistent with Bryan et al. (2015), we hypothesized that veterans with an NSSI history would have a significantly longer time lag from SI to SA compared with veterans with no NSSI history. We hypothesized, based on clinical severity, the inpatient sample would display significantly shorter time lags. Second, consistent with acquired capability (e.g., NSSI results in decreased fear of death; Van Orden et al., 2010), we hypothesized that veterans with an NSSI history will have made a SA with greater medical lethality compared with veterans with no NSSI history in both samples. Third, veterans with an NSSI history would have greater lifetime relative risk of experiencing suicidal SITBs (i.e., SI, SP, SA) and significantly shorter lifetime survival time across all suicidal SITBs (i.e., shorter time to SITB event since birth) compared with veterans with no NSSI history.

2. Method

Cross-sectional data were drawn from two independent samples examining veteran suicide risk. Study procedures and participants will be described by sample. Measures will be described together as both samples completed the same self-report and interview assessments.

2.1. Sample 1: veterans admitted to inpatient psychiatric care

2.1.1. Procedure

Eligible participants were admitted to a VA Medical Center inpatient psychiatric unit for current SI or SA, ≥ 18 years of age, and fluent in English. In consultation with the attending psychiatrist, we excluded individuals who were severely cognitively impaired (cognitive screener; Callahan et al., 2002). Participants completed self-report questionnaires and an interview during their inpatient psychiatric stay. Study procedures were approved by the VA Institutional Review Board and the Human Research Protection Office of the US Army Medical Research and Materiel Command.

2.1.2. Participants

Participants were 157 veterans recruited from a VA inpatient psychiatric hospital in the northeastern US as part of a larger study focused on identifying suicide risk factors (Millner et al., 2019). See Table 1 for demographic characteristics.

2.2. Sample 2: community-residing veterans

2.2.1. Procedures

Eligible participants were individuals from the community surrounding the local VA Medical Center where Sample 1 was recruited, ≥ 18 years of age, fluent in English, provided documentation of military service/veteran status, and endorsed at least one primary depressive symptoms (depressed mood, anhedonia) in the past two weeks and/or past month SI. We excluded individuals with severe cognitive impairment (congitive screener; Callahan et al., 2002). Participants completed self-report assessments and an interview in a university-based research laboratory. Study procedures were approved by the University's Institutional Review Board and the Human Research Protection Office of the US Army Medical Research and Materiel Command.

[2] Data for the two samples were collected simultaneously at two sites (see *Procedure* sections for additional details).

Table 1
Demographic, military, and clinical characteristics by sample.

	Sample 1: Inpatient (n = 157)	Sample 2: Community-Residing (n = 200)	Group Comparison Statistical Test[1]	p
Male, % (n)	70.8 (109)	89.5 (179)	$\chi^2 = 20.10$	< .001
Age, *M* (*SD*)	39.31 (23.51)	43.44 (14.53)	t = -.950	.343
Race/Ethnicity, % (n)			$\chi^2 = 4.89$	.428
Caucasian	74.5 (117)	71.0 (142)		
Black	14.6 (23)	20.5 (41)		
Asian	-	1.0 (2)		
Native American	-	1.0 (2)		
Multi-racial	3.2 (5)	3.0 (6)		
Hispanic	3.8 (6)	3.5 (7)		
Highest Education, % (n)				
High school/GED	26.1 (40)	18.0 (36)	$\chi^2 = 8.59$	.126
Technical School	9.1 (14)	6.0 (12)		
Some College	43.8 (67)	41.5 (83)		
College Graduate	13.1 (20)	20.5 (41)		
Some Graduate School	3.3 (5)	5.0 (10)		
Advanced Degree	4.6 (7)	9.0 (18)		
Age entered warzone, *M (SD)*	22.61 (6.03)	23.04 (5.21)	t = -1.23	.220
Military Branch, % (n)			$\chi^2 = 3.81$	.431
Army	51.3 (78)	48.2 (94)		
Air Force	15.8 (24)	10.8 (21)		
Navy	15.1 (23)	20.0 (39)		
Marines	16.4 (25)	16.9 (33)		
Other	1.3 (2)	4.1 (7)		
Type of Military Duty, % (n)			$\chi^2 = 1.48$	.477
Active	74.3 (113)	70.2 (139)		
Guard/Reserves	8.6 (13)	12.6 (25)		
Both	17.1 (26)	16.7 (33)		
Combat Exposure, % (n)			$\chi^2 = 2.87$	.238
Yes	45.4 (69)	45.2 (89)		
No	49.3 (75)	45.2 (89)		
Unsure	5.3 (8)	9.6 (19)		
Deployment to a warzone/draw hazard pay, % (n)	56.6 (86)	58.4 (115)	$\chi^2 = .113$	.736
Yes	56.6 (86)	58.4 (115)		
No	43.4 (66)	41.6 (82)		
Symptom severity, *M* (*SD*)				
PHQ-9	16.62 (7.00)	12.16 (6.38)	$t = 7.52$	.003
BSS	16.43 (6.5)	11.97 (5.23)	$t = 4.15$	< .001

Note. BSS = Beck Scale for Suicide Ideation; PHQ-9 = Patient Health Questionnaire – 9.

[1] Mean group differences were examined using independent samples t-tests and categorial group differences were examined using Pearson chi-square (χ^2) tests.

2.2.2. Participants

Participants were 200 veterans recruited from the surrounding community of a large city in the northeastern US as part of a larger study focused on identifying suicide risk factors. Approximately 59.5% (n = 119) were currently in psychiatric treatment at the time of enrollment. See Table 1 for demographic characteristics.

2.3. Measures

2.3.1. Self-injurious thoughts and behaviors interview

The Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock et al., 2007) is an interview that assesses a range of characteristics related to suicidal and nonsuicidal SITBs. The presence and age-of-onset for the following constructs were the focus of analyses: NSSI thoughts, NSSI behaviors, suicide ideation (SI), suicide plan (SP), and suicide attempt (SA; not including aborted/interrupted SA).[3] Trained interviewers administered the SITBI.

2.3.2. Medical lethality of most severe suicide attempt

Trained interviewers used the Lethality of Suicide Attempt Rating Scale-II (Berman et al., 2003) to assess medical lethality of the most severe SA. This scale, intended for use by non-medical professionals, generates a severity score of 0 (*no damage*) to 10 (*death*) and is designed to allow for comparison across SA methods.

2.3.3. Symptom severity

The Patient Health Questionnaire-9 (PHQ-9; Kroenke and Spitzer, 2002) and Beck Scale for Suicide Ideation (BSS; Beck et al., 1988) provided an overview of current symptom severity for depression and suicide intensity, respectively. Cronbach's alpha for PHQ-9 (Inpatient: α = .90; Community: α =.88) and BSS scores (Inpatient: α = .84; Community: α =.80) were good.

3. Data analytic plan

We performed analyses in SPSS 25. We examined the presence of suicidal and nonsuicidal SITBs separately for the samples and then compared across samples using Pearson chi-square tests and Cramer's phi for effect size. We examined SITB age-of-onset for each sample and then compared across samples using non-parametric Mann-Whitney U tests and r for effect size. For age-of-onset, outliers ($M \pm 3$ *SD*) were examined and retained if they did not change the pattern of results. To examine the time lag between SITBs, consistent with Glenn et al. (2017), we calculated difference scores using age-of-onset for each SITB; these were calculated with and without outliers ($M \pm 3$ *SD*). For example, to calculate the time lag between SI and SA, we subtracted SI age-of-onset from SA age-of-onset. As an example interpretation, a positive value would indicate that the onset of SI occurred before SA, whereas a negative value would indicate the onset of SI occurred after SA. We analyzed time lags in each sample using independent samples t-tests and Cohen's d for effect size. To determine whether NSSI history was related to the medical lethality of the most medically serious SA, we analyzed each sample using independent samples t-tests and Cohen's d for effect size.

Using data from each sample, we conducted survival analysis models with person year (i.e., number of years participants were at risk of the suicidal SITB outcome since birth to time of assessment) as the unit of analysis. We treated each year in the life of each respondent as a separate observation, with years prior to the onset of the outcome (e.g., SI) coded 0 and the year of onset coded 1. For respondents who never experienced the outcome, we included all person-years up to the age at assessment. We used cox regression analyses to determine relative risk of experiencing the suicidal SITB outcome based on NSSI history (no NSSI history coded as 0, NSSI history coded as 1). The primary assumption of this analysis is that the model(s) passes the test of proportional hazards (Flynn, 2012); sample size and expected effect size are similar to prior military veteran studies using this approach (e.g., Bryan et al., 2015). We used Kaplan Meier analyses to determine median (i.e., time point at

[3] All modules of the SITBI were administered. SITBI administration time varied, depending on the number of SITBs endorsed by the interviewee. Example items from the SITBI include: (a) SI: "Have you had thoughts of killing yourself?" (response provided as yes or no), (b) SI age-of-onset: "How old were you the first time you had thoughts of killing yourself?" (response provided in years), (c) SA: "Have you ever made an actual attempt to kill yourself in which you had at least some intent to die?" (response provided as yes or no), (d) SA age-of-onset: "How old were you the first time you made a suicide attempt?" (response provided in years)

which the cumulative survival drops below 50%) and mean survival times for all of the suicidal SITB outcomes in each sample. We conducted log rank tests to determine if there were differences in the survival distribution for suicidal SITBs for veterans with and without an NSSI history.

4. Results

4.1. Descriptive analyses

Table 2 provides SITBs characteristics.

4.1.1. Sample 1: veterans admitted to inpatient psychiatric care

Regarding history of suicidal SITBs, there was no statistically significant difference between men and women in SA history (χ^2 [1, N = 126] = 1.31, p = .252). There was a statistically significant difference between men and women in SI (χ^2 [1, N = 154] = 6.71, p = .010) and SP history (χ^2 [1, N = 154] = 9.46, p = .002), such that 63.03% (n = 69) of men and 84.44% (n = 38) of women reported a SI history and 39.5% (n = 43) of men and 66.67% (n = 30) of women reported a SP history.

4.1.2. Sample 2: community-residing veterans

Regarding suicidal SITBs, there was no significant difference between men and women in SP (χ^2 [1, N = 200] = .102, p = .750) or SA history (χ^2 [1, N = 200] = .023, p = .879); however, there was a statistically significant difference between men and women in SI history (χ^2 [1, N = 200] = 4.46, p = .035), such that 62.01% (n = 111) of men and 38.10% (n = 8) women reported an SI history.

4.2. Age-of-onset of suicidal and nonsuicidal SITBs

Both samples reported all SITBs began between ages 14-28. SA had an earlier age-of-onset than SP in the inpatient sample (SP: age 28; SA: age 26); however, this pattern was not observed among the community-residing sample (SP: age 26; SA: age 28). In both samples, nonsuicidal SITBs preceded all suicidal SITBs; however, the age-of-onset was not statistically significant across samples ($ps > .05$).

4.3. Time lag of suicidal and nonsuicidal SITBs

We examined the time lag between SITBs using difference scores that were calculated using the age-of-onset of each SITB (Table 3). With one exception (i.e., SI to SA in the inpatient sample), the time lag between SITBs was not significantly different across the two samples. On average, the time lag between suicidal SITBs was shorter in the inpatient sample compared with the community-residing sample.

We examined the time lag of SI to SA based on presence of NSSI history. Among veteran inpatients, those with an NSSI history reported a shorter transition from SI to SA compared with veteran with No-NSSI history (3.2 vs. 3.4 years on average, respectively). In the community sample, those with an NSSI history reported a shorter transition from SI to SI compared with veteran with No-NSSI history (6.4 vs. 7.6 years on average, respectively). In sum, veterans with an NSSI history, had a shorter transition, on average, from SI to SA compared with veterans with No-NSSI history.

After adjustment for multiple comparisons when the results of hypothesis testing have statistically dependent outcomes (Sjölander and Vansteelandt, 2019) using the standard false discovery rate procedures (Benjamini and Hochberg, 1995), the significant time-lag results were no longer significant.

4.4. NSSI history and medical lethality of the most medically serious SA

In the inpatient sample, there was no significant difference in medical lethality in the most serious SA between the No-NSSI history group (M = 4.41, SE = 0.33) and the NSSI history group (M = 3.70, SE = 0.34). In the community-residing sample, there was no significant difference in medical lethality in the most serious SA between the No-NSSI history group (M = 5.18, SE = 1.07) and the NSSI history group (M = 4.50, SE = 1.50).

5. Survival analyses

5.1. Cox regression results

5.1.1. Suicide ideation

In the inpatient sample, NSSI history significantly predicted lifetime survival time (χ^2 [1, N = 154] = 15.95, p < .001), such that the NSSI history group was 2.65 times (p < .001, 95% CI = 1.53-3.65) more likely to experience SI than the No-NSSI history group. In the community-residing sample, NSSI history significantly predicted lifetime survival time (χ^2 [1, N = 199] = 52.77, p < .001), such that the NSSI history group was 4.26 times (p < .001, 95% CI = 2.79-6.51) more likely to experience SI than the No-NSSI history group.

5.1.2. Suicide plan

In the inpatient sample, NSSI history significantly predicted lifetime survival time (χ^2 [1, N = 155] = 13.24, p < .001), such that the NSSI history group was 2.50 (p < .001, 95% CI = 1.50-4.16) times more likely to experience a SP than the No-NSSI history group. In the community-residing sample, NSSI history significantly predicted lifetime survival time (χ^2 [1, N = 199] = 60.80, p < .001), such that the NSSI history group was 6.05 times (p < .001, 95% CI = 3.63 10.10) more likely to experience a SP than the No-NSSI history group.

5.1.3. Suicide attempt

In the inpatient sample, NSSI history significantly predicted lifetime survival time (χ^2 [1, N = 155] = 18.12, p < .001), such that the NSSI history group was 3.19 times (p < .001, 95% CI = 1.82-5.60) more likely to experience a SA than the No-NSSI history group. In the community-residing sample, NSSI history significantly predicted lifetime survival time (χ^2 [1, N = 199] = 42.69, p < .001), such that the NSSI history group was 6.60 times (p < .001, 95% CI = 3.45-12.64) more likely to experience a SA than the No-NSSI history group.

5.2. Kaplan Meier results

5.2.1. Suicide ideation

Lifetime survival distributions for SI are presented in Fig. 1. Lifetime survival distributions for the two groups (NSSI history vs. No-NSSI history) were significantly different, $\chi^2(1) = 62.408$, p < .001, adjusting for sample. In the inpatient sample, the median lifetime survival time was 22 years for the NSSI history group and 27 years for the No-NSSI history group. The mean lifetime survival time was 18.67 years and 45.58 years for the NSSI history and No-NSSI history group, respectively. In the community-residing sample, the median lifetime survival time was 16 years for the NSSI history group and 43 years for the No-NSSI history group. The mean lifetime survival time was 23.38 years and 39.48 years for the NSSI history and No-NSSI history group, respectively.

5.2.2. Suicide plan

Lifetime survival distributions for SP are presented in Fig. 2. Lifetime survival distributions for the two groups (NSSI history vs. No-NSSI history) were statistically significantly different, $\chi^2(1) = 61.655$, p < .001, adjusting for sample. In the inpatient sample, the median lifetime survival time was 30 years for the NSSI history group and 55 years for the No-NSSI history group. The mean lifetime survival time was 27.66 years and 59.84 years for the NSSI history and No-NSSI history group, respectively. In the community-residing sample, the median lifetime survival time was 23 years for the NSSI history group and 76 years for the No-NSSI history group. The mean lifetime survival time was 32.48 years and 50.92 years for the NSSI history and No-NSSI history group,

Table 2
Lifetime prevalence, age-of-onset, and characteristics of SITB in inpatient and community samples.

Prevalence	Sample 1: Inpatient (n = 157) %, *(n)*	Sample 2: Community-Residing (n = 200) %, *(n)*	Group Comparison Statistical Test (χ^2)[1]	*p*		*ES* (ϕ)	
NSSI Thoughts	19.9 (31)	22.5 (45)	0.36	0.548		0.032	
NSSI	21.2 (33)	17.1 (34)	0.94	0.331		0.052	
Suicide Ideation	69.2 (108)	59.5 (119)	3.59	0.058		0.100	
Suicide Plan	47.4 (74)	36.5 (73)	4.32	**0.038**		0.110	
SA	34.6 (54)	20.0 (40)	9.63	**0.002**		0.165	
Age-of-Onset (Years)	*M (SD); Mdn (Range)*	*M (SD); Mdn (Range)*	*Statistical Test*[2]	*p*		*ES (r)*	
NSSI Thoughts	14.97 (22.27); 16 (5-45)	21.79 (11.59); 18 (8-55)	593.00	0.338		-0.11	
NSSI	18.15 (8.79); 16 (3-45)	20.87 (13.46); 18 (6-88)	589.00	0.431		-0.09	
Suicide Ideation	24.56 (12.23); 22 (4-58)	22.66 (11.74); 20 (4-63)	5784.50	0.194		-0.08	
Suicide Plan	28.20 (13.36); 25 (5-61)	26.94 (13.36); 25 (4-62)	2527.50	0.501		-0.05	
SA	26.46 (11.43); 23.50 (7-58)	28.57 (14.66); 25 (4-65)	1056.50	0.567		-0.06	
Most Medically Serious SA			*Statistical Test*[3]	*t*	*df*	*p*	*d*
LSARS-II, *M (SD)*	4.15 (1.81)	5.0 (3.22)		-1.35	68	0.179	0.32
Age at SA, *M (SD)*	33.87 (11.18)	33.89 (14.25)		-.008	89	0.994	0.01
Method, % (*n*)[4]							
Medication	72.2 (39)	-					
Multiple Methods	7.4 (4)	-					
Cutting	7.4 (4)	-					
Jumping	5.6 (3)	-					
Suffocation	3.7 (2)	-					
Firearm	1.9 (1)	-					
Drowning	1.9 (1)	-					

Note. ES = effect size; LSARS-II: Lethality of Suicide Attempt Rating Scale-II; NSSI = nonsuicidal self-injury; SA = suicide attempt; SITB = self-injurious thoughts and behaviors.

[1] Group differences were examined using Pearson chi-square tests and Cramer's phi coefficient *(ϕ)* was used for examination of effect size.

[2] Group differences in age-of-onset were examined using Mann-Whitney *U* tests and *r* was used for examination of effect size.

[3] Group differences concerning the most medically serious suicide attempt were examined using independent samples *t*-tests and Cohen's *d* was used for examination of effect size.

[4] Method used in the most medically serious suicide attempt was not collected for the community sample.

respectively.

5.2.3. Suicide attempt

Lifetime survival distributions for SA are presented in Fig. 3. Lifetime survival distributions for the two groups (NSSI history vs. No-NSSI history) were statistically significantly different, $\chi^2(1) = 54.418$, $p < .001$, adjusting for sample. In the inpatient sample, the median lifetime survival time was 28 years for the NSSI history group but could not be determined for the No-NSSI history group.[4] The mean lifetime survival time was 39 years and 72.12 years for the NSSI history and No-NSSI history group, respectively. In the community-residing sample, the median lifetime survival time was 43 years for the NSSI history group but could not be determined for the No-NSSI history group. The mean lifetime survival time was 35.07 years and 59.02 years for the NSSI history and No-NSSI history group, respectively.

6. Discussion

The findings from this study improve our understanding of suicidal and nonsuicidal SITBs among inpatient (high-risk) and community-residing (moderate-risk) veterans by identifying when SITBs emerge and their temporal development. We identified an important subgroup of veterans–those with an NSSI history–and showed that those veterans are not only at an increased lifetime relative risk for all suicidal SITBs, but also have a shorter lifetime survival time for all suicidal SITBs compared to veterans without an NSSI history.

Suicidal and nonsuicidal SITBs emerged, on average, between ages 14-28 in both samples with suicidal and nonsuicidal behavior beginning several years earlier in the inpatient sample relative to the community-residing sample. Nonsuicidal SITBs had an earlier age-of-onset compared to suicidal SITBs in both samples, which is consistent with active duty military (Turner et al., 2019) and non-veteran samples (Glenn et al., 2017). Suicidal SITBs began in early adulthood (ages 22-28)–much later than what is observed in the general population (Nock et al., 2008). For the most part, thoughts (NSSI thoughts, SI) had an earlier age-of-onset than behaviors (NSSI, SA); however, in the community-residing sample, NSSI thoughts emerged after NSSI. This discrepancy may be related to impulsiveness or negative urgency associated with NSSI (e.g., Bresin et al., 2013), but given this finding is inconsistent with literature on NSSI development (Glenn et al., 2017), it is likely an artifact. Finally, NSSI had an earlier age-of-onset than SA. This pattern suggests the temporal ordering of SITBs begins with NSSI thoughts and/or NSSI and is then followed by SI and SA. However, the inclusion of SP complicates this temporal ordering. SA precedes SP in the inpatient sample whereas SP precedes SA in the community-residing sample. This difference suggests that the inpatient sample may be engaging in more "impulsive" SAs (see Millner et al., 2017 for a discussion on SPs and Rimkeviciene and De Leo, 2015 for a review on impulsive SAs) or, alternatively, current research lacks measures sensitive enough to examine SPs (Anestis et al., 2014). More nuanced examinations of SPs–an inconsistently defined construct (Millner et al., 2017)–and replication is needed. In sum, the majority of these findings align with age-of-onset research among veterans (Bryan et al., 2015) and adolescents (Glenn et al., 2017).

The time lag of SITBs was not significantly different across samples, indicating, overall, the time and pattern between SITB transitions is relatively similar among inpatient and community-residing veterans. Generally, veterans reported thinking about suicide for 4-5 years before developing their first SP and it took <1 year-3 years to transition from SP to SA. The time lag between SI and SA and between SP and SA is longer than what is observed among non-veterans (Nock et al., 2008). The reasons for this difference are unclear but may be related to characteristics of being in a military environment which is comparatively more controlled than non-military environments. Taken together with our age-of-onset results, there are differences in when SITBs begin, but the time it takes to transition between SITBs is relatively similar.

[4] Median survival times for some subgroups were unable to be determined because the event had not occurred for more than half of that subgroup.

Table 3
Time lag (in years) between one type of SITB to another type of SITB in inpatient and community samples.

Time lag between SITBs[1]	Sample 1: Inpatient (n = 157)			Sample 2: Community-Residing (n = 200)			Group Comparison[2]				
	n	*M (SD)*	Range (years)	*n*	*M (SD)*	Range (years)	*t*	*df*	*p*	*Adj p*	*d*
NSSI thoughts to NSSI											
With outliers	28	0.57 (1.45)	0 to 6	31	-0.19 (3.70)	-15 to 7	1.02	57	0.311	0.734	0.27
Without outliers	27	0.37 (1.01)	0 to 4	30	0.33 (2.53)	-10 to 7	0.13	55	0.893	0.963	0.03
NSSI thoughts to SI											
With outliers	28	0.71 (11.44)	-23 to 32	36	-0.33 (8.66)	-27 to 25	0.38	62	0.699	0.904	0.09
Without outliers	28	0.71 (11.44)	-23 to 32	35	0.42 (7.47)	-20 to 25	0.09	61	0.929	0.963	0.02
NSSI thoughts to SP											
With outliers	22	5.09 (11.53)	-12 to 34	27	4.11 (11.75)	-27 to 42	0.29	47	0.771	0.917	0.08
Without outliers	22	5.09 (11.53)	-12 to 34	26	2.65 (9.16)	-27 to 25	0.25	46	0.419	0.734	0.23
NSSI thoughts to SA											
With outliers	19	3.73 (13.46)	-23 to 34	17	5.05 (16.40)	-27 to 55	0.92	34	0.792	0.917	0.08
Without outliers	19	3.73 (13.46)	-23 to 34	16	1.93 (10.51)	-27 to 16	0.43	33	0.434	0.734	0.14
NSSI to SI											
With outliers	29	0.68 (11.06)	-23 to 28	37	-1.18 (7.48)	-21 to 25	0.82	64	0.415	0.734	0.18
Without outliers	29	0.68 (11.06)	-23 to 28	36	-1.91 (6.12)	-21 to 12	1.20	63	0.233	0.734	0.29
NSSI to SP											
With outliers	22	5.13 (10.90)	-12 to 30	29	5.00 (10.10)	-13 to 42	0.04	49	0.963	0.963	0.01
Without outliers	22	5.13 (10.90)	-12 to 30	28	3.67 (7.30)	-13 to 25	0.56	48	0.575	0.878	0.15
NSSI to SA											
With outliers	19	4.26 (13.27)	-23 to 30	20	7.50 (11.15)	-2 to 42	-0.82	37	0.414	0.734	0.26
Without outliers	19	4.26 (13.27)	-23 to 30	19	5.68 (7.86)	-2 to 25	-0.40	36	0.690	0.904	0.12
SI to SP											
With outliers	74	4.22 (8.61)	-24 to 39	72	5.90 (10.62)	-33 to 50	-1.03	144	0.301	0.734	0.17
Without outliers	73	3.76 (7.64)	-24 to 27	69	5.34 (7.11)	-8 to 28	-1.27	140	0.205	0.734	0.20
SI to SA											
With outliers	54	3.38 (7.18)	-6 to 44	42	7.07 (10.29)	-7 to 40	-2.06	94	**0.042**	0.462	0.41
Without outliers	53	2.62 (4.51)	-6 to 20	41	6.28 (8.99)	-7 to 30	-2.56	92	**0.012**	0.264	0.51
SP to SA											
With outliers	45	0.44 (8.53)	-15 to 43	35	3.25 (9.75)	-11 to 39	-1.37	78	0.174	0.734	0.30
Without outliers	44	-0.52 (5.61)	-15 to 13	34	2.20 (7.63)	-11 to 27	-1.82	76	0.071	0.513	0.40
SI to Most Lethal											
With outliers	55	10.60 (12.44)	-6 to 48	38	12.00 (12.76)	0 to 42	-0.52	91	0.599	0.878	0.11
Without outliers	54	9.99 (11.44)	-6 to 44	38	12.00 (12.76)	0 to 42	-0.82	90	0.413	0.734	0.17

Note. NSSI = nonsuicidal self-injury; SA = suicide attempt; SI = suicide ideation; SP = suicide plan.

[1] Time lags were calculated by subtracting the first SITB's age-of-onset of the from the second SITB's age-of-onset (e.g., age-of-onset for SI minus age-of-onset for SA). A negative value indicates that the second SITB had an earlier age-of-onset than the first SITB. For example, to calculate the SI to SA time lag for a participant with an SI age-of-onset of 12 years old and an SA age-of-onset of 20 years old, we would subtract 12 years old (SI) from 20 years old (SA) to get a value of 8 years. This positive value indicates that the onset of SI occurred before the onset of SA. Consistent with Glenn et al. (2017), outliers are defined as $M \pm 3$ *SD*.

[2] Independent samples *t*-tests were used for group comparison and Cohen's *d* was used for examination of effect size. Adjusted *p*-values, using the standard false discovery rate procedures (Benjamini and Hochberg, 1995), are also reported in this table.

We examined the role of NSSI history in relation to risk for suicidal SITBs, their temporal development, and time lag between types of SITBs. For both samples, an NSSI history was associated with an increased lifetime relative risk for all suicidal SITBs, shorter lifetime survival time, and shorter time lag between SITBs. Age-of onset was earlier in veterans with a NSSI history compared with those without a NSSI history for both samples. The findings from time lag analyses, specifically the role of NSSI in the SI to SA time lag, provide clarity for the temporal development of suicidal and nonsuicidal SITBs. For veterans with an NSSI history, the transition from SI to SA was, on average, shorter compared to veterans with no NSSI history, lending support to NSSI as a marker of suicide risk for inpatient and community-residing veterans. One explanation may be through acquired capability in which NSSI results in habituation to the fear and pain of death. Recent work with military service members and veterans supports this hypothesis, demonstrating that the association between NSSI and SA history was only significant for individuals with high levels of acquired capability (Chu et al., 2018). Our time lag results contrast with the Bryan and colleagues (2015) study which found that a history of NSSI slowed the transition from SI to SA. This discrepancy may be the result of differences in clinical severity and underscores the need to understand the full spectrum of clinical severity in veterans and how NSSI's role may change as function of that clinical severity. Overall, our results converge with studies in active duty personnel (Turner et al., 2019), veterans (Bryan and Bryan, 2014; Bryan et al., 2015; Bryan et al., 2015), and general population (e.g., Klonsky, 2011) which indicate that NSSI plays an important role in relative risk for SAs.

Our hypothesis that NSSI increases medical lethality of the most serious SA was not supported. Veterans with an NSSI history did not have a SA with greater medical lethality compared with veterans with no NSSI history. This finding was surprising given that NSSI is theoretically posited to increase an individual's acquired capability and should facilitate more medically serious SAs through increased pain tolerance and decreased fear of death (Van Orden et al., 2010). Although there is research on the relation between NSSI and subjective lethal intent (subjective SA lethality; e.g., Andover and Gibb, 2010), to our knowledge, research on whether NSSI increases the objective medical lethality of SAs is absent from literature. Subjective medical lethality was not measured in this study and cannot be examined. Future studies may want to examine the role of NSSI in both objective and subjective medical lethality of a SA.

Our results have important clinical implications for risk assessment and prevention efforts among veterans. These findings provide clinicians with a general sense of the temporal timing and patterns of transition between suicidal and nonsuicidal SITBs for two higher-risk groups of veterans. Findings suggest that NSSI may be an important factor to routinely incorporate into suicide risk assessments, while being mindful of potentially stigmatizing or gendered language that can decrease reporting in men (e.g., Berger et al., 2012). Veterans who screen positive for NSSI may be at elevated risk for suicide and may benefit from effective interventions targeted towards SITBs (e.g., Cognitive Behavioral Therapy for Suicide Prevention; Stanley et al., 2009). Contrary to

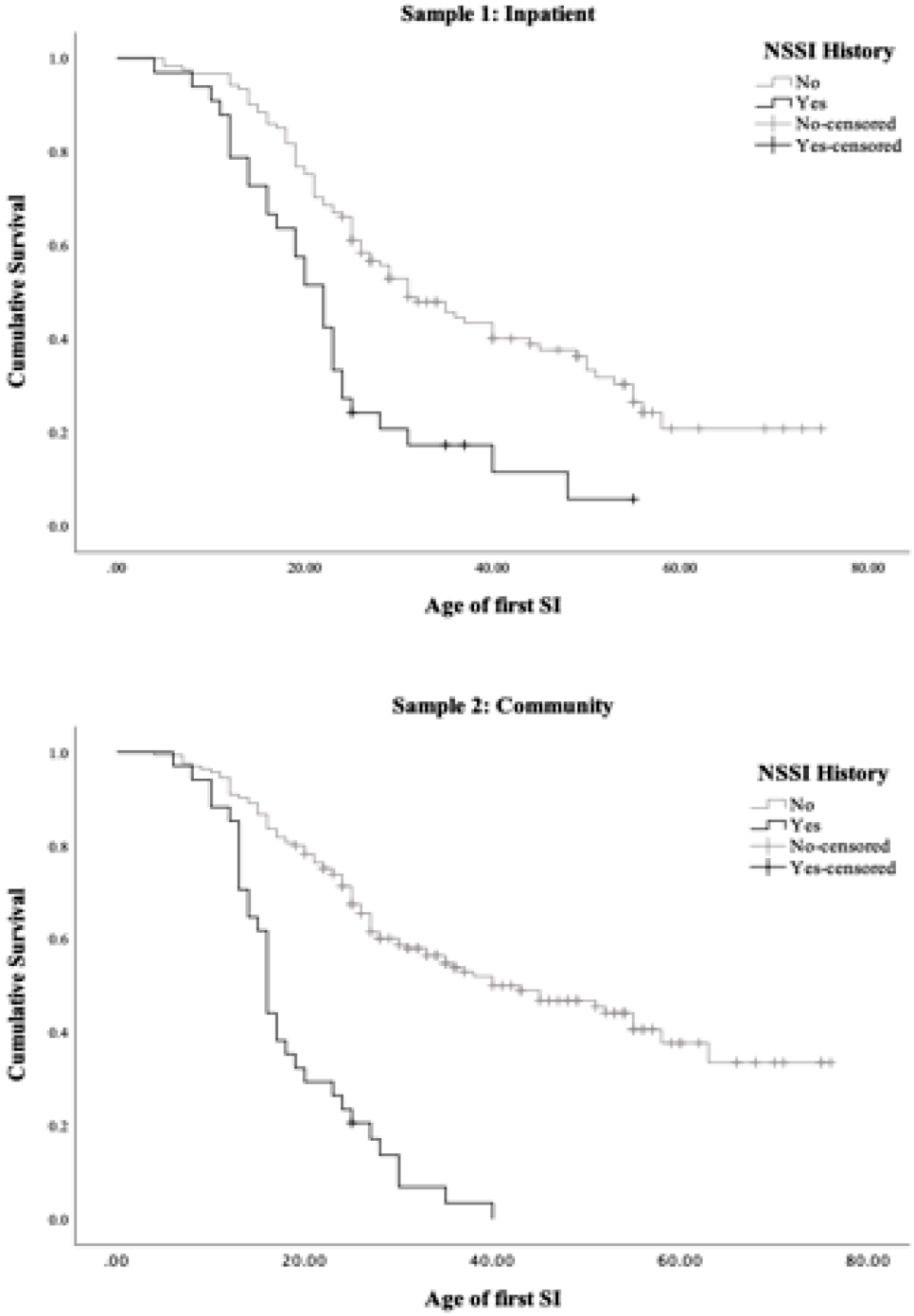

Fig. 1. Survival curves for time to suicide ideation according to history of nonsuicidal self-injury.

prior work, our time lag results suggest that NSSI does not slow the transition from SI to SA for higher-risk groups of veterans and clinical decisions based on previous findings may be misguided. Our time lag results suggest that clinicians should be quick to intervene when working with veterans with an NSSI history, ideally within a year of onset for inpatient veterans before SI emerges. The transition from NSSI to SA occurs, on average, 4-7 years from the onset of NSSI. Although this longer time period may be less helpful for treatment, it may represent a period of heightened awareness for clinical monitoring. Veterans who screen positive for NSSI, but have not attempted suicide, may benefit from preventative care to reduce the likelihood of transitioning to a SA. Early intervention or increased targeted VA outreach (Tsai et al., 2020) may be a crucial step in preventing veteran suicide.

7. Limitations and future directions

Study results should be interpreted within the context of their limitations. First, the study is cross-sectional and the onset of SITBs was retrospectively self-reported in years, not in specific dates or months. This decreased specificity hinders our ability to understand the precise timing of when SITBs emerged and to provide more specific periods for intervention. The results provide a general timeline for the development of SITBs in veterans that can be used to narrow down assessment periods for future research that utilizes more intensive retrospective (e.g., timeline followback interview; Bagge et al., 2013) or prospective measurement (e.g., ecological momentary assessment; Kleiman et al., 2017). Second, this study did not assess for age-of-onset of all SITBs, such as

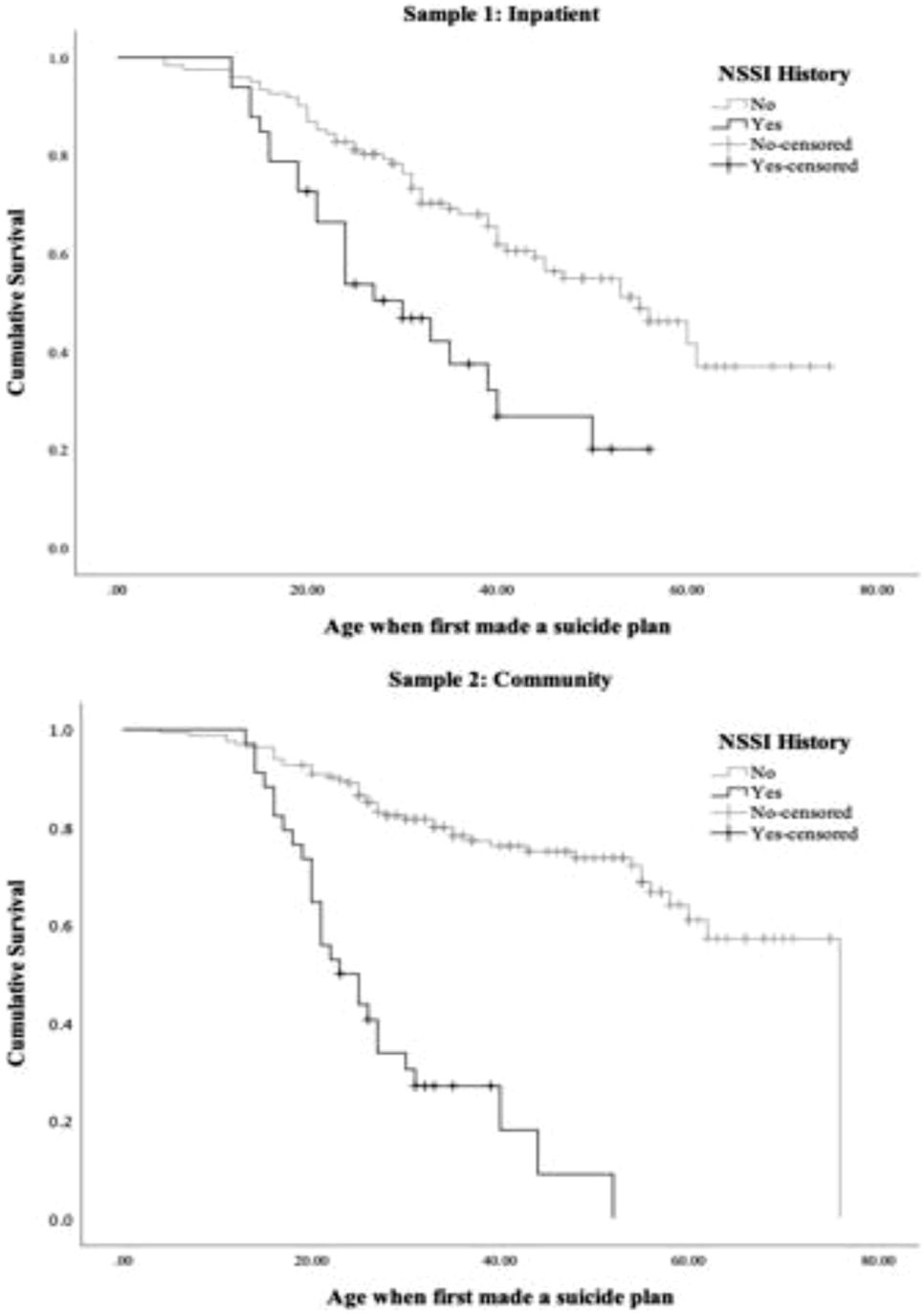

Fig. 2. Survival curves for time to suicide plan according to history of nonsuicidal self-injury.

passive SI (i.e., thoughts of wishing one were dead) or aborted and interrupted SAs–all of which may have important implications for understanding SITB trajectories. Suicide death was also not examined and understanding this outcome in relation to other non-fatal SITBs is needed, as meta-analytic evidence suggests differential associations with risk factors (Franklin et al., 2017). Third, this study examined the time course of SITBs, not mechanisms that may underlie the transition between SITBs, why NSSI influences suicide trajectories and trajectory lengths, or why veterans have a higher suicide death rate relative to non-veterans. Future studies could build upon our findings by identifying veteran-specific (e.g., enlistment age/timing, combat; Nichter et al., 2020; Smith et al., 2020) and time-varying factors (e.g., housing instability; Blosnich et al., 2020) that can be used to improve prediction (Glenn and Nock, 2014). Lastly, this study was conducted with high-risk inpatient and moderate risk community-residing samples (mostly male) and results may not generalize to lower-risk groups (e.g., outpatient veterans without recent SI), suggesting a need for additional research on the spectrum of risk and the role of gender. Further, the high-risk inpatient veterans received psychiatric care at a VA facility and may differ from high-risk veterans not receiving VA care. Since not all veterans are enrolled in VA care (Landes et al., 2018), future studies may benefit from seeking out additional sources outside of VA and increase enrollment of female veterans to better understand SITBs among these groups.

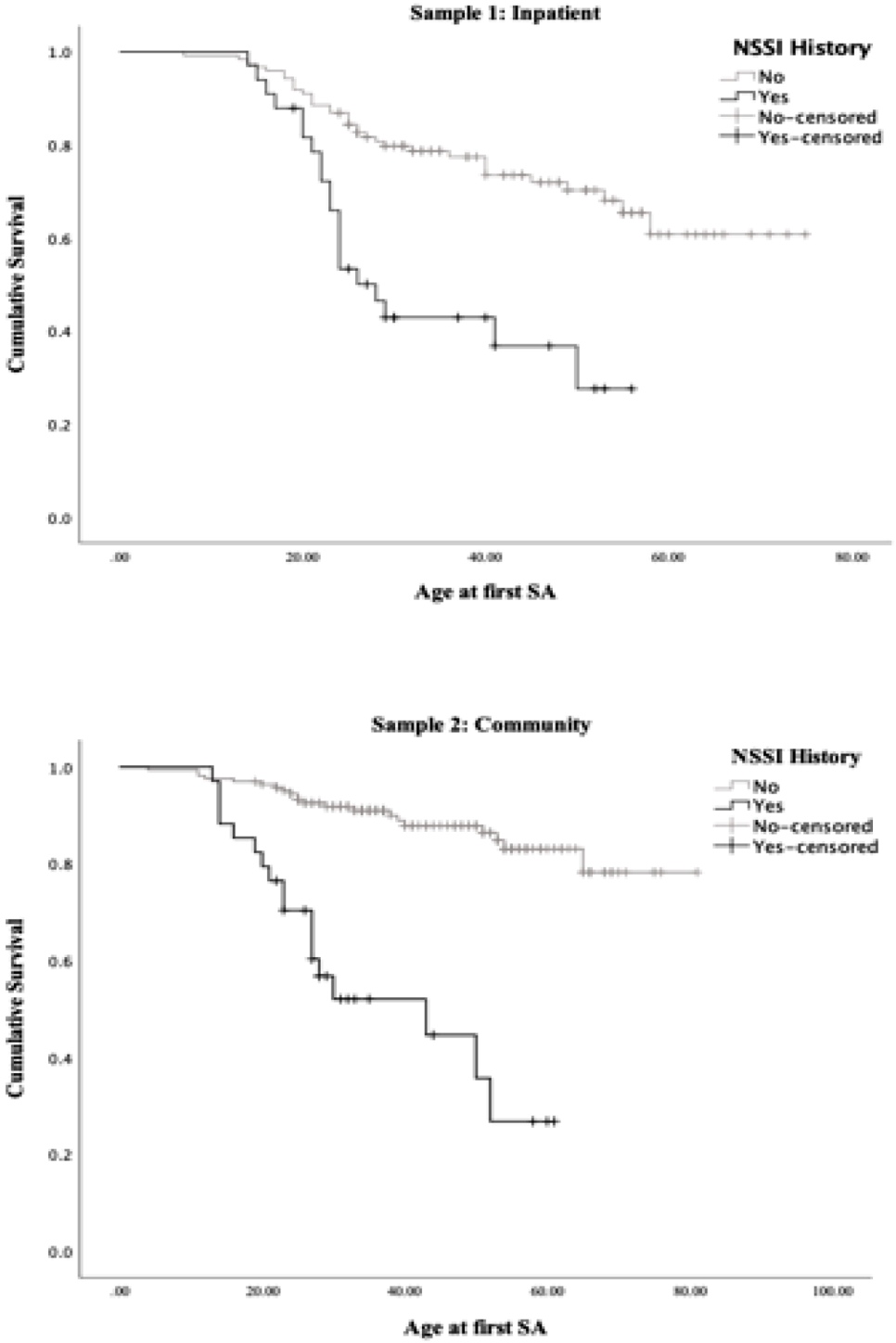

Fig. 3. Survival curves for time to suicide attempt according to history of nonsuicidal self-injury.

8. Conclusion

Study results diverge from recent temporal research in veterans, indicating that a NSSI history may shorten the transition from SI to SA in inpatient and community-residing veterans. NSSI history was associated with shorter lifetime survival time and an increased lifetime relative risk for all suicidal SITBs. This study enhanced our understanding of relative risk, age-of-onset, and temporal development of suicidal and non-suicidal SITBs among inpatient and community-residing veterans and highlights critical assessment points based on NSSI history.

Declaration of Competing Interest

Authors have no known conflict of interest to disclose.

Contributors

Jaclyn C. Kearns conceptualized and wrote the manuscript as well as conducted part of the formal analysis. Sarah L. Brown conducted the formal analysis and contributed to writing. Ian Cero assisted with formal analysis. Kaitlyn R. Gorman, Matthew K. Nock, Terence M. Keane, and Brian P. Marx edited the manuscript and provided expert commentary.

All authors reviewed and approved of the manuscript.

Role of the funding source

This research was funded by the Military Suicide Research Consortium (MSRC), an effort supported by the Office of the Assistant Security of Defense for Health Affairs (Award W81XWH-10-2-0181; MKN, TMK, BPM). Opinions, interpretations, conclusions, and recommendations are those of the authors and not necessarily endorsed by MSRC or the Department of Defense. Sarah L. Brown's work was supported, in part, by a grant from the National Institute for Mental Health (Award R01 MH115922).

Acknowledgements

Authors have no known conflict of interest to disclose. This research was funded by the Military Suicide Research Consortium (MSRC), an effort supported by the Office of the Assistant Security of Defense for Health Affairs (Award W81XWH-10-2-0181; MKN, TMK, BPM). Opinions, interpretations, conclusions, and recommendations are those of the authors and not necessarily endorsed by MSRC or the Department of Defense.

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