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RESEARCH ARTICLE

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Transition to suicide attempt from recent suicide ideation in U.S. Army soldiers: Results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)

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Background: Most people with suicide ideation (SI) do not attempt suicide (SA). Understanding the transition from current/recent SI to SA is important for mental health care. Our objective was to identify characteristics that differentiate SA from 30-day SI among representative U.S. Army soldiers.

Methods: Using a unique case–control design, soldiers recently hospitalized for SA (n = 132) and representative soldiers from the same four communities (n = 10,193) were administered the same questionnaire. We systematically identified variables that differentiated suicide attempters from the total population, then examined whether those same variables differentiated all 30-day ideators (n = 257) from the total population and attempters from nonattempting 30-day ideators.

Results: In univariable analyses, 20 of 23 predictors were associated with SA in the total population (0.05 level). The best multivariable model included eight significant predictors: interpersonal violence, relationship problems, major depressive disorder, posttraumatic stress disorder (PTSD), and substance use disorder (all having positive associations), as well as past 12-month combat trauma, intermittent explosive disorder (IED), and any college education (all having negative associations). Six of these differentiated 30-day ideators from the population. Three differentiated attempters from ideators: past 30-day PTSD (OR = 6.7 [95% CI = 1.1–39.4]), past 30-day IED (OR = 0.2 [95% CI = 0.1–0.5]), and any college education (OR = 0.1 [95% CI = 0.0–0.6]). The 5% of ideators with highest predicted risk in this final model included 20.9% of attempters, a four-fold concentration of risk.

Conclusions: Prospective army research examining transition from SI to SA should consider PTSD, IED, and education. Combat exposure did not differentiate attempters from ideators. Many SA risk factors in the Army population are actually risk factors for SI.

KEYWORDS
military, suicide attempt, suicide ideation

Rates of suicidal behavior increased sharply among U.S. Army soldiers during the Iraq and Afghanistan wars and have remained high (Schoenbaum et al., 2014; Ursano, Kessler, Heeringa, et al., 2015). Despite decades of research, identifying risk factors for suicidal behavior remains a significant challenge (Franklin et al., 2017). Most people with suicide ideation (SI) do not transition to suicide attempt (SA) (Nock et al., 2008). In the U.S. Army, 17% of soldiers reporting lifetime SI also report a lifetime SA, with SA being much more likely among ideators with (34%) versus without (6%) a suicide plan (Nock et al., 2014). Variables identified as predictors of SA are often only

predictors of SI and do not predict the transition from SI to SA, a critically important clinical question for suicide risk assessment and treatment (Nock, Kessler, & Franklin, 2016).

Socio-demographic characteristics generally do not differentiate attempters from ideators (Nock et al., 2008). Enlisted army soldiers with medically documented SAs are more likely to be female, younger, white non-Hispanic, and less educated than the army general population (Ursano, Kessler, Stein, et al., 2015). However, these same characteristics are also associated with medically documented SI (Ursano et al., 2017). Although a broad range of stressors is associated with lifetime SA in the general population, few predict transitions from ideation to attempt (Stein et al., 2010), and comparable military research is limited. In particular, combat exposure is associated with increased risk of SA among servicemembers (Bryan et al., 2015), but its influence on SI-to-SA transition is unknown. Among new soldiers, childhood adversities (e.g., abuse, bullying) predict pre-enlistment attempts among ideators (Campbell-Sills et al., 2017; Stein et al., 2018). Research on the association of noncombat stressors (e.g., relationship, financial, and legal problems) with post enlistment attempts among ideators is lacking. The strongest mental disorder (MDx) predictors of lifetime SI-to-SA transition in the general population are characterized by anxiety/agitation (e.g., posttraumatic stress disorder [PTSD]) or difficulties with impulse control (e.g., bipolar disorder, substance use disorder, conduct disorder) (Kessler, Borges, & Walters, 1999; Nock et al., 2008, 2009; Nock, Hwang, Sampson, & Kessler, 2010), with similar but limited findings among soldiers (Millner et al., in press; Nock et al., 2014, 2015). In addition, while previous epidemiological studies typically focused on SA among lifetime or 12-month ideators (Glenn & Nock, 2014), few population-level studies have examined the timing of greatest importance: imminent suicide risk among current/recent ideators. Efforts to understand and predict this transition may be informed by the identification of factors that differentiate attempters from recent ideators who did not attempt suicide.

In the current study, we combine data from two cross-sectional survey components of the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS) (Ursano et al., 2014) in order to examine combat exposure, PTSD, and other potential predictors of the transition from recent SI to SA. Our approach was to: (1) identify socio-demographic, stressor (e.g., combat exposure), and MDx variables that differentiate hospitalized attempters from representative soldiers in the community, then examine whether those same variables differentiate; (2) soldiers with 30-day SI from representative soldiers in the community; and (3) hospitalized attempters from nonattempting ideators in the community.

1 | METHODS

1.1 | Sample

Army STARRS is a multicomponent epidemiological and neurobiological study of suicide and mental health risk and resilience among U.S. Army soldiers (Ursano et al., 2014). Cross-sectional survey data from two Army STARRS components were combined in order to compare hospitalized SA cases and community controls.

1.2 | SA cases

Soldier Health Outcomes Study-A (SHOS-A) is a case–control study of active duty U.S. Army soldiers hospitalized for a recent SA (Ursano et al., 2014). 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 (due to small numbers) soldiers with less than 6 months of service, in the Army National Guard or Army Reserve, deployed at the time of SA, and those who did not consent to linkage of their SAQ responses and army/DoD administrative records.

1.3 | Army population controls

Controls were a representative sample of nonhospitalized active duty soldiers who completed the same SAQ as cases while located at the same army installations where SA cases were recruited. Data came from two surveys within the Army STARRS Consolidated All Army Study (AAS), which combines large, representative survey samples (Heeringa et al., 2013; Kessler et al., 2013) of active duty soldiers serving inside and outside the continental US (excluding those in Basic Combat Training) (see Supplemental Methods). We selected the subset of nondeployed respondents from our four target installations. Other inclusion/exclusion criteria were the same as for SA cases. The final analytic sample included 10,193 population controls. Among these controls, we also identified those reporting past 30-day SI ($n = 125$).

1.4 | Weighting procedures

SA cases were weighted to represent the population of medically documented suicide attempters at the same army installations using Department of Defense Suicide Event Report (DoDSER) (Gahm et al., 2012) records available for Q4 2011 through 2012 (applying the same inclusion/exclusion criteria). Nonhospitalized controls from the Consolidated AAS were weighted to represent the corresponding army population at the recruitment installations using population snapshot data from Q4 of 2011 through 2012 (applying the same inclusion/exclusion criteria) (see Supplemental Methods for additional details).

1.5 | Measures

1.5.1 | Socio-demographic characteristics

Gender, age, race/ethnicity, education, and marital status variables were constructed from army and DoD administrative personnel records.

1.5.2 | MDx

The SAQ assessed DSM-IV internalizing and externalizing disorders, including 30-day and lifetime major depressive disorder (MDD), generalized anxiety disorder (GAD), panic disorder (PD), PTSD, and intermittent explosive disorder (IED), as well as past 6-month attention-deficit/hyperactivity disorder (ADHD), lifetime substance use disorder (SUD; alcohol/drug abuse or dependence, including illicit drugs and misused prescription drugs), and lifetime bipolar disorder I-II or sub-threshold BPD. Sub-threshold BPD was defined as lifetime history of hypomania without history of MDD, or sub-threshold hypomania with history of MDD (Merikangas et al., 2011). Past 30-day PTSD was assessed with the PTSD Checklist (PCL) (Weathers, Litz, Herman, Huska, & Keane, 1993) and the other disorders were assessed with the Composite International Diagnostic Interview screening scales (CIDI-SC) (Kessler et al., 2013) and a revised self-administered Family History Screen (FHS) (Weissman et al., 2000), which assessed personal, rather than family, disorder history. All disorders were assessed without DSM-IV diagnostic hierarchy or organic exclusion rules. The CIDI-SC and PCL have good concordance with independent clinical diagnoses in the Consolidated AAS (area under the receiver operating characteristic curve of 0.69–0.79 across diagnoses) (Kessler et al., 2013). Although the FHS has acceptable concordance with best-estimate clinical diagnoses (Weissman et al., 2000), items used in the Consolidated AAS yielded high prevalence estimates, so diagnoses based on the FHS should be considered combinations of threshold and sub-threshold disorders. These assessment data were used to construct recency variables (past 30 days, prior to past 30 days, never) for MDD, GAD, PD, PTSD, and IED. BP was examined only as a lifetime disorder due to small numbers. SUD was examined only as a lifetime disorder because some controls were not assessed for 30-day SUD. ADHD was examined only as a past 6-month disorder because that was the reference period for the assessment.

1.5.3 | Stressors

We assessed lifetime and past 12-month exposure to potentially traumatic and stressful events. Using items from the Joint-Mental Health Advisory Team 7 (J-MHAT 7) (Joint Mental Health Advisory Team 7 (J-MHAT 7), 2011) and Deployment Risk and Resilience Inventory (DRRI) (King, King, Vogt, Knight, & Samper, 2006), respondents indicated how many times they experienced 15 deployment-related stressors (e.g., fire rounds at the enemy or take enemy fire, wounded by the enemy, members of unit seriously wounded/killed, hazed/bullied by unit members) and 15 life stressors excluding deployment experiences (e.g., serious physical assault, sexual assault or rape, murder of a close friend/relative, life-threatening illness or injury, disaster). Item responses were discretized (yes/no). Respondents also indicated (yes/no) whether they had experienced 29 of those events in the past 12 months (a question inquiring about bullying during childhood or adolescence was excluded from the past 12-month stressors due to the item timeframe). Additional past 12-month stressors were assessed (yes/no) using 16 items from the Life Events Questionnaire (Brugha & Cragg, 1990) and 2008 DoD Survey of Health-Related Behaviors among Active Duty Military Personnel (Bray et al., 2009) (e.g., life-threatening illness of close friend/family member, separation or divorce, caused an accident where someone else was hurt, trouble with police).

1.5.4 | SI

Past 30-day SI was assessed using a modified version of the Columbia Suicidal 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 then asked whether they had those thoughts in the past 30 days. SA cases were logically included among past 30-day ideators.

1.5.5 | SA

Hospitalized soldiers with a recent SA were identified by the attending psychiatrists on the inpatient psychiatric units at the four army hospitals.

1.6 | Statistical analysis

Analyses were conducted to (1) systematically identify predictor variables that differentiate SA cases from the total community population (n = 132 cases; n = 10,193 controls). We first examined univariable associations of socio-demographics with SA. Significant socio-demographic predictors were then examined together in a multivariable model and nonsignificant multivariable predictors were removed. Due to the small number of cases and large number of stressor items, exploratory factor analysis (EFA) was used as a data reduction method to identify latent stressor subgroups. We conducted one polychoric EFA with promax rotation using the lifetime stressors (30 items), followed by a similar EFA with past 12-month stressors (45 items). The number of factors was determined based on eigenvalues ≥1 and scree plot examination. Items were assigned to factors based on loadings of ≥0.40. Cross-loading items were assigned to the factor on which they loaded highest. Dichotomous variables were created to indicate any stressor exposure within a given factor. The univariable and multivariable process used to identify significant socio-demographic predictors was then used for the stressor variables, and again for the MDx variables, except that the respective multivariable models of stressors and MDx also adjusted for significant variables from the socio-demographic analyses. Significant socio-demographic, stressor, and MDx predictors were then combined into a single multivariable model and nonsignificant variables were removed, resulting in a final model predicting SA in the total population.

We then examined whether these final model variables differentiated (2) past 30-day ideators from the total population (n = 257 total ideators, combining the 132 SA cases with the 125 nonattempting community soldiers reporting 30-day ideation; n = 10,068 controls); and (3) SA cases from nonattempting 30-day ideators in the community (n = 132 SA cases; n = 125 SI-only controls).

Logistic regression coefficients were exponentiated to obtain odds ratios (OR) and 95% confidence intervals (CI). Standard errors were estimated using the Taylor series method to adjust for stratification, weighting, and clustering of the Consolidated AAS survey data.

TABLE 1 Associations of socio-demographic characteristics with suicide attempt among active-duty U.S. Army soldiers

	Univariable		Multivariable[a]		Suicide attempt cases[b] ($n = 132$)		Army population controls[c] ($n = 10,193$)	
	OR	(95% CI)	OR	(95% CI)	*n*	Weighted %	*n*	Weighted %
Socio-demographics								
Gender								
Male	1.0	–	1.0	–	111	76.6	9,289	85.7
Female	1.8[e]	(1.0–3.3)	2.0[e]	(1.1–3.5)	21	23.4	904	14.3
χ^2_1	4.2[e]		5.8[e]					
Current age								
<21	0.8	(0.3–1.9)	0.6	(0.2–1.5)	8	3.9	1,422	7.2
21–24	2.2[e]	(1.2–4.3)	1.7	(0.9–3.2)	46	40.3	3,212	25.9
25–29	1.5	(0.8–2.9)	1.3	(0.7–2.6)	36	28.5	2,704	27.5
30–34	1.0	–	1.0	–	19	12.4	1,442	17.8
35–39	1.1	(0.4–3.0)	1.3	(0.5–3.5)	12	9.1	843	11.6
≥40	0.9	(0.4–2.1)	1.1	(0.4–2.7)	11	5.8	570	9.9
χ^2_5	12.4[e]		7.2					
Race/ethnicity								
White	1.0	–			87	57.5	6,600	60.1
Black	1.3	(0.8–2.2)			31	25.3	1,643	19.9
Hispanic	1.1	(0.2–1.3)			7	13.3	1,234	13.0
Other	0.6	(0.2–1.3)			7	3.8	716	7.0
χ^2_3	3.3							
Education								
<High school[d]	2.0[e]	(1.1–3.6)	2.0[e]	(1.1–3.6)	18	26.5	1,064	12.2
High school	1.0	–	1.0	–	105	68.8	7,445	64.2
≥Some college	0.2[e]	(0.1–0.4)	0.2[e]	(0.1–0.4)	9	4.8	1,684	23.6
χ^2_2	28.3[e]		24.9[e]					
Marital status								
Never married	1.3	(0.8–2.1)			31	37.7	4,010	32.6
Currently married	1.0	–			89	55.4	5,754	61.2
Previously married	1.2	(0.6–2.5)			12	7.0	429	6.2
χ^2_2	1.1							

[a]Model includes the socio-demographic variables that were significant univariable predictors of suicide attempts among the total population.
[b]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.
[c]Nonhospitalzied soldiers who participated in the Army STARRS Consolidated All Army Study at the same four army installations where suicide attempt cases were hospitalized. Controls were weighted to be representative of the general population at those installations.
[d]High School includes: General Educational Development credential (GED), home study diploma, occupational program certificate, correspondence school diploma, high school certificate of attendance, adult education diploma, and other nontraditional high school credentials.
[e]$p < 0.05$.

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). Statistical significance was evaluated using two-sided design-based tests and the 0.05 level of significance. To determine the effectiveness of the final model in identifying SA cases among 30-day ideators (i.e., concentration of risk), we used the model to generate predicted probabilities, then sorted those predicted probabilities into ventiles and examined the proportion of SA cases among the 5% of ideators in the top ventile of predicted risk.

2 | RESULTS

2.1 | Characteristics of SA cases and community controls

Weighted SA cases were mostly male (76.6%), younger than 30 (72.7%), white (57.5%), high school-educated (68.8%), and currently married (55.4%). Weighted population controls were also mostly male (85.7%), younger than 30 (60.6%), white (60.1%), high school-educated (64.2%), and currently married (61.2%).

TABLE 2 Associations of stressful events with suicide attempt among active-duty U.S. Army soldiers

	Univariable		Multivariable[a]		Suicide attempt cases[b] ($n = 132$)		Army population controls[c] ($n = 10,193$)	
	OR	(95% CI)	OR	(95% CI)	*n*	Weighted %	*n*	Weighted %
Lifetime stressful events[d]								
Combat trauma								
Yes	1.1	(0.7–1.8)			95	68.0	6,287	66.0
No	1.0	–			37	32.0	3,906	34.4
χ^2_1	0.2							
Death or injury of loved one								
Yes	2.5[e]	(1.3–4.6)	1.3	(0.7–2.5)	112	86.0	7,410	71.0
No	1.0	–	1.0	–	20	14.3	2,783	29.1
χ^2_1	8.1[e]		0.8					
Interpersonal violence								
Yes	5.7[e]	(3.6–8.9)	3.4[e]	(2.1–5.5)	60	46.4	1,094	13.2
No	1.0	–	1.0	–	72	53.6	9,099	86.8
χ^2_1	58.4[e]		23.0[e]					
Past 12-month stressful events[d]								
Combat trauma								
Yes	0.5[e]	(0.3–1.0)	0.3[e]	(0.2–0.6)	22	15.8	1,662	26.0
No	1.0	–	1.0	–	110	84.2	8,531	74.0
χ^2_1	4.5[e]		13.0[e]					
Death or injury of loved one								
Yes	1.9[e]	(1.3–3.0)	1.1	(0.7–1.7)	75	52.6	3,602	36.2
No	1.0	–	1.0	–	57	47.4	6,591	63.8
χ^2_1	8.8[e]		0.1					
Legal problems								
Yes	6.9[e]	(4.4–10.9)	3.2[e]	(2.0–5.2)	55	38.7	939	8.4
No	1.0	–	1.0	–	77	61.3	9,254	91.6
χ^2_1	70.2[e]		23.4[e]					
Relationship problems								
Yes	7.3[e]	(4.6–11.7)	4.0[e]	(2.4–6.4)	93	70.8	2,443	24.9
No	1.0	–	1.0	–	39	29.2	7,750	75.1
χ^2_1	69.3[e]		30.9[e]					
Interpersonal violence								
Yes	4.5[e]	(2.4–8.6)	1.6	(0.8–3.3)	22	16.6	520	4.2
No	1.0	–	1.0	–	110	83.4	9,673	95.8
χ^2_1	21.1[e]		2.0					
Accident								
Yes	2.1[e]	(1.3–3.5)	1.1	(0.7–2.0)	28	16.6	966	8.6
No	1.0	–	1.0	–	104	83.4	9,227	91.5
χ^2_1	8.8[e]		0.3					

(Continues)

2.2 | Differentiating SA cases from the total community population

Gender and education were the only socio-demographic variables that remained significant in the multivariable model. Soldiers who were female and less than high school-educated had increased odds of attempt (Table 1). EFAs of the stressor items produced three lifetime factors (combat trauma, death/injury of loved one, interpersonal violence; Table S1) and seven past 12-month stressor factors (combat trauma, death/injury of loved one, legal problems, relationship problems, interpersonal violence, accident, and bullied by unit members (Table S2). Although nearly all stressor variables were associated with SA in univariable analyses, the only significant multivariable predictors (also adjusting for gender and education) were lifetime

TABLE 2 (Continued)

	Univariable		Multivariable[a]		Suicide attempt cases[b] ($n = 132$)		Army population controls[c] ($n = 10,193$)	
	OR	(95% CI)	OR	(95% CI)	*n*	Weighted %	*n*	Weighted %
Bullied by unit members								
Yes	4.4[e]	(1.7–11.1)	1.9	(0.6–5.7)	10	6.9	111	1.7
No	1.0	–	1.0	–	122	93.1	10,082	98.3
χ^2_1	9.4[e]		1.2					

[a]Model includes the stressful event variables that were significant univariable predictors of suicide attempts among the total population plus the significant socio-demographic variables from Table 1 (gender, education).
[b]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.
[c]Nonhospitalzied soldiers who participated in the Army STARRS Consolidated All Army Study at the same four army installations where suicide attempt cases were hospitalized. Controls were weighted to be representative of the general population at those installations.
[d]Lifetime and past 12-month stressful event variables were derived from exploratory factor analyses. Variables indicate endorsement of any event within a factor (yes/no).
[e]$p < 0.05$.

interpersonal violence and past 12-month combat trauma, legal problems, and relationship problems. Adjusted odds of SA were elevated for all of these stressors except past 12-month combat exposure, which had a negative association (Table 2). Similarly, all MDx were positively associated with SA in univariable analyses. MDD, PTSD, SUD, and IED remained significant when combined in a multivariable model (also adjusting for gender and education), with all disorders except IED maintaining a positive association with SA (Table 3).

When significant variables from previous steps were examined together, all remained significant except gender and past 12-month legal problems (Table S3). Gender was retained in subsequent analyses owing to its consistent association with SA in military (Nock et al., 2014; Ursano, Kessler, Stein, et al., 2015) and civilian (Nock et al., 2008) studies. In the final multivariable model, higher odds of SA in the community was associated with lifetime interpersonal violence exposure (OR = 2.1 [95% CI = 1.2–3.5]), past 12-month relationship problems (OR = 2.9 [95% CI = 1.8–4.8]), MDD (past 30 days, OR = 12.4 [95% CI = 4.3–35.7]; prior to past 30 days, OR = 8.2 [95% CI = 3.0–22.7]), PTSD (past 30 days, OR = 3.1 [95% CI = 1.3–7.2]), and SUD (lifetime, OR = 2.1 [95% CI = 1.2–3.6]). Lower odds was associated with having at least some college education (OR = 0.2 [95% CI = 0.1–0.6]), past 12-month combat trauma (OR = 0.4 [95% CI = 0.2–0.7]), and IED (prior to past 30 days, OR = 0.3 [95% CI = 0.1–0.7]) (Table 4).

2.3 | Differentiating 30-day ideators from the total community population

When the final model was used to differentiate past 30-day ideators from the community, the results for gender, lifetime interpersonal violence, past 12-month combat trauma and relationship problems, MDD, and SUD were similar to the analysis of SA in the community. Education and PTSD were nonsignificant and IED was significant in the opposite direction (past 30 days, OR = 2.2 [95% CI = 1.2–4.0]) (Table 4). Distributions of these variables are available from the authors upon request.

2.4 | Differentiating SA cases from 30-day ideators in the community

When the final model was used to differentiate SA cases from past 30-day ideators, education, PTSD, and IED were significant. Odds of SA was higher for past 30-day ideators with PTSD (past 30 days, OR = 6.7[95% CI = 1.1–39.4]) and lower for those with at least some college education (OR = 0.1 [95% CI = 0.0–0.6]) and IED (past 30 days, OR = 0.2 [95% CI = 0.1–0.5]) (Table 4). Distributions of these variables are available from the authors upon request. Using predicted probabilities from the final model, the 5% of 30-day ideators in the top ventile of predicted risk included 20.9% of attempters.

3 | DISCUSSION

Predicting transition from SI to SA is an important aspect of suicide risk assessment for mental health care. The current study of active duty soldiers aimed to improve understanding of that transition by administering the same SAQ to representative samples of hospitalized suicide attempters, nonhospitalized soldiers from the same communities, and soldiers in the community who reported past 30-day SI but did not attempt suicide. After identifying variables associated with SA in the community, including self-reported MDx that may have been unrecognized and undiagnosed by clinicians, we found that a subset of those variables also differentiated attempters from 30-day ideators, suggesting that most predictors of SA in the population are really predictors of SI, not transition from SI to SA.

Of the variables associated with SA in the community, 6 out of 8 were also associated with SI in the community, including a number of stressors (lifetime interpersonal violence, past 12-month relationship problems, and past 12-month combat trauma [which was protective]) and MDx (MDD, SUD, IED [negatively associated with SA but positively associated with SI]). When the same variables were examined as predictors of SA among ideators (addressing transition from SI to SA), soldiers at risk of SA had higher odds of current PTSD and lower odds of current IED and college education. However, most variables (5 of 8) actually predicted SI and did not differentiate attempters from

TABLE 3 Associations of mental disorders with suicide attempt among active-duty U.S. Army soldiers

	Univariable		Multivariable[a]		Suicide attempt cases[b] ($n = 132$)		Army population controls[c] ($n = 10,193$)	
	OR	(95% CI)	OR	(95% CI)	*n*	Weighted %	*n*	Weighted %
Internalizing disorders[d]								
MDD								
Past 30 days	47.4[d]	(21.5–104.3)	13.2[d]	(4.3–40.5)	86	58.3	766	8.1
Prior to past 30 days	12.8[d]	(5.4–30.2)	8.5[d]	(2.5–28.4)	33	30.1	1,076	15.5
Never	1.0	–	1.0	–	13	11.6	8,351	76.4
χ^2_2	101.3[d]		21.1[d]					
BPD								
Lifetime	9.3[d]	(5.7–15.1)	0.9	(0.5–1.7)	45	32.7	500	5.0
Never	1.0	–	1.0	–	87	67.3	9,693	95.0
χ^2_1	79.8[d]		0.0					
GAD								
Past 30 days	27.5[d]	(15.0–50.4)	1.6	(0.6–4.0)	74	48.8	611	6.5
Prior to past 30 days	4.8[d]	(2.5–9.4)	1.4	(0.5–4.0)	34	32.6	1,530	25.0
Never	1.0	–	1.0	–	24	18.6	8,052	68.5
χ^2_2	126.2[d]		0.9					
PD								
Past 30 days	7.5[d]	(4.6–12.1)	0.8	(0.4–1.6)	36	22.2	360	3.9
Prior to past 30 days	5.0[d]	(1.4–17.3)	1.0	(0.3–3.3)	5	5.7	134	1.5
Never	1.0	–	1.0	–	91	72.1	9,699	94.6
χ^2_2	69.1[d]		0.3					
PTSD								
Past 30 days	28.9[d]	(15.8–52.7)	3.4[d]	(1.3–9.3)	74	56.2	725	6.9
Prior to past 30 days	3.3[d]	(1.8–6.4)	0.8	(0.3–2.0)	35	24.9	1,678	26.4
Never	1.0	–	1.0	–	23	18.9	7,790	66.7
χ^2_2	143.4[d]		18.8[d]					
Externalizing disorders								
SUD								
Lifetime	6.5[d]	(4.2–10.1)	2.1[d]	(1.3–3.6)	70	51.6	1,851	14.2
Never	1.0	–	1.0	–	62	48.3	8,342	85.8
χ^2_1	68.7[d]		8.2[d]					
IED								
Past 30 days	4.2[d]	(2.6–6.8)	0.9	(0.5–1.5)	50	35.1	1,152	10.8
Prior to past 30 days	0.5	(0.2–1.3)	0.3[d]	(0.1–0.7)	6	2.9	873	7.8
Never	1.0	–	1.0	–	76	62.0	8,168	81.4
χ^2_2	42.5[d]		7.1[d]					
ADHD								
Past 6 months	9.8[d]	(6.2–15.3)	1.1	(0.7–1.8)	57	42.8	761	7.1
Never	1.0	–	1.0	–	75	57.2	9,432	92.9
χ^2_1	98.3[d]		0.2					

[a]Model includes the mental disorder variables that were significant univariable predictors of suicide attempts among the total population plus the significant socio-demographic variables from Table 1 (gender, education).

[b]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.

[c]Nonhospitalzied soldiers who participated in the Army STARRS Consolidated All Army Study at the same four army installations where suicide attempt cases were hospitalized. Controls were weighted to be representative of the general population at those installations.

MDD = major depressive disorder; BPD = bipolar disorder; GAD = generalized anxiety disorder; PD = panic disorder; PTSD = posttraumatic stress disorder; SUD = substance use disorder; IED = intermittent explosive disorder; ADHD = attention-deficit/hyperactivity disorder.

[d]$p < 0.05$.

TABLE 4 Multivariable associations of socio-demographic characteristics, stressful events, and mental disorders with suicide attempts, suicide ideation, and attempts among ideators[a]

	Suicide attempters among the total population[b] *n* = 132 cases *n* = 10,193 controls		30-Day suicide ideators among the total population[c] *n* = 257 cases *n* = 10,068 controls		Suicide attempters among 30-day ideators[d] *n* = 132 cases *n* = 125 controls	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Socio-demographic characteristics						
Gender						
Male	1.0	–	1.0	–	1.0	–
Female	0.8	(0.4–1.5)	0.8	(0.4–1.6)	0.4	(0.1–1.6)
χ^2_1	0.6		0.3		1.6	
Education						
<High school	1.5	(0.8–2.9)	1.1	(0.6–2.1)	1.3	(0.4–4.1)
High school	1.0	–	1.0	–	1.0	–
≥Some college	0.2[f]	(0.1–0.6)	0.9	(0.3–2.2)	0.1*	(0.0–0.6)
χ^2_2	13.2[f]		0.2		7.9*	
Lifetime stressful events[e]						
Interpersonal violence						
Yes	2.1[f]	(1.2–3.5)	2.6[f]	(1.5–4.6)	0.7	(0.2–2.4)
No	1.0	–	1.0	–	1.0	–
χ^2_1	7.4[f]		10.6[f]		0.3	
Past 12-month stressful events[e]						
Combat trauma						
Yes	0.4[f]	(0.2–0.7)	0.3[f]	(0.2–0.8)	3.0	(0.8–10.6)
No	1.0	–	1.0	–	1.0	–
χ^2_1	9.3[f]		7.0[f]		2.9	
Relationship problems						
Yes	2.9[f]	(1.8–4.8)	2.1[f]	(1.2–3.6)	1.5	(0.6–3.9)
No	1.0	–	1.0	–	1.0	–
χ^2_1	18.0[f]		6.6[f]		0.7	
Internalizing disorders						
MDD						
Past 30 days	12.4[f]	(4.3–35.7)	11.5[f]	(5.1–26.0)	3.1	(0.5–21.5)
Prior to past 30 days	8.2[f]	(3.0–22.7)	4.9[f]	(2.1–11.6)	6.0	(0.9–40.6)
Never	1.0	–	1.0	–	1.0	–
χ^2_2	21.9[f]		36.2[f]		3.7	
PTSD						
Past 30 days	3.1[f]	(1.3–7.2)	1.3	(0.7–2.3)	6.7*	(1.1–39.4)
Prior to past 30 days	0.8	(0.4–1.8)	1.0	(0.5–1.8)	0.7	(0.2–3.1)
Never	1.0	–	1.0	–	1.0	–
χ^2_2	20.9[f]		1.2		11.2*	
Externalizing disorders						
SUD						
Lifetime	2.1[f]	(1.2–3.6)	2.2[f]	(1.3–3.7)	0.6	(0.2–1.7)
Never	1.0	–	1.0	–	1.0	–
χ^2_1	7.7[f]		9.1[f]		0.8	

(Continues)

TABLE 4 (Continued)

	Suicide attempters among the total population[b] $n = 132$ cases $n = 10{,}193$ controls		30-Day suicide ideators among the total population[c] $n = 257$ cases $n = 10{,}068$ controls		Suicide attempters among 30-day ideators[d] $n = 132$ cases $n = 125$ controls	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
IED						
Past 30 days	0.7	(0.4–1.2)	2.2[f]	(1.2–4.0)	0.2*	(0.1–0.5)
Prior to past 30 days	0.3[f]	(0.1–0.7)	1.1	(0.4–2.9)	0.1	(0.0–1.7)
Never	1.0	–	1.0	–	1.0	–
χ^2_2	8.4[f]		7.7[f]		11.8*	

[a]Models include significant multivariable predictors from Tables 1–3 that remained significant when combined into a single multivariable model predicting suicide attempts among the total population (see Table S6). Gender, while nonsignificant in the final multivariable model, was included because of its consistent association with suicide attempts in previous army studies.
[b]Cases: Hospitalized suicide attempters (weighted). Controls: Nonhospitalized soldiers from the community who participated in the Army STARRS Consolidated All Army Study (weighted).
[c]Cases: Past 30-day suicide ideators included hospitalized suicide attempters plus nonhospitalized soldiers reporting past 30-day ideation (weighted separately). Controls: Nonhospitalized soldiers from the community who participated in the Army STARRS Consolidated All Army Study and did not report past 30-day suicide ideation (weighted).
[d]Cases: Hospitalized suicide attempters (weighted). Controls: Nonhospitalized soldiers from the community who participated in the Army STARRS Consolidated All Army Study and reported past 30-day suicide ideation (weighted).
[e]Lifetime and past 12-month stressful event variables were derived from exploratory factor analyses. Variables indicate endorsement of any event within a factor (yes/no).
MDD = major depressive disorder; PTSD = posttraumatic stress disorder; SUD = substance use disorder; IED = intermittent explosive disorder.
[f]$p < 0.05$.

ideators, consistent with previous army (Millner et al., 2018, in press; Nock et al., 2014, 2015, 2018) and civilian (Kessler et al., 1999; Nock et al., 2008, 2009, 2010; Stein et al., 2010) research. Importantly, lifetime and past-year stressors were associated with both SA and SI in the population but were not associated with attempts among ideators. In particular, recent combat exposure did not differentiate SA from SI. More recent stressors (e.g., experienced in the past weeks, days, or hours) might distinguish these groups.

PTSD and IED were the only disorders associated with attempts among ideators. PTSD was positively associated with lifetime SI-to-SA transition in previous army (Nock et al., 2015, 2018) and civilian (Kessler et al., 1999; Nock et al., 2009, 2010) studies, and our findings suggest an association with SA among 30-day ideators as well. In contrast to previous findings, other disorders characterized by anxiety/agitation or impulsiveness did not differentiate attempters from ideators. Whereas the bivariate association of IED with SA in the population was positive, it had a negative multivariable association with SA in the total population and among ideators. This conflicts with army studies demonstrating a positive multivariable association between IED and lifetime SA (Millner et al., in press; Nock et al., 2014). Post hoc analyses suggested the inverse multivariable association of IED resulted primarily from interrelationships with MDD and PTSD, warranting further exploration of transdiagnostic processes that may be involved in these disorders. However, it is important to recognize that anger plays a complex role in military populations where it can be perceived as adaptive, despite conflicting evidence (Adler, Brossart, & Toblin, 2017). Among soldiers with SI, those expressing anger outward (characteristic of IED) may be less likely to harm themselves than those expressing anger inward. Further study of how anger is experienced and expressed may clarify the role of IED.

A concentration of risk analysis indicated final model variables improved identification of SA risk among those with SI. The 5% of ideators in the top ventile of predicted risk included more than 20% of attempters, a four-fold concentration of risk. Results suggest that screening MDx, particularly PTSD and IED, could be incorporated (Bernecker et al., 2018) as part of an algorithm-based decision support tool to assist clinical judgment in assessing risk of transition from ideation to attempt (Kessler, 2018).

Our results should be interpreted with certain limitations. First, without a comparison sample of psychiatrically hospitalized soldiers who did not attempt suicide, it is possible that the variables in our final model are risk factors for psychiatric hospitalization rather than being specific to SA. In order to explore this possibility using the available data, we examined administrative records of the community controls to identify soldiers who received an inpatient psychiatric diagnosis in the 3 months after completing the survey ($n = 54$). Using our final multivariable model to predict inpatient diagnosis, we found that MDD was the only significant predictor. This analysis, while likely underpowered, provides some evidence that the majority of the final model variables are not risk factors for psychiatric hospitalization in general. Second, the retrospective, cross-sectional nature of self-report data is subject to recall bias and precludes causal inferences. 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 target population on other important characteristics (e.g., mental health history).

4 | CONCLUSIONS

Specific MDx may be associated with transition from recent SI to SA, although many apparent risk factors for SA in the population are actually risk factors for SI and do not differentiate attempters from ideators. Given the importance of this transition for understanding and predicting the course of suicidal behavior, future research should consider other potential risk factors, such as the age-of-onset, persistence, and severity of SI, history of nonsuicidal self-injury and/or other dangerous behaviors, very recent stressors, and capability of engaging in suicidal behavior (Nock et al., 2018; Selby et al., 2010). Findings would assist clinicians and program planners in identifying those most at risk in the near future.

CONFLICT OF INTEREST

Dr. Kessler reports grants from Sanofi Aventis, personal fees from Johnson & Johnson Wellness and Prevention, personal fees from Sage Pharmaceuticals, personal fees from Shire, personal fees from Takeda, other from Johnson & Johnson Services Inc. Lake Nona Life Project, other from Datastat, Inc., outside the submitted work. The remaining authors report nothing to disclose.

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