



Medically Documented Suicide Ideation Among U.S. Army Soldiers

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We used administrative data to examine predictors of medically documented suicide ideation (SI) among Regular Army soldiers from 2006 through 2009 ($N = 10,466$ ideators, 124,959 control person-months). Enlisted ideators (97.8% of all cases) were more likely than controls to be female, younger, older when entering service, less educated, never or previously deployed, and have a recent mental health diagnosis. Officer ideators were more likely than controls to be female, younger, younger when entering service, never married, and have a recent mental health diagnosis. Risk among enlisted soldiers peaked in the second month of service and declined steadily, whereas risk among officers remained relatively stable over time. Risk of SI is highest among enlisted soldiers early in Army service, females, and those with a recent mental health diagnosis.

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In recent years, there have been several large-scale efforts to understand the sharp increase in fatal (LeardMann et al., 2013; Reger et al., 2015; Schoenbaum et al., 2014) and nonfatal (Nock et al., 2014; Ursano, Kessler, Heeringa, et al., 2015; Ursano, Kessler, Stein, et al., 2015) suicidal behaviors among U.S. military personnel that occurred during the wars in Iraq and Afghanistan. Suicide ideation (SI) is an important outcome both as an indicator of distress and as a predictor of more serious suicidal behavior (Kessler, Borges, & Walters, 1999; Nock et al., 2014; Ursano, Heeringa, et al., 2015). The lifetime prevalence of SI is approximately 14% among active duty Regular Army soldiers (Nock et al., 2014). The sociodemographic correlates of ideation in service members, including female gender, younger age, and non-Hispanic White race and ethnicity (Nock et al., 2014; Ursano, Kessler, Heeringa, et al., 2015) are consistent with those of the U.S. general population (Borges, Angst, Nock, Ruscio, & Kessler, 2008; Kessler, Berglund, Borges, Nock, & Wang, 2005). Risk of attempting or dying by suicide is higher among enlisted soldiers in their first tour of duty (Gilman et al., 2014; Ursano, Kessler, Stein, et al., 2015), but the relationship of time in service with SI is not yet known. Although the influence of deployment on adverse mental health outcomes is well supported (Bray et al., 2010; Gadermann et al., 2012; Jacobson et al., 2008; Shen, Arkes, & Williams, 2012; Wells et al., 2010), the association of deployment with suicidal thoughts and behaviors has generated inconsistent results (Bryan et al., 2015). Prior mental disorders are a robust predictor of both fatal (Black, Gallaway, Bell, & Ritchie, 2011) and nonfatal (Ursano, Kessler, Stein, et al., 2015) suicidal behaviors in service members, findings in line with a large body of civilian research (Harris & Barraclough, 1997; Nock, Hwang, Sampson, & Kessler, 2010).

Risk factors for SI differ from those for other suicidal behavior (Kessler et al., 2005; Nock & Kazdin, 2002; Nock et al., 2014; Ursano, Heeringa, et al., 2015). Mood

disorder is often linked to suicide. However, only a small minority of people with mood disorders make a suicide attempt, and only about 2% die by suicide (Bostwick & Pankratz, 2000). In contrast, approximately one-third of suicide ideators go on to make an attempt (Kessler et al., 1999; Nock et al., 2014; Ursano, Heeringa, et al., 2015). Despite this, surprisingly few studies have focused on understanding and predicting the occurrence of SI in its own right. Ideators already identified by the health care system provide an opportunity for preventive interventions.

Our aim was to provide the first comprehensive analysis of medically documented SI in the U.S. Army during the wars in Iraq and Afghanistan. Using data from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS; www.army-starrs.org; Kessler et al., 2013; Ursano et al., 2014), we examined sociodemographic, service-related, and mental health predictors of SI from 2006 through 2009. This study includes a large, representative, multiyear sample of active duty soldiers serving during wartime. It is an important addition to retrospective self-report data on SI from recent Army STARRS survey research, which did not include soldiers in basic training or those who were currently deployed (Nock et al., 2014). Administrative medical records are a feasible way to study SI using existing data, in which no additional assessment is required. Furthermore, ideators who are already identified by the military health care system provide an opportunity to intervene and prevent more serious outcomes. In contrast to the growing number of findings based on survey research, we are not aware of any studies that have systematically examined medically documented SI among active duty service members.

METHODS

Sample

The Army STARRS Historical Administrative Data Study (HADS) integrates 38

Army/Department of Defense (DoD) administrative data systems (Kessler et al., 2013). Creation and analysis of this consolidated and deidentified data system were approved by the institutional review boards of the Uniformed Services University, University of Michigan Institute for Social Research, University of California, San Diego, and Harvard Medical School. In this longitudinal, retrospective cohort study, we focused on records for the 778,041 Regular Army soldiers (excluding activated Army National Guard and Army Reserve) on active duty from January 1, 2006, through December 31, 2009. There were 10,466 soldiers (10,232 enlisted, 234 commissioned and warrant officers) with documented SI during this time (excluding those with documentation of other suicidal behaviors). Data were analyzed using a discrete-time survival framework with person-month as the unit of analysis (Willett & Singer, 1993), such that each month in the career of a soldier was treated as a separate observational record. Given that discrete-time survival coefficients can be estimated without bias when control person-months are randomly subsampled and weighted using the logic of case-control analysis (Schlesselman, 1982), we reduced computational intensity by selecting from the population an equal-probability 1:200 sample of 124,959 control person-months (104,369 enlisted, 20,590 officer) stratified by gender, rank, time in service, deployment status (never, currently, previously), and historical time. The control person-months excluded all soldiers with documented SI or other nonfatal suicidal event (e.g., suicide attempt; Ursano, Kessler, Heeringa, et al., 2015) and person-months in which a soldier died. Control person-months were assigned a weight of 200 to adjust for under-sampling.

Measures

Administrative documentation of SI during Army service was identified using: records from the Department of Defense Suicide Event Report (DoDSER; Gahm et al., 2012) and ICD-9-CM V62.84 diagnostic codes (indicating SI) from health care

encounter information from military and civilian treatment facilities, combat operations, and aeromedical evacuations. We excluded soldiers who ever attempted or completed suicide. For soldiers documented to have had SI more than once, we selected the first record using a hierarchical classification scheme that prioritized DoDSER records (Ursano, Kessler, Heeringa, et al., 2015). Using administrative person-month records dating to the year 2000 (or first entry into the Army for those who began service later), we constructed indicators for temporally prior predictor variables, including socio-demographics, time in service, deployment status, and mental health diagnosis (Table S1 in Supporting Information, www.armystarrs.org/publications). The indicator variable for previous mental health diagnosis was created from ICD-9-CM mental disorder codes (e.g., major depression, posttraumatic stress disorder, personality disorders), excluding postconcussion syndrome, tobacco use disorder, and supplemental V-codes (e.g., stressors/adversities, marital problems) (Table S2 in Supporting Information). Recency of diagnosis was determined based on the number of months between the most recent diagnostic record and the SI record (cases) or sampled person-month record (controls).

Analysis Methods

Analyses were conducted separately for enlisted soldiers and officers owing to their different sociodemographic profiles, Army training and career experiences (Segal & Segal, 2004), risk of mental health problems (Bray et al., 2009; Lapierre, Schweiger, & LaBauve, 2007; Smith et al., 2008), suicide attempt (Ursano, Kessler, Stein, et al., 2015), and suicide death (Gilman et al., 2014; Hyman, Ireland, Frost, & Cottrell, 2012). Logistic regression analyses examined multivariate associations of socio-demographics (gender, age at entry into Army service, current age, race, education, and marital status) with SI, followed by separate models evaluating incremental

predictive effects of time in service (1–2 years, 3–4 years, 5–10 years, >10 years), deployment status (never deployed [ND], currently deployed [CD], previously deployed [PD]), and presence/recency of mental health diagnosis (none vs. 1, 2–3, 4–12, and 13+ months since most recent diagnosis). Logistic regression coefficients were exponentiated to obtain odds ratios (OR) and 95% confidence intervals (CI). Final model coefficients were used to generate *standardized* estimates of risk (number of suicide ideators per 100,000 person-years; Roalfe, Holder, & Wilson, 2008) for each category of each predictor under the model assuming other predictors were at their samplewide means. The number of suicide ideators per 100,000 person-years is the number of ideators we would expect out of 100,000 soldiers followed for a year. For example, the total Regular Army suicide rate during 2004–2009 was 18.5 per 100,000 person-years (Gilman et al., 2014). Based on evidence that the rate of SI in the Army increased during the wars in Iraq and Afghanistan (Ursano, Kessler, Heeringa, et al., 2015), a separate dummy predictor was included in each logistic regression to control for calendar month and year. Coefficients of other predictors can consequently be interpreted as averaged within-month associations based on the assumption that effects of other predictors do not vary over time. To further examine associations between time in service and risk of SI, we generated separate discrete-time hazard functions for enlisted soldiers and officers. These hazard functions were used to estimate risk of ideation in each month since entering Army service (suicide ideators per 100,000 person-months).

RESULTS

Enlisted soldiers comprised 83.5% of active duty Regular Army soldiers, 97.8% of all suicide ideators ($n = 10,232$), and had an overall SI rate of 587.9 per 100,000 person-years (95% CI: 576.9–599.8). Officers

(commissioned and warrant officers) made up 16.5% of the Regular Army and 2.2% of ideators ($n = 234$), with an overall rate of 68.2 per 100,000 person-years (95% CI: 60.0–77.5) (Tables 1 and 2).

Sociodemographic Characteristics

Among enlisted soldiers, higher odds of SI were observed in those who were female (OR = 1.6 [95% CI: 1.5–1.7]); younger (age <21 years, OR = 3.9 [95% CI: 3.6–4.3]); entered the Army at age ≥25 (OR = 1.6 [95% CI: 1.5–1.8]); and had less than a high school education (OR = 1.8 [95% CI: 1.7–1.9]). Odds of SI were lower among non-Whites (OR = 0.7–0.9) (Table 1).

Among officers, higher odds of SI were observed in those who were female (OR = 2.3 [95% CI: 1.7–3.1]) and entered the Army at <21 years of age (OR = 1.8 [95% CI: 1.3–2.4]). Lower odds of SI were observed for those ≥40 (OR = 0.6 [95% CI: 0.4–0.9]) and never married (OR = 0.6 [95% CI: 0.4–0.9]) (Table 2).

Enlisted females had more than six times the risk of female officers (rate ratio [RR] = 6.5 [95% CI: 5.1–8.3]). Having a current age of ≥40 was protective for both enlisted personnel and officers, but risk among enlisted personnel in this age group was more than four times higher than officers (RR = 4.1 [95% CI: 3.0–5.6]).

Time in Service

After adjusting for sociodemographics, enlisted soldiers in their first 4 years of service had higher odds of SI (1–2 years, OR = 2.2 [95% CI: 2.0–2.4]; 3–4 years, OR = 1.4 [95% CI: 1.3–1.5]) than those with 5–10 years of service; those serving for >10 years had lower odds (OR = 0.6 [95% CI: 0.5–0.7]) (Table 3). Additional pairwise analyses revealed differences across all categories of time in service among enlisted soldiers ($\chi^2_1 = 82.6$ –419.4, $p < .0001$ for all analyses). Time in service was not associated with ideation among officers ($\chi^2_3 = 6.8$, $p = .08$) (Table 4). Enlisted soldiers in

their first 2 years of service had the highest standardized risk, which was more than 10 times that of officers in the same category (RR = 10.6 [95% CI: 7.5–15.1]).

A discrete-time hazard model (Figure 1) demonstrated greatly elevated risk among enlisted soldiers during their first year in the Army (average risk: 115.7 per 100,000 person-months), with risk peaking in the second month of service (182.2 per 100,000 person-months), followed by a

sharp decrease to 79.2 per 100,000 person-months. Rising again to 127.5 per 100,000 person-months by the sixth month of service, risk of SI then decreased substantially to a mean of 66.3 per 100,000 person-months during the second year of service, followed by a gradual decline to a mean of 51.1 per 100,000 person-months during the third and fourth years of service. For officers, risk remained relatively stable across the first 4 years of service (overall mean 4.6 per 100,000 person-months).

TABLE 1

Multivariate Associations of Sociodemographic Characteristics with Suicide Ideation among Enlisted Soldiers in the U.S. Army^a

	OR (95% CI)	Cases (n)	Total (N) ^b	Rate ^c	Pop% ^d	SR ^e
Gender						
Male	1.0	8,407	18,105,007	557.2	86.7	550.4
Female	1.6* (1.5–1.7)	1,825	2,779,025	788.0	13.3	857.8
χ^2_1	282.7*					
Age at Army entry						
<21	0.7* (0.7–0.8)	6,537	12,842,737	610.8	61.5	509.9
21–24	1.0	2,341	5,128,941	547.7	24.6	688.8
≥25	1.6* (1.5–1.8)	1,354	2,912,354	557.9	13.9	1,141.6
χ^2_2	430.2*					
Current age						
<21	3.9* (3.6–4.3)	3,031	3,006,231	1,209.9	14.4	1,283.4
21–24	2.2* (2.0–2.4)	3,606	6,232,206	694.3	29.8	728.6
25–29	1.4* (1.3–1.5)	2,006	5,034,306	478.2	24.1	453.5
30–34	1.0	843	2,835,043	356.8	13.6	328.9
35–39	0.8* (0.7–0.9)	512	2,297,312	267.4	11.0	274.6
≥40	0.6* (0.5–0.7)	234	1,488,034	188.7	7.1	188.4
χ^2_3	1,340.4*					
Race/Ethnicity						
White	1.0	7,308	12,625,908	694.6	60.5	656.9
Black	0.7* (0.7–0.7)	1,489	4,573,689	390.7	21.9	459.0
Hispanic	0.7* (0.7–0.7)	958	2,463,158	466.7	11.8	454.7
Asian	0.9 (0.7–1.0)	333	834,333	478.9	4.0	501.7
Other	0.8* (0.7–0.9)	144	386,944	446.6	1.9	547.7
χ^2_4	234.7*					
Education						
<High school ^f	1.8* (1.7–1.9)	3,046	2,936,646	1,244.7	14.1	974.5
High school	1.0	6,736	15,709,936	514.5	75.2	521.7
Some college	0.7* (0.6–0.8)	225	1,124,225	240.2	5.4	359.4
≥ College	0.6* (0.5–0.7)	225	1,113,225	242.5	5.3	304.3
χ^2_5	842.8*					
Marital status						

(continued)

TABLE 1
(continued)

	OR (95% CI)	Cases (n)	Total (N) ^b	Rate ^c	Pop% ^d	SR ^e
Never married	1.0 (1.0–1.1)	5,384	8,258,784	782.3	39.5	594.7
Currently married	1.0	4,593	11,718,593	470.3	56.1	584.4
Previously married	0.9 (0.8–1.0)	255	906,655	337.5	4.3	520.5
χ^2	5.3					
Total		10,232	20,884,032	587.9	100.0	—

^aThe sample of enlisted soldiers ($n = 10,232$ cases, 104,369 control person-months) is a subset of the total sample ($n = 135,425$ person-months) from the Army STARRS Historical Administrative Data Study (HADS) that includes all Regular Army soldiers (i.e., excluding those in the U.S. Army National Guard and Army Reserve) with suicide ideation in their administrative records during the years 2006–2009, plus a 1:200 stratified probability sample of all other active duty Regular Army person-months in the population exclusive of soldiers with suicide ideation or other nonfatal suicidal event (e.g., suicide attempt) and person-months in which the soldier died (i.e., suicides, combat deaths, homicides, and deaths due to other injuries or illnesses). All records in the 1:200 sample were assigned a weight of 200 to adjust for the under-sampling of months not associated with suicide ideation. The analysis included a dummy predictor variable for calendar month and year to control for secular trends.

^bTotal includes both cases (i.e., soldiers with suicide ideation) and control person-months.

^cRate per 100,000 person-years, calculated based on n_1/n_2 , where n_1 is the unique number of soldiers within each category and n_2 is the annual number of person-years, not person-months, in the population ($n = 3.08$ million).

^dPop % = Percent of the Regular Army enlisted population.

^eSR = Standardized risk estimate (suicide ideators per 100,000 person-years) was calculated assuming other predictors were at their samplewide means.

^f<High School includes the following: General Educational Development (GED) credential, home study diploma, occupational program certificate, correspondence school diploma, high school certificate of attendance, adult education diploma, and other nontraditional high school credentials.

* $p < 0.05$.

Deployment Status

We found higher odds of SI among ND (OR = 3.9 [95% CI: 3.6–4.2]) and PD (OR = 3.5 [95% CI: 3.2–3.8]) enlisted soldiers than among those CD, adjusting for sociodemographic variables (Table 3). ND enlisted soldiers also had significantly higher odds than those PD in an additional pairwise analysis (OR = 1.1 [95% CI: 1.1–1.2]). Deployment status was not associated with ideation among officers (Table 4). ND enlisted soldiers accounted for a similar proportion of their respective population as ND officers (36.2% vs. 30.7%), but had a standardized risk more than 11 times higher (RR = 11.6 [95% CI: 9.1–14.8]). Although a smaller proportion of enlisted soldiers were PD compared to officers (38.7% vs.

48.2%), their standardized risk of SI was more than eight times higher (RR = 8.8 [95% CI: 7.4–10.5]).

Mental Health Diagnosis

Among those with SI, 58.9% of enlisted soldiers and 73.1% officers had a previous mental health diagnosis. Among ideators with a history of mental health diagnosis, 59.1% of enlisted soldiers and 57.3% of officers most recently had diagnoses in the month prior to ideation. Adjusting for sociodemographics, enlisted soldiers with a mental health diagnosis in the previous month had the highest odds of ideation (OR = 14.4 [95% CI: 13.7–15.0]) compared to those without a diagnosis, with odds decreasing as the time since most

recent diagnosis increased from 2 to 3 months ($OR = 5.0$ [95% CI: 4.7–5.4]) to ≥ 13 months ($OR = 1.3$ [95% CI: 1.2–1.4]) (Table 3). Officers with a mental health diagnosis in the previous month similarly had the greatest likelihood of SI ($OR = 74.0$ [95% CI: 52.9–103.6]), and longer intervals resulted in increasingly smaller ORs, ranging from 13.4 (95% CI: 7.7–23.1) for 2–3 months to 3.8 (95% CI: 2.4–6.0) for ≥ 13 months (Table 4). The elevated standardized risk in the month after the diagnosis was nearly three times higher for

enlisted soldiers than officers ($RR = 2.8$ [95% CI: 2.3–3.4]).

DISCUSSION

Using comprehensive U.S. Army and DoD administrative data, this study identified active duty Regular Army soldiers at greatest risk of documented SI from 2006 through 2009. These ideators have been identified by the medical care system and, importantly, are therefore available for intervention.

TABLE 2

Multivariate Associations of Sociodemographic Characteristics with Suicide Ideation among Officers in the U.S. Army^a

	OR (95% CI)	Cases (n)	Total (N) ^b	Rate ^c	Pop% ^d	SR ^e
Gender						
Male	1.0	172	3,489,772	59.1	84.7	58.1
Female	2.3* (1.7–3.1)	62	628,462	118.4	15.3	131.2
χ^2_1	27.1*					
Age at Army entry						
<21	1.8* (1.3–2.4)	67	866,867	92.7	21.0	99.2
21–24	1.0	115	2,407,915	57.3	58.5	55.9
≥ 25	1.3 (0.9–1.9)	52	843,452	74.0	20.5	74.5
χ^2_2	12.5*					
Current age						
≤ 24	0.9 (0.5–1.6)	17	372,017	54.8	9.0	68.3
25–29	0.9 (0.6–1.4)	51	899,651	68.0	21.8	70.8
30–34	1.0	54	834,254	77.7	20.3	75.5
35–39	1.2 (0.8–1.7)	65	850,065	91.8	20.6	88.3
≥ 40	0.6* (0.4–0.9)	47	1,162,247	48.5	28.2	46.5
χ^2_4	11.1*					
Race/Ethnicity						
White	1.0	172	2,998,572	68.8	72.8	72.8
Black	0.6* (0.4–1.0)	26	542,426	57.5	13.2	46.9
Hispanic	1.4 (0.9–2.1)	22	244,822	107.8	5.9	98.8
Asian	0.6 (0.3–1.5)	9	202,209	53.4	4.9	49.5
Other	0.7 (0.4–1.3)	5	103,205	46.1	3.2	45.3
χ^2_5	9.2					
Education						
<High school ^f	1.1 (0.3–4.1)	3	70,003	51.4	1.7	44.6
High school	1.0	12	267,812	53.8	6.5	39.9
Some college	1.0 (0.4–2.7)	6	142,606	50.5	3.5	39.9
\geq College	1.8* (1.0–3.4)	213	3,637,813	70.3	88.3	73.1
χ^2_3	5.9					
Marital status						

(continued)

TABLE 2
(continued)

	OR (95% CI)	Cases (<i>n</i>)	Total (<i>N</i>) ^b	Rate ^c	Pop% ^d	SR ^e
Never married	0.6* (0.4–0.9)	43	988,843	52.2	24.0	46.1
Currently married	1.0	173	2,945,373	70.5	71.5	74.2
Previously married	1.5 (0.9–2.4)	18	184,018	117.4	4.5	107.5
χ^2	9.1*					
Total		234	4,118,234	68.2	100.0	—

^aThe sample of officers (*n* = 234 cases, 20,590 control person-months) is a subset of the total sample (*n* = 135,425 person-months) from the Army STARRS Historical Administrative Data Study (HADS) that includes all Regular Army soldiers (i.e., excluding those in the U.S. Army National Guard and Army Reserve) with suicide ideation in their administrative records during the years 2006–2009, plus a 1:200 stratified probability sample of all other active duty Regular Army person-months in the population exclusive of soldiers with suicide ideation or other nonfatal suicidal event (e.g., suicide attempt) and person-months in which the soldier died (i.e., suicides, combat deaths, homicides, and deaths due to other injuries or illnesses). All records in the 1:200 sample were assigned a weight of 200 to adjust for the under-sampling of months not associated with suicide ideation. The analysis included a dummy predictor variable for calendar month and year to control for secular trends.

^bTotal includes both cases (i.e., soldiers with suicide ideation) and control person-months.

^cRate per 100,000 person-years, calculated based on n_1/n_2 , where n_1 is the unique number of soldiers within each category and n_2 is the annual number of person-years, not person-months, in the population (*n* = 3.08 million).

^dPop% = Percent of the Regular Army officer population.

^eSR = Standardized risk estimate (suicide ideators per 100,000 person-years) was calculated assuming other predictors were at their samplewide means.

^f<High School includes: General Educational Development (GED) credential, home study diploma, occupational program certificate, correspondence school diploma, high school certificate of attendance, adult education diploma, and other nontraditional high school credentials.

**p* < 0.05.

Consistent with research on suicide attempts (Ursano, Kessler, Stein, et al., 2015) and suicide deaths (Gilman et al., 2014) among soldiers, risk of ideation was far greater in enlisted personnel than officers. Enlisted soldiers comprised approximately 83% of the Army, but nearly 98% of suicide ideators, with an overall rate of 587.9 per 100,000 person-years versus 68.2 per 100,000 person-years for officers. As in the military, most civilian data on the epidemiology of SI come from survey research (Nock et al., 2008), making accurate comparisons of medically documented ideation rates between military and civilian populations virtually impossible. Medically documented ideation among U.S. civilians is not captured by comprehensive administrative data systems that can be integrated across medical facilities.

The most consistent predictors of ideation, regardless of rank, were being

female, younger age, and a history of mental health diagnosis, supporting previous civilian (Borges et al., 2008; Kessler et al., 2005; Nock et al., 2010) and active duty military (Nock et al., 2014) research on self-reported SI. Female enlisted soldiers were 60% more likely than males to have documented ideation, whereas female officers were more than twice as likely. However, females comprised only 17.8% of ideation cases among enlisted soldiers and 26.5% of cases among officers, supporting the important fact that Army clinicians are far more likely to treat male ideators. The higher likelihood of SI among females is consistent with survey data from new soldiers, which found that females entering the Army are about 40% more likely than males to report a preenlistment history of ideation (Ursano, Heeringa, et al., 2015). In addition to this differential preenlistment vulnerability, female soldiers may

TABLE 3
Multivariate Associations of Time in Service, Deployment Status, and Time Since Most Recent Mental Health Diagnosis with Suicide Ideation among Enlisted Soldiers in the U.S. Army^{a,b}

	OR (95% CI)	Cases (n)	Total (N) ^c	Rate ^d	Pop% ^e	SR ^f
I. Time in service						
1–2 years	2.2* (2.0–2.4)	5,374	5,792,174	1,113.4	27.7	902.9
3–4 years	1.4* (1.3–1.5)	2,336	4,622,536	606.4	22.1	575.2
5–10 years	1.0	1,842	5,826,042	379.4	27.9	413.6
>10 years	0.6* (0.5–0.7)	680	4,643,280	175.7	22.2	231.6
χ^2_3	550.0*					
II. Deployment status						
Never deployed	3.9* (3.6–4.2)	5,900	7,557,900	936.8	36.2	733.2
Currently deployed	1.0	826	5,234,426	189.4	25.1	193.2
Previously deployed	3.5* (3.2–3.8)	3,506	8,091,706	519.9	38.7	690.2
χ^2_2	1,301.7*					
III. Time since most recent mental health diagnosis						
No diagnosis	1.0	4,203	15,163,403	332.6	72.6	313.4
1 month	14.4* (13.7–15.0)	3,564	914,564	4,676.3	4.4	4,638.9
2–3 months	5.0* (4.7–5.4)	886	664,086	1,601.0	3.2	1,598.9
4–12 months	2.5* (2.4–2.7)	967	1,523,567	761.6	7.3	812.7
≥13 months	1.3* (1.2–1.4)	612	2,618,412	280.5	12.5	413.4
χ^2_4	13,691.1*					

^aThe sample of enlisted soldiers ($n = 10,232$ cases, 104,369 control person-months) is a subset of the total sample ($n = 135,425$ person-months) from the Army STARRS Historical Administrative Data Study (HADS) that includes all Regular Army soldiers (i.e., excluding those in the U.S. Army National Guard and Army Reserve) with suicide ideation in their administrative records during the years 2006–2009, plus a 1:200 stratified probability sample of all other active duty Regular Army person-months in the population exclusive of soldiers with suicide ideation or other nonfatal suicidal event (e.g., suicide attempt) and person-months in which the soldier died (i.e., suicides, combat deaths, homicides, and deaths due to other injuries or illnesses). All records in the 1:200 sample were assigned a weight of 200 to adjust for the under-sampling of months not associated with suicide ideation.

^bTime in service, deployment status, and mental health diagnosis were examined in separate models that controlled for basic sociodemographic variables (gender, age at entry into the Army, current age, race, education, marital status). All analyses also included a dummy predictor variable for calendar month and year to control for secular trends.

^cTotal includes both cases (i.e., soldiers with suicide ideation) and control person-months.

^dRate per 100,000 person-years, calculated based on n_1/n_2 , where n_1 is the unique number of soldiers within each category and n_2 is the annual number of person-years, not person-months, in the population ($n = 3.08$ million).

^ePop% = Percent of the Regular Army enlisted population.

^fSR = Standardized risk estimate (suicide ideators per 100,000 person-years) was calculated assuming other predictors were at their samplewide means.

* $p < 0.05$.

experience unique stressors during military service (Street, Vogt, & Dutra, 2009). Males and females may also experience different challenges in acclimating to the military culture and environment, although this has yet to be examined systematically.

Enlisted soldiers and officers varied on a number of sociodemographic and Army career predictors. In particular, time in service and deployment status were significantly associated with ideation among enlisted soldiers, but not among officers.

TABLE 4

Multivariate Associations of Time in Service, Deployment Status, and Time Since Most Recent Mental Health Diagnosis with Suicide Ideation among Officers in the U.S. Army^{a,b}

	OR (95% CI)	Cases (N)	Total (N) ^c	Rate ^d	Pop% ^e	SR ^f
I. Time in service						
1–2 years	0.9 (0.5–1.7)	25	449,225	66.8	10.9	84.9
3–4 years	0.6 (0.3–1.0)	18	476,218	45.4	11.6	52.1
5–10 years	1.0	75	987,075	91.2	24.0	88.9
>10 years	0.7 (0.4–1.0)	116	2,205,716	63.1	53.6	59.6
χ^2_3	6.8					
II. Deployment status						
Never deployed	1.3 (0.8–1.9)	69	1,265,469	65.4	30.7	63.2
Currently deployed	1.0	37	867,837	51.2	21.1	52.2
Previously deployed	1.5* (1.0–2.1)	128	1,984,928	77.4	48.2	78.5
χ^2_2	4.3					
III. Time since most recent mental health diagnosis						
No diagnosis	1.0	63	3,381,463	22.4	82.1	21.9
1 month	74.0* (52.9–103.6)	98	80,298	1,464.5	1.9	1,632.0
2–3 months	13.4* (7.7–23.1)	17	74,017	275.6	1.8	303.6
4–12 months	10.5* (6.7–16.3)	30	167,030	215.5	4.1	236.1
≥ 13 months	3.8* (2.4–6.0)	26	415,426	75.1	10.1	83.2
χ^2_4	672.3*					

^aThe sample of officers ($n = 234$ cases, 20,590 control person-months) is a subset of the total sample ($n = 135,425$ person-months) from the Army STARRS Historical Administrative Data Study (HADS) that includes all Regular Army soldiers (i.e., excluding those in the U.S. Army National Guard and Army Reserve) with suicide ideation in their administrative records during the years 2006–2009, plus a 1:200 stratified probability sample of all other active duty Regular Army person-months in the population exclusive of soldiers with suicide ideation or other nonfatal suicidal event (e.g., suicide attempt) and person-months in which the soldier died (i.e., suicides, combat deaths, homicides, and deaths due to other injuries or illnesses). All records in the 1:200 sample were assigned a weight of 200 to adjust for the under-sampling of months not associated with suicide ideation.

^bTime in service, deployment status, and mental health diagnosis were examined in separate models that controlled for basic socio-demographic variables (gender, age at entry into the Army, current age, race, education, marital status). All analyses also included a dummy predictor variable for calendar month and year to control for secular trends.

^cTotal includes both cases (i.e., soldiers with suicide ideation) and control person-months.

^dRate per 100,000 person-years, calculated based on n_1/n_2 , where n_1 is the unique number of soldiers within each category and n_2 is the annual number of person-years, not person-months, in the population ($n = 3.08$ million).

^ePop % = Percent of the Regular Army officer population.

^fSR = Standardized risk estimate (suicide ideators per 100,000 person-years) was calculated assuming other predictors were at their samplewide means.

* $p < 0.05$.

Less experienced enlisted personnel in their first 2 years of service are more than twice as likely to experience documented SI relative to soldiers in their fifth year and beyond. Risk among enlisted soldiers peaked in the second month of service (182.2 per 100,000 person-months), around the time soldiers are completing basic training and

transitioning to more specialized training. Although further research is needed to better understand this period of elevated risk, it may reflect the stressors of basic training (e.g., high physical and mental performance demands, separation from family and friends, loss of control over one's day-to-day life) and preexisting vulnerabilities. Army

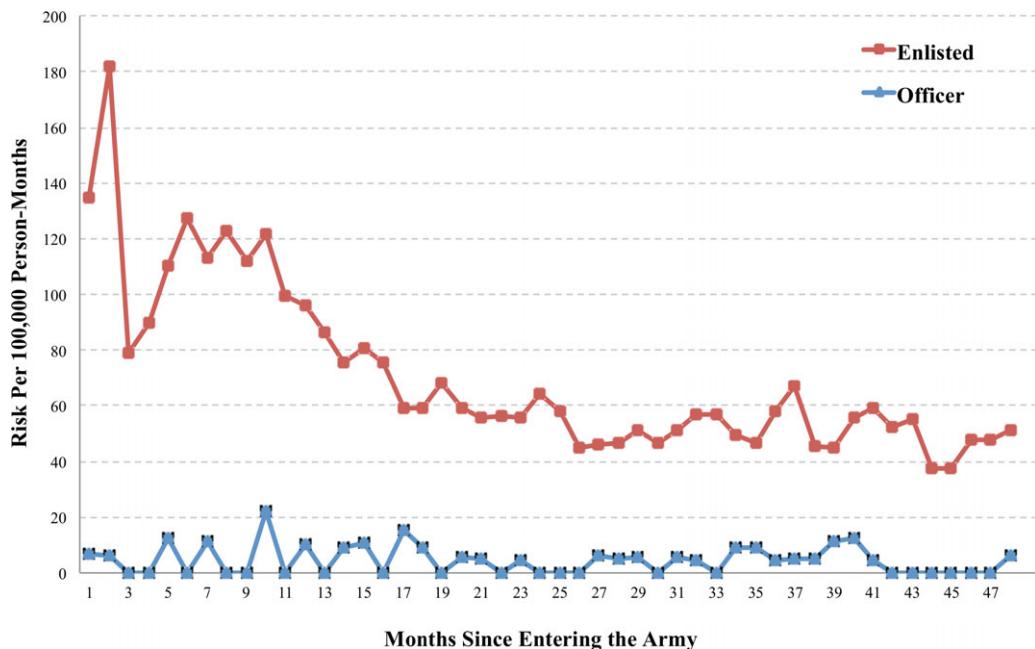


Figure 1. Risk of suicide ideation among enlisted soldiers and officers by month since entering the army. The sample of enlisted soldiers ($n = 10,232$ cases, 104,369 control person-months) and officers ($n = 234$ cases, 20,590 control person-months) is from the Army STARRS Historical Administrative Data Study (HADS). It includes all Regular Army soldiers (i.e., excluding those in the U.S. Army National Guard and Army Reserve) with suicide ideation in their administrative records during the years 2006–2009, plus a 1:200 stratified probability sample of all other active duty Regular Army person-months in the population exclusive of soldiers with suicide ideation or other nonfatal suicidal event (e.g., suicide attempt) and person-months in which the soldier died (i.e., suicides, combat deaths, homicides, and deaths due to other injuries or illnesses). All records in the 1:200 sample were assigned a weight of 200 to adjust for the under-sampling of months not associated with suicide ideation. [Color figure can be viewed at wileyonlinelibrary.com]

STARRS survey research has found that a substantial proportion of soldiers entering the Army report a preenlistment history of mental health disorders (39%; Rosellini et al., 2015) as well as SI (14.1%), plans (2.3%), and attempts (1.9%) (Ursano, Heeringa, et al., 2015). Soldiers with a premilitary history of suicidality may be at risk for more serious suicidal outcomes during and after service (Bryan, Bryan, Ray-Sannerud, Etienne, & Morrow, 2014). Importantly, enlisted soldiers in the early months of training were similarly found to be at risk of attempting suicide (Ursano, Kessler, Stein, et al., 2015), suggesting that early screening and documentation of suicidal thoughts could provide an opportunity to prevent more serious outcomes and improve population health.

Suicide ideation was less likely among CD enlisted soldiers than those never or

PD, consistent with findings on attempted suicide (Ursano, Kessler, Stein, et al., 2015). This association was not observed among officers. Deployment is associated with a variety of negative mental health outcomes (Bray et al., 2010; Gadermann et al., 2012; Jacobson et al., 2008; Shen et al., 2012; Wells et al., 2010), including risk of suicide death (Gilman et al., 2014). However, specific combat experiences while deployed may be more important than deployment, *per se*, in understanding suicide risk (Bryan et al., 2015). Although reduced risk of SI during deployment could be influenced by a number of factors, including predeployment mental health screening (i.e., a healthy deployed soldier effect; Warner, Appenzeller, Parker, Warner, & Hoge, 2011), it is also possible that medical documentation and coding procedures differ during deployment. To the

extent that changes in coding procedures for SI occur in theater, this could artificially reduce the observed risk in CD soldiers. Linked survey and administrative data would help clarify this by allowing for a comparison of self-reported and medically documented ideation among soldiers across the entire deployment cycle. Additional research is also needed to address broader questions regarding the role of deployment status in fatal versus nonfatal suicidal behaviors.

Consistent with the well-documented association between mental health diagnoses and suicidal outcomes (Black et al., 2011; Harris & Barraclough, 1997; Nock et al., 2010, 2013; Ursano, Kessler, Stein, et al., 2015), we found that a history of a mental health diagnosis was present in 58.9%–73.1% of ideators. Recency of diagnosis was particularly important, with nearly 60% of ideators having a diagnosis recorded in the month before ideation was documented. These findings were very similar to research on attempted suicide among soldiers (Ursano, Kessler, Stein, et al., 2015), suggesting that a large proportion of at-risk soldiers had a recent encounter with the health care system in which mental and/or behavioral health difficulties were noted. Although suicide risk assessment and prevention are ongoing challenges in any health care system, these recent encounters provide opportunities for intervention. Further research that examines the influence of specific diagnoses on risk of future SI, and particularly transitions from ideation to attempt (Nock et al., 2010, in press), as well as research on how ideation may be affected by the type and continuity of care can further refine our understanding and opportunities for intervention (King et al., 2001; Luoma, Martin, & Pearson, 2002).

The current study is informed and limited by its exclusive focus on medically documented SI. The fact that these cases came to the attention of clinicians may reflect a number of factors, including severity of SI, effectiveness of health screening and referral procedures, vigilance on the part of commanders who ordered the

soldier to seek care, the soldier's willingness to access treatment, thorough assessment of suicide risk by clinicians in either general medical and specialty care, and the soldier's openness in reporting SI. Future longitudinal studies of Army STARRS will examine self-reported SI which is and is not documented in medical records. Civilian research suggests that most people with a history of SI have never sought treatment (Bruffaerts et al., 2011), and recent survey research indicates that the majority of soldiers who report a mental disorder are not currently receiving mental health treatment (Colpe et al., 2015). In addition, Army chaplains and other nonmedical parts of the system are likely to hear reports of SI that may not make their way into administrative records. Thus, administrative records capture a particular subset of soldiers who, in spite of any perceived stigma or negative career implications (Hoge & Castro, 2012), sought medical care (or were referred) and acknowledged that they were considering suicide. Administrative records are also subject to errors in clinician diagnosis or medical coding. Although the data in this study cannot speak to the proportion of all soldiers with SI who are captured in administrative medical records, they reveal that the Army health care system was successful in documenting a substantial number of at-risk soldiers. This may reflect the Army's efforts to improve mental health screening and SI reporting mechanisms, decreasing stigma (Warner, Appenzeller, Mullen, Warner, & Grieger, 2008), and perhaps soldiers' increasing trust in mental health care. How people feel when they interact with clinicians, particularly their level of trust, may be key in the ability to detect SI (Ganzini et al., 2013). For soldiers with SI who have not been identified by clinicians, the administrative data included in this study could be used to develop algorithms to assist in risk detection (Kessler et al., 2015, in press; McCarthy et al., 2015).

There are several other noteworthy limitations. First, our findings may not generalize to the Army population in other time

periods. Second, our focus on active duty Regular Army soldiers does not address risk and protective factors in Army National Guard and Reserve soldiers, or among veterans who have separated from the Army. We will include these populations in future Army STARRS analyses. Third, the predictors examined in the current study are not exhaustive. Future studies should examine the association of SI with other service-related characteristics (e.g., military occupational specialty, history of promotion, and demotion) and mental health indicators (e.g., number and types of psychiatric diagnoses, treatment history) documented in administrative records, as well as predictors derived from Army STARRS prospective survey data. Lastly, it is important to note that the observed differences across time in service and deployment status are not evidence of within-person changes in risk over time, as the composition of these groups is affected

by the nonrandom nature of Army attrition and deployment (Hoge, Auchterlonie, & Milliken, 2006; Ireland, Kress, & Frost, 2012; Warner et al., 2011).

CONCLUSION

From 2006 through 2009, most cases of medically documented SI in the U.S. Army occurred among enlisted soldiers in their first tour of duty. Risk was particularly elevated among enlisted soldiers during the initial months of training, and among soldiers with a mental health diagnosis recorded during a recent health care encounter. Given apparent similarities between our findings on SI and recently published evidence on suicide attempts, it is important for future studies to examine how risk may differ across suicide-related outcomes of increasing severity.

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APPENDIX:

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1. List and brief descriptions of administrative data systems in the Army STARRS Historical Administrative Data Study (HADS) included in the current study.

Table S2. International classification of diseases, Ninth Revision—Clinical Modification (ICD-9-CM) codes used to identify mental disorders.

Appendix S1. Methods and results.