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Self-injurious thoughts and behaviors that differentiate soldiers who attempt suicide from those with recent suicide ideation

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Abstract

Background: Risk for suicide attempt (SA) versus suicide ideation (SI) is clinically important and difficult to differentiate. We examined whether a history of self-injurious thoughts and behaviors (SITBs) differentiates soldiers with a recent SA from nonattempting soldiers with current/recent SI.

Methods: Using a unique case-control design, we administered the same questionnaire (assessing the history of SITBs and psychosocial variables) to representative U.S. Army soldiers recently hospitalized for SA ($n = 132$) and soldiers from the same Army installations who reported 30-day SI but did not make an attempt ($n = 125$). Logistic regression analyses examined whether SITBs differentiated attempters and ideators after controlling for previously identified covariates.

Results: In separate models that weighted for systematic nonresponse and controlled for gender, education, posttraumatic stress disorder, and intermittent explosive disorder, SA was positively and significantly associated with the history of suicide plan and/or intention to act (odds ratio [OR] = 12.1 [95% confidence interval {CI} = 3.6–40.4]), difficulty controlling suicidal thoughts during the worst week of ideation (OR = 3.5 [95% CI = 1.1–11.3]), and nonsuicidal self-injury (NSSI) (OR = 4.9 [95% CI = 1.3–18.0]). Area under the curve was 0.87 in a full model that combined these SITBs and covariates. The top ventile based on predicted risk had a sensitivity of 24.7%, specificity of 99.8%, and positive predictive value of 97.5%.

Conclusions: History of suicide plan/intention, difficult to control ideation, and NSSI differentiate soldiers with recent SA from those with current/recent SI independent of sociodemographic characteristics and mental disorders. Longitudinal research is

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needed to determine whether these factors are prospectively associated with the short-term transition from SI to SA.

KEYWORDS
military, nonsuicidal self-injury, suicide attempt, suicide ideation, suicide plan

1 | INTRODUCTION

The majority of people who consider suicide never act on those thoughts (Nock, Borges, Bromet, Alonso et al., 2008). Research suggests that most of the commonly identified risk factors for suicide attempt (SA) are predictors of suicide ideation (SI) and do not predict the transition from ideation to attempt (Nock, Kessler, & Franklin, 2016). This is also true in military populations such as the U.S. Army, where rates of suicidal behavior rose sharply during the wars in Iraq and Afghanistan and have remained elevated (Gibson, Corrigan, Kateley, Youmans Watkins, & Pecko, 2017; Psychological Health Center for Excellence, 2017; Schoenbaum et al., 2014; Ursano, Kessler, Heeringa et al., 2015). Although retrospective population surveys have identified a range of sociodemographic characteristics (e.g., female gender, younger age, and lower education), stressors (e.g., childhood adversity, bullying, relationship problems, and financial problems), and mental disorders (e.g., major depressive disorder, posttraumatic stress disorder [PTSD], and intermittent explosive disorder [IED]) associated with SA history in soldiers, few of these factors differentiate attempters and ideators (Campbell-Sills et al., 2017; Millner et al., 2019, 2018; Naifeh et al., 2019; Nock et al., 2014; Nock et al., 2015; Stein et al., 2018). This limits the ability to deliver interventions to soldiers most at risk of attempting suicide. To improve suicide risk assessment and treatment, it is important to identify additional factors that differentiate soldiers who have SI from those who acted on those thoughts. Examining histories of self-injurious thoughts and behaviors (SITBs) may assist in this effort (Ribeiro et al., 2016).

Several characteristics of SI may be associated with SA risk, including the severity of ideation at its worst point, the duration and controllability of suicidal thoughts, making a suicide plan, and having an intention to act on suicidal thoughts (Beck, Brown, Steer, Dahlsgaard, & Grisham, 1999; Joiner et al., 2003; Nock, Borges, Bromet, Alonso et al., 2008). A history of nonsuicidal self-injury (NSSI) or engaging in dangerous behaviors may increase the capability of an individual to act on suicidal thoughts by decreasing the fear associated with self-injury (Joiner, 2005). There is evidence from cross-sectional studies that such behaviors are associated with SAs among soldiers with lifetime ideation (Bryan, Bryan, May, & Klonsky, 2015; Nock et al., 2018; Turner, Kleinman, & Nock, 2019).

Population-level research on SITBs and other factors that may differentiate recent (e.g., past month) SA and SI are needed. Similar to U.S. and cross-national general population studies (e.g., Kessler, Borges, & Walters, 1999; Nock, Borges, Bromet, Alonso et al., 2008; Nock, Hwang, Sampson, & Kessler, 2010; Nock et al., 2009), studies based on representative Army population surveys have focused on differentiating lifetime attempters and ideators (e.g., Campbell-Sills et al., 2017; Millner et al., 2019, 2018; Nock et al., 2014; Nock et al., 2015; Stein et al., 2018), a practical consequence of the low base rate of recent SI and even lower rate of recent SA (e.g., Ursano et al., 2020). However, most soldiers who have attempted suicide report doing so within the first year of SI onset (Nock et al., 2014; Ursano, Heeringa et al., 2015). Studies differentiating recent suicidal thoughts and behaviors tend to use more selective (e.g., clinical) samples (Glenn & Nock, 2014), which may not generalize to the population of ideators. More than one-third of soldiers who attempt suicide have no prior history of mental health diagnosis (Ursano et al., 2018) and would not be captured in a typical high-risk clinical sample. In the military, it is particularly important to improve understanding of SA risk relative to nonhospitalized ideators, as psychiatric hospitalization often results in medical separation from the military (Hoge et al., 2002, 2005).

Using data from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS; www.starrs-ls.org; Ursano et al., 2014), the current study of active-duty U.S. Army soldiers examined whether the history of SITBs can differentiate hospitalized suicide attempters from a representative, community sample of soldiers who reported 30-day ideation but did not attempt. To determine the incremental value of these SITBs, we examined them in models that controlled for variables (sociodemographics and mental disorders) previously found to differentiate the exact same samples of attempters and ideators (Naifeh et al., 2019). This approach helped ensure that the results were not due, for example, to the association of mental disorders with both the explanatory variables (SITBs) and outcome (SA). Given that the SITBs may be related to one another, significant explanatory variables were then examined together in a single multivariable model.

2 | METHODS

2.1 | Sample

2.1.1 | SA cases

Soldier Health Outcomes Study-A, a component of Army STARRS, is a case-control study of active-duty U.S. Army soldiers hospitalized for a recent SA. Cases were recruited from inpatient psychiatric units at hospitals located at four large continental U.S. Army installations. Data collection occurred from Q4 (October) 2011 through Q4 (November) 2013. Study personnel coordinated with attending psychiatrists to identify soldiers currently hospitalized due to SA. Potential participants were provided with a study description

and informed that participation was voluntary. Following written informed consent, cases completed a self-administered questionnaire (SAQ) as part of a larger assessment battery. There were 132 regular Army participants after excluding soldiers who had less than 6 months of Army service, were in the Army National Guard or Army Reserve, or were deployed at the time of their SA. The few soldiers who met these criteria were excluded because they are not characteristic of the populations at our study sites. We also excluded soldiers who did not consent to the linkage of their SAQ responses and Army/DoD administrative records.

2.1.2 | SI controls from the community

The Army STARRS Consolidated All Army Study (AAS) combines large representative survey samples (Heeringa et al., 2013; Kessler, Heeringa et al., 2013; Millner et al., 2018) of all active-duty soldiers serving inside and outside the continental U.S. (excluding those in Basic Combat Training; see Supporting Information). Soldiers in the Consolidated AAS completed the same SAQ as SA cases. Using the subset of nondeployed respondents from our four target installations, we applied the same inclusion/exclusion criteria that were applied to cases, resulting in a representative community sample of 10,193 soldiers. We selected from this sample all soldiers reporting 30-day SI (n = 125).

2.1.3 | Weighting procedures

The samples were weighted using propensity scores (see Supporting Information) to more accurately represent characteristics of the target populations, adjust for nonresponse, and estimate population-level values. SA cases were weighted to represent the population of medically documented suicide attempters at the same Army installations using the Department of Defense Suicide Event Report (Gahm et al., 2012) records available for Q4 2011 through 2012 (applying the same inclusion/exclusion criteria). Nonhospitalized respondents from the Consolidated AAS, including the 30-day suicide ideators used as controls in the current study, were weighted to represent the corresponding Army population at the study installations using population snapshot data from Q4 of 2011 through 2012 (applying the same inclusion/exclusion criteria).

2.2 | Measures

2.2.1 | SITBs

History of SITBs was assessed with a modified version of the Columbia Suicide Severity Rating Scale (Posner et al., 2009). Respondents who endorsed lifetime SI ("Did you ever in your life have thoughts of killing yourself?" or "Did you ever wish you were dead or would go to sleep and never wake up?") were asked whether they had those thoughts in the past 30 days, whether they ever had an intention to act ("Did you ever have any intention to act on thoughts of wishing you were dead or trying to kill yourself?"), and whether they ever had a suicide plan ("Did you ever think of how you might kill yourself [e.g., taking the pill, shooting yourself] or work out a plan of how to kill yourself?"). Respondents were also asked about characteristics of SI during the worst week ("Think of the one week in your life when you thought most about killing yourself or wanting to be dead"), including frequency ("How many days during that worst week did you have those thoughts?"), duration ("How long during that worst week did those thoughts usually last on the days you had them?"), and controllability ("During that worst week, how easy was it for you to control those thoughts or push them out of your mind when you wanted to?"). We also assessed extreme risk-taking or tempting fate ("People who wish they were dead or think about killing themselves sometimes do dangerous things as a way to tempt fate [e.g., take a lot of drugs, drive too fast, volunteer for dangerous missions, or act recklessly]. How often in your life did you ever do dangerous things related to wishing you were dead?"), and the number of times respondents had engaged in NSSI ("Did you ever do something to hurt yourself on purpose, but without wanting to die [e.g., cutting yourself, hitting yourself, or burning yourself]? About how many times in your life did you do something like that?"). We categorized NSSI frequency (0, 1–10, 11 or more) to compare episodic versus chronic NSSI based on evidence that psychopathology, distress, and impairment are worse among those who have engaged in NSSI more than 10 times (Muehlenkamp & Brausch, 2016).

2.2.2 | Sociodemographic characteristics

Army and Department of Defense administrative records were used to construct sociodemographic variables (gender, age, race, education, and marital status). Based on previous analyses of the exact same samples (Naifeh et al., 2019), gender (male and female) and education (less than high school, high school, at least some college) were included as covariates in multivariable models. Although gender was not a significant multivariable predictor of attempts among ideators in those previous analyses (Naifeh et al., 2019), it was retained as a covariate because of its consistent association with SA in other military (Nock et al., 2014; Ursano, Kessler, Stein et al., 2015) and civilian (Fox, Millner, Mukerji, & Nock, 2018; Nock, Borges, Bromet, Cha et al., 2008) studies. The remaining sociodemographic characteristics are used for descriptive purposes.

2.2.3 | Mental disorders

All multivariable models included recency of PTSD and IED (past 30 days, before past 30 days, never), the two mental disorders previously found to differentiate the same samples of attempters and ideators (Naifeh et al., 2019). The recency variables were constructed using assessment data from the PTSD Checklist (Weathers, Litz, Herman, Huska, &

Keane, 1993), Composite International Diagnostic Interview screening scales (Kessler, Calabrese et al., 2013), and a revised self-administered Family History Screen (Weissman et al., 2000), which assessed personal, rather than family, disorder history.

2.3 | Statistical analysis

Analyses were conducted using SAS version 9.4 (SAS Institute Inc., 2013). We examined the association of each SITB variable with SA (coded as SA = 1, SI = 0) in a separate multivariable logistic regression analysis that adjusted for gender, education, PTSD, and IED. Significant SITBs were then examined simultaneously in a model that adjusted for the other covariates. Missing values, which affected ≤11% of cases and ≤10% of controls on individual SITB variables, were imputed using the multiple imputation (MI) method (Little & Rubin, 2002). For each of the MI datasets, logistic regression coefficients were calculated and exponentiated to obtain odds ratios (ORs) and 95% confidence intervals (CIs). Standard errors were estimated using the Taylor series method to adjust for stratification, weighting, and clustering of the consolidated AAS survey data. Multivariable significance tests in logistic regression analyses were made using Wald χ^2 tests based on coefficient variance–covariance matrices that were adjusted for design effects using the Taylor series method (Wolter, 1985). MI-adjusted model statistics are reported.

3 | RESULTS

The weighted sample of hospitalized SA cases (n = 132) was mostly male (78.4%), under 30 years old (69.5%), white (59.0%), high school educated (69.8%), and married (59.9%). Similarly, the weighted sample of nonhospitalized community controls with 30-day SI (n = 125) was mostly male (75.3%), under 30 years old (52.6%), white (53.0%), high school educated (64.9%), and married (57.9%; Table 1).

When each SITB was examined separately, adjusting for gender, education, PTSD, and IED (Table 2), higher odds of SA was associated with reporting a suicide plan and/or intention to act (OR = 12.1 [95% CI = 3.6–40.4]), very difficult or impossible to control suicidal thoughts during the worst week of ideation (OR = 3.5 [95% CI = 1.1–11.3]), and engaging in NSSI 1–10 times (OR = 4.9 [95% CI = 1.3–18.0]). Tempting fate and the frequency and duration of worst-week SI were nonsignificant (analysis of the nonimputed dataset generated similar results; Table S1).

When the three significant SITB variables from above were examined together in a model that also adjusted for gender, education, PTSD, and IED, all three remained significant (Table 3). Odds were increased for those reporting a suicide plan and/or intention to act (OR = 15.8 [95% CI = 3.6–68.9]) and very difficult or impossible to control suicidal thoughts during the worst week of ideation (OR = 9.3 [95% CI = 2.5–34.1]). While the association of NSSI remained significant overall, NSSI frequency of 1–10 times had nonsignificantly higher odds of SA, whereas a frequency of 11+ times had significantly lower odds (OR = 0.1 [95% CI = 0.0–0.3]). PTSD and IED were also significant but education was not (analysis of the nonimputed dataset generated similar results; Table S2).

The area under the curve (AUC) of the base model, which included gender, education, PTSD, and IED, was 0.68. The expanded model including SITBs improved prediction accuracy significantly (global Wald $\chi^2_{11} = 49.0$; $p < .0001$) and AUC was 0.87. Using predicted probabilities from this expanded model, the 5% of soldiers with the highest predicted risk included 24.7% of suicide attempters (nearly a 5:1 ratio of attempters to ideators), with a sensitivity of 24.7%, specificity of 99.8%, and positive predictive value (PPV) of 97.5% at that threshold. In contrast, the 5% of soldiers with the highest predicted risk according to the base model included 16.6% of attempters (sensitivity = 16.6%, specificity = 97.5%, PPV = 64.0%).

TABLE 1 Sociodemographic characteristics of suicide attempt cases and suicide ideation controls

	Suicide attempt cases[a] (n = 132)		Suicide ideation controls[b] (n = 125)	
	n	Weighted %	n	Weighted %
Gender				
Male	111	78.4	111	75.3
Female	21	21.6	14	24.7
Current age				
<21	8	3.2	16	6.1
21–24	46	35.6	36	21.6
25–29	36	30.7	31	24.9
30–34	19	13.3	29	30.1
35–39	12	10.6	8	16.8
40+	11	6.5	5	0.5
Race/ethnicity				
White	87	59.0	82	53.0
Black	31	24.0	21	37.8
Hispanic	7	13.1	14	5.1
Other	7	3.8	8	4.1
Education				
<High school[c]	18	26.4	18	18.3
High school	105	69.8	92	64.9
≥Some college	9	3.8	15	16.8
Marital status				
Never married	31	33.1	45	24.9
Currently married	89	59.9	72	57.9
Previously married	12	7.0	8	17.2

[a]Cases: Soldiers currently hospitalized for a suicide attempt.
[b]Controls: Nonhospitalized soldiers from the community who participated in the Army STARRS Consolidated All Army Study and reported 30-day suicide ideation.
[c]<High School includes General Educational Development credential, home study diploma, occupational program certificate, correspondence school diploma, high school certificate of attendance, adult education diploma, and other nontraditional high school credentials.

TABLE 2 Separate multivariable associations of SITB variables with suicide attempt among active-duty U.S. Army soldiers with 30-day suicide ideation

	Separate multivariable models[a]		Suicide attempt cases[b]		Suicide ideation controls[c]	
	OR	(95% CI)	*n*	Weighted %	*n*	Weighted %
I. Suicide plan and/or intention to act						
Yes	12.1*	(3.6–40.4)	109	86.5	31	43.3
No	1.0	–	23	13.5	94	56.8
χ^2_1	18.1*					
II. Worst-week ideation frequency						
1–3 days	1.0	–	58	36.2	65	54.5
4–7 days	1.6	(0.6–4.3)	74	63.8	60	45.5
χ^2_1	1.3					
III. Worst-week ideation duration						
Just a few seconds	1.0	–	11	8.3	24	11.3
<1 hr	1.3	(0.2–11.5)	29	28.0	24	23.8
1–4 hr	0.7	(0.1–5.2)	38	21.8	37	27.7
5–8 hr	0.7	(0.1–5.2)	27	18.7	17	25.0
9 hr or more	2.1	(0.3–17.0)	27	23.3	23	12.1
χ^2_4	4.9					
IV. Worst-week ideation controllability						
Easy to somewhat difficult	1.0	–	55	39.0	98	66.9
Very difficult or impossible	3.5*	(1.1–11.3)	77	61.0	27	33.2
χ^2_1	5.9*					
V. Ever tempted fate						
Yes	3.5	(0.9–13.5)	104	86.7	86	68.8
No	1.0	–	28	13.3	39	31.3
χ^2_1	3.8					
IV. Nonsuicidal self-injury frequency						
0	1.0	–	92	66.8	92	67.1
1–10	4.9*	(1.3–18.0)	26	21.8	15	8.7
11+	0.2	(0.0–1.1)	14	11.5	18	24.2
χ^2_2	15.7*					

Abbreviations: 95% CI, 95% confidence interval; OR, odds ratio; SITB, self-injurious thoughts and behaviors.

[a]Each SITB variable was examined in a separate multivariable model that adjusted for gender, education, posttraumatic stress disorder, and intermittent explosive disorder. The multiple imputation method was used to impute missing values.

[b]Cases are 132 soldiers hospitalized at one of four Army installations following a suicide attempt. Cases were weighted based on data from the Department of Defense Suicide Event Report to be representative of suicide attempters at those installations. *N* and weighted % columns represent actual responses, excluding cases with missing values.

[c]Controls are 125 nonhospitalized soldiers from the community who participated in the Army STARRS Consolidated All Army Study and reported 30-day suicide ideation. The full control sample (n = 10,193) was weighted to be representative of the general population at those installations. *N* and weighted % columns represent actual responses, excluding controls with missing values.

*$p < .05$.

4 | DISCUSSION

Building on a previous analysis of the same representative case-control samples (Naifeh et al., 2019), the current study identified SITBs that may help differentiate soldiers at risk of attempting suicide from those with current/recent SI. Having a suicide plan and/or intention to act on suicidal thoughts, difficulty controlling SI, and NSSI frequency differentiated soldiers recently hospitalized for SA from nonattempting 30-day ideators in the general population of the same communities. Importantly, each of these characteristics was found to be significant when examined separately in models that adjusted for gender and three variables previously found to differentiate the same samples of attempters from ideators (education, PTSD, and IED; Naifeh et al., 2019). These SITBs, along with PTSD and IED, remained significant when all variables were examined together in a final model, indicating their unique associations with SA. The 5% of soldiers with the highest predicted risk based on the final model included 24.7% of attempters, a nearly fivefold concentration of risk. The findings, which are generally consistent with a recent study of lifetime attempts among soldiers with lifetime ideation

TABLE 3 Full multivariable model examining associations of SITB variables with suicide attempts among U.S. Army soldiers with 30-day suicide ideation

	Suicide attempters among 30-day ideators[a]	
	OR	(95% CI)
Gender		
Male	1.0	–
Female	0.4	(0.1–1.6)
χ^2_1	2.1	
Education		
<High school	3.3	(0.9–12.6)
High school	1.0	–
≥Some college	0.4	(0.1–1.8)
χ^2_2	5.9	
Posttraumatic stress disorder		
Past 30 days	5.0*	(1.2–20.7)
Before past 30 days	0.6	(0.2–2.5)
Never	1.0	–
χ^2_2	13.1*	
Intermittent explosive disorder		
Past 30 days	0.1*	(0.0–0.3)
Before past 30 days	0.1*	(0.0–0.5)
Never	1.0	–
χ^2_2	18.5*	
Suicide plan and/or intention to act		
Yes	15.8*	(3.6–68.9)
No	1.0	–
χ^2_1	15.2*	
Worst-week ideation controllability		
Easy to somewhat difficult	1.0	–
Very difficult or impossible	9.3*	(2.5–34.1)
χ^2_1	14.5*	
Nonsuicidal self-injury frequency		
0	1.0	–
1–10	3.7	(0.9–14.8)
11+	0.1*	(0.0–0.3)
χ^2_2	18.4*	

Abbreviations: 95% CI, 95% confidence interval; IED, intermittent explosive disorder; OR, odds ratio; PTSD, posttraumatic stress disorder; SITB, self-injurious thoughts and behaviors.

[a]Cases: 132 hospitalized suicide attempters (weighted). Controls: 125 nonhospitalized soldiers from the community who participated in the Army STARRS Consolidated All Army Study and reported 30-day suicide ideation (weighted). The multiple imputation method was used to impute missing values.

*$p < .05$.

(Nock et al., 2018), suggest that a history of certain SITBs may also be relevant to identifying SA risk among soldiers with current/recent SI. Meta-analyses have demonstrated that our ability to predict suicidal behavior is very limited (Franklin et al., 2017), even when considering previous SITBs (Ribeiro et al., 2016). Far less is known about what differentiates those at risk of SA in the near future (Glenn & Nock, 2014). Longitudinal research is needed to determine whether these SITBs are actually predictors of the transition from 30-day SI to SA. The representative case-control data used in the current study, while limited by a cross-sectional and retrospective design, provides a rare opportunity to identify factors that may inform future efforts to differentiate these groups.

Consistent with practice guidelines that emphasize the assessment of suicide planning and intention (Jacobs et al., 2010), soldiers who attempted suicide were more likely than 30-day ideators to report ever having had a suicide plan and/or intention to act on suicidal thoughts. Retrospective population surveys of civilians (Nock, Borges, Bromet, Alonso et al., 2008) and the military (Nock et al., 2018) have found that having had a suicide plan differentiates lifetime attempters from lifetime ideators. Our findings suggest that a history of suicide plans or intentions may also differentiate soldiers with current SI who make a SA.

Our finding related to the controllability of SI is consistent with previous work demonstrating that soldiers with lifetime ideation who reported that worst-week ideation was either very difficult or impossible to control had significantly elevated odds of a lifetime SA (Nock et al., 2018). Perceived uncontrollability of thoughts, which may also be a component of depressive rumination (Papageorgiou & Wells, 2004), warrants additional study as a potentially important cognitive dimension of suicide risk.

The overall association of NSSI frequency with SA was significant in all models. Adjusting for gender, education, PTSD, and IED, odds of SA were increased among those who engaged in NSSI 1–10 times. Interestingly, in the full model that included other SITBs, the odds associated with NSSI frequency of 1–10 were nonsignificantly elevated, whereas engaging in NSSI more than 10 times was associated with significantly lower odds of attempt. This suggests that while NSSI history may differentiate recent attempters and ideators, those soldiers who engage in chronic NSSI are less likely to make an attempt when the co-occurrence of other SITBs is considered. Previous research is somewhat mixed regarding the association between NSSI and SAs among service members and veterans with a history of ideation (Bryan et al., 2015; Nock et al., 2018; Turner et al., 2019). An important difference between those previous studies and the current study is that the former examined lifetime outcomes, whereas we aimed to differentiate very recent attempters from current/recent ideators who did not make a SA. Additional research is needed to determine whether the frequency/chronicity of NSSI is valuable as an indicator of acute SA risk, and to understand the influence of mental disorders and other SITBs on that relationship. Some have suggested that engaging in intentional self-harm increases the risk of suicidal behavior through habituation to the natural fear of self-injury (Joiner, 2005), whereas others have proposed that the emotion regulatory function of NSSI can reduce suicide risk (Suyemoto, 1998). It is possible that the risk associated with NSSI varies as a function of chronicity and one's history of other SITBs. Additional research is needed to determine whether there is a threshold at which NSSI frequency may decrease the risk of SA.

Our results should be interpreted with certain limitations. First, the current study compared retrospective self-report data from two different

cross-sectional samples, increasing the potential for recall bias. Hospitalized attempters may have been biased in favor of reporting they had a suicide plan/intention or difficulty controlling SI. Conversely, soldiers with SI who did not attempt may have been biased toward minimizing their SITB history. As a result, we cannot conclude that the factors found to differentiate these groups would also prospectively predict attempts among 30-day ideators in a longitudinal study. Second, we did not have data on the severity of 30-day SI. Given that the control sample was comprised of 30-day ideators from the community, recent ideation severity may account for SITB differences between hospitalized SA cases and nonhospitalized SI controls. Similarly, we did not assess duration or variability of recent SI, characteristics which may be important indicators of SA risk (Witte, Fitzpatrick, Joiner, & Schmidt, 2005). Third, our sample was weighted to the population of soldiers at four Army installations and may not be generalizable to other military populations, veterans, or civilians. Fourth, although we used sociodemographic and service-related variables to weight SA cases to the population of documented attempters at the same installations, those who volunteered to participate may differ from the population on other important characteristics.

Differentiating recent attempters and ideators is clinically important and a significant research challenge. The extent to which long-term (e.g., lifetime) SA risk factors are associated with short-term SA risk is not yet known (Glenn & Nock, 2014). While this cross-sectional study could not address SI-to-SA transition directly, our findings highlight the potential value of SITB history in differentiating soldiers with increased risk of acting on current/recent suicidal thoughts. More research is needed to understand how dynamic aspects of SITBs (e.g., ideation, planning, and intention) may influence risk (Bagge, Littlefield, Conner, Schumacher, & Lee, 2014; Bryan, Rozek, Butner, & Rudd, 2019; Kleinman et al., 2017; Witte et al., 2005). Recent efforts to address the complexity of suicide risk prediction through machine learning have generated promising results (e.g., Kessler et al., 2017; Kessler et al., 2015; McCarthy et al., 2015), including prediction of short-term SA risk in a civilian healthcare system (Walsh, Ribeiro, & Franklin, 2017) and prediction of medically documented SAs among lifetime ideators in the Army general population (Zuromski et al., 2019). Machine learning may be a valuable tool for predicting imminent SI-to-SA transitions in the general population if the practical barriers to such research (e.g., low base rates) can be overcome through the collection and integration of larger datasets.

ARMY STARRS TEAM

The Army STARRS Team consists of Co-Principal Investigators: Robert J. Ursano, MD (Uniformed Services University of the Health Sciences) and Murray B. Stein, MD, MPH (University of California San Diego and VA San Diego Healthcare System). Site Principal Investigators: Steven Heeringa, PhD (University of Michigan), James Wagner, PhD (University of Michigan) and Ronald C. Kessler, PhD (Harvard Medical School). Army scientific consultant/liaison: Kenneth Cox, MD, MPH (Office of the Deputy Under Secretary of the Army). Other team members: Pablo A. Aliaga, MS (Uniformed Services University of the Health Sciences); COL David M. Benedek, MD (Uniformed Services University of the Health Sciences); Laura Campbell-Sills, PhD (University of California San Diego); Carol S. Fullerton, PhD (Uniformed Services University of the Health Sciences); Nancy Gebler, MA (University of Michigan); Robert K. Gifford, PhD (Uniformed Services University of the Health Sciences); Meredith House, BA (University of Michigan); Paul E. Hurwitz, MPH (Uniformed Services University of the Health Sciences); Sonia Jain, PhD (University of California San Diego); Tzu-Cheg Kao, PhD (Uniformed Services University of the Health Sciences); Lisa Lewandowski-Romps, PhD (University of Michigan); Holly Herberman Mash, PhD (Uniformed Services University of the Health Sciences); James A. Naifeh, PhD (Uniformed Services University of the Health Sciences); Tsz Hin Hinz Ng, MPH (Uniformed Services University of the Health Sciences); Matthew K. Nock, PhD (Harvard University); Nancy A. Sampson, BA (Harvard Medical School); LTC Gary H. Wynn, MD (Uniformed Services University of the Health Sciences); and Alan M. Zaslavsky, PhD (Harvard Medical School).

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As a cooperative agreement, scientists employed by NIMH (Lisa J. Colpe, PhD, MPH and Michael Schoenbaum, PhD) and Army liaisons/consultants (Col. Steven Cersovsky, MD, MPH USAPHC and Kenneth Cox, MD, MPH USAPHC) collaborated to develop the study protocol and data collection instruments, supervise data collection, interpret results, and prepare reports. Although a draft of this manuscript was submitted to the Army and NIMH for review and comment before submission, this was with the understanding that comments would be no more than advisory.

CONFLICT OF INTERESTS

In the past 3 years, Kessler received support for his epidemiological studies from Sanofi Aventis; was a consultant for Datastat Inc., Sage Pharmaceuticals, and Takeda. In the past 3 years, Stein has been a consultant for Actelion, Alkermes, Aptinyx, Bionomics, Dart Neuroscience, Healthcare Management Technologies, Janssen, Neurocrine Biosciences, Oxeia Biopharmaceuticals, Pfizer, and Resilience Therapeutics. Stein has stock options in Oxeia Biopharmaceuticals. Other authors declare that there are no conflict of interests.

DATA AVAILABILITY STATEMENT

For information on data availability, please contact the Uniformed Services University of the Health Sciences Institutional Review Board, 4301 Jones Bridge Road, Bethesda, MD 20814.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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