

Original Investigation

Suicide Attempts in the US Army During the Wars in Afghanistan and Iraq, 2004 to 2009

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IMPORTANCE The rate of suicide attempts in the US Army increased sharply during the wars in Afghanistan and Iraq. Research on this important health outcome has been hampered by the lack of integration among Army administrative data systems.

OBJECTIVE To identify risk factors for suicide attempts among active-duty members of the regular Army from January 1, 2004, through December 31, 2009.

DESIGN, SETTING, AND PARTICIPANTS This longitudinal, retrospective cohort study, as part of the Army Study to Assess Risk and Resilience in Servicemembers (STARRS), used individual-level person-month records from Army and Department of Defense administrative data systems to examine sociodemographic, service-related, and mental health predictors of medically documented suicide attempts among active-duty regular Army soldiers from January 1, 2004, through December 31, 2009. We analyzed data from 9791 suicide attempters and an equal-probability sample of 183 826 control person-months using a discrete-time survival framework. Data analysis was performed from February 3 through November 12, 2014.

MAIN OUTCOMES AND MEASURES Suicide attempts identified using Department of Defense Suicide Event Report records and diagnostic codes E950 through E958 from the *International Classification of Diseases, Ninth Revision, Clinical Modification*. Standardized estimates of suicide attempt risk for sociodemographic, service-related, and mental health predictor variables were constructed from Army personnel and medical records.

RESULTS Enlisted soldiers accounted for 98.6% of all suicide attempts (9650 attempters; overall rate, 377.0 [95% CI, 369.7-384.7] per 100 000 person-years). In multivariate models, suicide attempts among enlisted soldiers were predicted (data reported as odds ratio [95% CI]) by female sex (2.4 [2.3-2.5]), entering Army service at 25 years or older (1.6 [1.5-1.8]), current age of 29 years or younger (<21 years, 5.6 [5.1-6.2]; 21-24 years, 2.9 [2.6-3.2]; 25-29 years, 1.6 [1.5-1.8]), white race (black, 0.7 [0.6-0.7]; Hispanic, 0.7 [0.7-0.8]; Asian, 0.7 [0.6-0.8]), an educational level of less than high school (2.0 [2.0-2.1]), being in the first 4 years of service (1-2 years, 2.4 [2.2-2.6]; 3-4 years, 1.5 [1.4-1.6]), having never (2.8 [2.6-3.0]) or previously (2.6 [2.4-2.8]) been deployed, and a mental health diagnosis during the previous month (18.2 [17.4-19.1]). Attempts among officers (overall rate, 27.9 per 100 000 person-years) were predicted by female sex (2.8 [2.0-4.1]), entering Army service at 25 years or older (2.0 [1.3-3.1]), current age of 40 years or older (0.5 [0.3-0.8]), and a mental health diagnosis during the previous month (90.2 [59.5-136.7]). Discrete-time hazard models indicated risk among enlisted soldiers was highest in the second month of service (102.7 per 100 000 person-months) and declined substantially as length of service increased (mean during the second year of service, 56.0 per 100 000 person-years; after 4 years of service, 29.4 per 100 000 person-months), whereas risk among officers remained stable (overall mean, 6.1 per 100 000 person-months).

CONCLUSIONS AND RELEVANCE Our results represent, to our knowledge, the most comprehensive accounting to date of suicide attempts in the Army. The findings reveal unique risk profiles for enlisted soldiers and officers and highlight the importance of research and prevention focused on enlisted soldiers in their first Army tour.

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Preventing military suicides is a national health concern and research priority.¹ From January 1, 2004, through December 31, 2009, the Army experienced the longest sustained increase in suicide rates relative to other US military branches (ie, Navy, Marines, and Air Force).² Rates of non-fatal suicide attempts among soldiers also rose sharply during this time,³ in parallel with the trend in suicide deaths.^{4,5} Individuals with a previous suicide attempt are approximately 40 times more likely to die by suicide than those with no previous attempt,⁶ yet our understanding of Army suicide attempts remains limited. Recent survey findings are informative,⁷⁻⁹ with approximately 1.3% of soldiers reporting the onset of a first suicide attempt after enlistment.¹⁰ These data may not correspond with actual medical encounters, which are particularly important owing to their effect on the Army health care system. Although prior studies of medically documented attempts relied on a single Army or Department of Defense (DOD) database to identify cases,^{11,12} recent evidence suggests that a comprehensive examination of Army suicide attempts requires integration of multiple administrative data systems.³

Our aim is to provide the first comprehensive analysis of documented suicide attempts in the active-duty US Army during the wars in Afghanistan and Iraq. Using data from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS; <http://www.armystarrs.org>),^{13,14} we examined sociodemographic, service-related, and mental health predictors of suicide attempts from 2004 through 2009 to identify segments of the regular Army population at greatest risk. This analysis of administrative records is an important addition to retrospective self-report data on suicide attempts from recent Army STARRS survey research, which did not include soldiers in basic combat training or soldiers currently deployed.¹⁰

Methods

Sample

The Historical Administrative Data Study (HADS) is a component of the Army STARRS that integrates 38 Army and DOD administrative data systems, including every system in which suicidal events are medically documented. Creation and analysis of the consolidated and deidentified data system were approved by the institutional review boards of the Uniformed Services University of the Health Sciences for the Henry M. Jackson Foundation (the primary grantee), the University of Michigan Institute for Social Research (site of the Army STARRS Data Enclave), University of California, San Diego, and Harvard Medical School. The HADS includes individual-level person-month records for all 1.66 million soldiers on active duty from January 1, 2004, through December 31, 2009.¹⁴ In this longitudinal, retrospective cohort study, we focused on records for the 975 057 regular Army soldiers on active duty during this time (excluding activated Army National Guard and Army Reserve soldiers), 9791 of whom had a documented suicide attempt. Data were analyzed using a discrete-time survival framework with person-month as the unit of analysis,¹⁵ such that each month in the career of a soldier was treated as a separate observational record. Given that discrete-time survival co-

efficients can be estimated without bias when control person-months are subsampled randomly and weighted using the logic of case-control analysis,¹⁶ we reduced computational intensity by selecting from the population an equal-probability 1:200 sample of control person-months stratified by sex, rank, time in the Army, deployment status (never, currently, or previously), and historical time ($n = 183\,826$). Control person-months excluded all soldiers with a documented suicide attempt or other nonfatal suicidal event (eg, suicidal ideation)³ and person-months in which a soldier died of suicide, combat, homicide, injury, or illness. The full case-control analytic sample contained 193 617 person-months, with each control person-month assigned a weight of 200 to adjust for the undersampling of months without a suicide attempt.

Measures

Cases of attempted suicide were identified using records from the DOD Suicide Event Report,¹⁷ a DOD-wide surveillance mechanism that aggregates information on suicidal behaviors via a standardized form completed by health care professionals at DOD treatment facilities (3594 cases), and diagnostic codes E950 through E958 from the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* (indicating self-inflicted poisoning or injury with suicidal intent) from the Military Health System Data Repository, Theater Medical Data Store, and TRANSCOM (Transportation Command) Regulating and Command and Control Evacuation System, which together provide health care encounter information from military and civilian treatment facilities, combat operations, and aeromedical evacuations (6197 cases). We excluded suicide deaths and DOD Suicide Event Report records indicating only suicidal ideation. The *ICD-9-CM* code E959 (late effects of a self-inflicted injury) was excluded because it confounded the temporal relationships between the predictor variables and the suicide attempt.¹⁸ Records from different data systems were cross-referenced to ensure all cases represent unique soldiers. For soldiers with multiple suicide attempts, we selected the first attempt by using a hierarchical classification scheme that prioritized DOD Suicide Event Report records owing to that system's more extensive reporting requirements.³ Sociodemographic, length of service, deployment status, and mental health diagnosis variables were constructed from administrative records (eTable 1 in the Supplement; <http://www.armystarrs.org/publications>). An indicator variable for a previous mental health diagnosis was created from *ICD-9-CM* codes for mental disorder (eg, major depression, posttraumatic stress disorder, personality disorders), excluding postconcussion syndrome, tobacco use disorder, and supplemental V-codes that are not disorders (eg, stressors/adversities, marital problems) (eTable 2 in the Supplement). Recency of diagnosis was determined based on the number of months elapsed from the most recent diagnostic record to the suicide attempt (cases) or control person-month.

Statistical Analysis

Analyses were conducted separately among enlisted soldiers (163 178 person-months) and officers (30 439 person-months [including warrant officers]) owing to their different sociode-

mographic profiles, training, Army career experiences,¹⁹ and risks for mental health problems^{7,20,21} and suicide.^{22,23} Logistic regression analyses examined multivariate associations of sociodemographic characteristics (sex, age at entry into Army service, current age, race, educational level, and marital status) with suicide attempts, followed by separate models evaluating incremental predictive effects of the length of service (1-2, 3-4, 5-10, and ≥ 11 years), deployment status (never, currently, and previously), and the presence or recency of a mental health diagnosis (no diagnosis vs 1, 2-3, 4-12, and ≥ 13 months since the most recent diagnosis). Logistic regression coefficients were exponentiated to obtain odds ratios (ORs) and 95% CIs. Final model coefficients were used to generate standardized estimates of risk²⁴ (number of suicide attempters per 100 000 person-years) for each category of each predictor under the model, assuming other predictors were at their samplewide means. Based on evidence that the Army suicide attempt rate increased from 2004 through 2009,³ a separate dummy predictor was included in each logistic regression equation to control for the calendar month and year. Coefficients of other predictors can consequently be interpreted as mean within-month associations based on the assumption that the effects of other predictors do not vary over time.

To further examine associations between length of service and the risk for suicide attempts, we generated separate discrete-time hazard functions for enlisted soldiers and officers. These hazard functions were used to estimate the risk for suicide attempts in each month since entering Army service (number of suicide attempters per 100 000 person-months). Data analysis was performed from February 3 through November 12, 2014.

Results

Enlisted soldiers constituted 83.5% of active-duty regular Army soldiers and accounted for 98.6% of all cases of suicide attempt ($n = 9650$), with an overall rate of 377.0 (95% CI, 369.7-384.7) per 100 000 person-years during the 2004-2009 study period. Officers (commissioned and warrant officers) constituted 16.5% of the regular Army and accounted for 1.4% of cases ($n = 141$), with an overall rate of 27.9 (95% CI, 23.7-32.9) per 100 000 person-years (Table 1 and Table 2).

Sociodemographic Characteristics

Enlisted soldiers with higher odds of a suicide attempt (OR [95% CI]) were female (2.4 [2.3-2.5]), entered Army service at 25 years or older (1.6 [1.5-1.8]), were currently 29 years or younger (< 21 years, 5.6 [5.1-6.2]; 21-24 years, 2.9 [2.6-3.2]; 25-29 years, 1.6 [1.5-1.8]), and did not complete high school (2.0 [2.0-2.1]). Lower odds (OR [95% CI]) were associated with entering Army service before age 21 years (0.7 [0.7-0.8]), being 35 years or older (35-39 years, 0.7 [0.6-0.8]; ≥ 40 years, 0.5 [0.4-0.6]), completing at least some college (some college, 0.7 [0.6-0.8]; completed college, 0.6 [0.5-0.7]), and being of black (0.7 [0.6-0.7]), Hispanic (0.7 [0.7-0.8]), or Asian (0.7 [0.6-0.8]) race or ethnicity (Table 1). Officers with increased odds of suicide attempt were female (OR, 2.8 [95% CI, 2.0-4.1]) and entered Army service at 25 years or older (OR, 2.0 [95% CI, 1.3-3.1]). Officers

currently 40 years or older had decreased odds (OR, 0.5 [95% CI, 0.3-0.8]) (Table 2).

Examination of the standardized risk estimates reveals that enlisted women had nearly 13 times the risk of female officers (rate ratio [RR], 12.6 [95% CI, 9.4-16.8]). Similarly, enlisted soldiers who entered Army service at 25 years or older had more than 16 times the standardized risk of officers in the same group (RR, 16.3 [95% CI, 12.2-21.6]). Although currently being 40 years or older was protective for enlisted soldiers and officers, the risk among enlisted personnel in this age group was 5.6 times higher than that of officers in the same age group (RR, 5.6 [95% CI, 3.5-9.0]).

Length of Service

After we adjusted for sociodemographic characteristics, enlisted soldiers in their first 4 years of service had higher odds of suicide attempts (OR for 1-2 years, 2.4 [95% CI, 2.2-2.6]; OR for 3-4 years, 1.5 [95% CI, 1.4-1.6]) than those with 5 to 10 years of service, whereas those serving for more than 10 years had lower odds (OR, 0.5 [95% CI, 0.4-0.5]) (Table 3). Additional pairwise analyses revealed that the rates of attempted suicide differed significantly by time in service (χ^2 values, 226.9-390.2; $P < .001$ for all comparisons). Length of service was not associated with suicide attempt among officers ($\chi^2_3 = 6.3$; $P = .10$), although the ORs had a similar decrease beyond the second year of service (Table 4). Enlisted soldiers in their first 2 years of service had the greatest standardized risk, which was more than 10 times that of officers in the same category (RR, 10.6 [95% CI, 7.4-15.1]).

A discrete-time hazard model examining time to suicide attempt demonstrated greatly elevated risk among enlisted soldiers during their first year in Army service, with the risk peaking in the second month of service (102.5 per 100 000 person-months). Risk decreased substantially to a mean of 56.0 per 100 000 person-years during the second year of service, followed by a more gradual decline to a mean of 29.4 per 100 000 person-months after 4 years of service. Risk among officers remained relatively stable across time, with an overall mean of 6.1 per 100 000 person-months (Figure).

Deployment Status

We found higher odds of suicide among never deployed (OR, 2.8 [95% CI, 2.6-3.0]) and previously deployed (OR, 2.6 [95% CI, 2.4-2.8]) enlisted soldiers than among those currently deployed when we controlled for sociodemographic variables (Table 3). The pairwise difference between never and previously deployed was also significant ($\chi^2_1 = 6.3$; $P = .01$). Deployment status was not associated with suicide attempt among officers ($\chi^2_2 = 1.2$; $P = .54$), although the ORs changed in the same direction as for enlisted soldiers (Table 4). Never-deployed enlisted soldiers, the group at greatest risk based on deployment status, accounted for a similar proportion of their respective population as never-deployed officers (40.4% vs 37.9%) but had a standardized risk nearly 16 times higher (RR, 15.9 [95% CI, 12.2-20.9]). Although a smaller proportion of enlisted soldiers were previously deployed compared with officers (36.2% vs 42.8%), their standardized risk for suicide attempt was approximately 14 times higher (RR, 14.0 [95% CI, 11.0-17.9]).

Table 1. Multivariate Associations of Sociodemographic Characteristics With Suicide Attempts by Enlisted Soldiers in the Army STARRS^a

Characteristic	OR (95% CI)	No. of Cases	Total ^b	Rate ^c	Population, % ^d	SR Estimate ^e
Sex						
Male	1 [Reference]	7214	26 507 814	326.6	86.3	322.3
Female	2.4 (2.3-2.5) ^f	2436	4 207 436	694.8	13.7	758.7
χ^2 Value	1266.6 ^f	NA	NA	NA	NA	NA
Age at army entry, y						
<21	0.7 (0.7-0.8) ^f	6471	19 095 671	406.6	62.2	330.3
21-24	1 [Reference]	2139	7 531 739	340.8	24.5	460.8
≥25	1.6 (1.5-1.8) ^f	1040	4 087 840	305.3	13.3	762.3
χ^2 Value	392.9 ^f	NA	NA	NA	NA	NA
Current age, y						
<21	5.6 (5.1-6.2) ^f	3315	4 624 915	860.1	15.1	927.1
21-24	2.9 (2.6-3.2) ^f	3499	9 230 699	454.9	30.1	478.3
25-29	1.6 (1.5-1.8) ^f	1756	7 119 756	296.0	23.2	275.6
30-34	1 [Reference]	635	4 239 435	179.7	13.8	165.7
35-39	0.7 (0.6-0.8) ^f	300	3 344 500	107.6	10.9	111.7
≥40	0.5 (0.4-0.6) ^f	145	2 155 945	80.7	7.0	79.8
χ^2 Value	1832.5 ^f	NA	NA	NA	NA	NA
Race or ethnicity						
White	1 [Reference]	6808	18 358 008	445.0	59.8	424.3
Black	0.7 (0.6-0.7) ^f	1415	6 972 415	243.5	22.7	281.3
Hispanic	0.7 (0.7-0.8) ^f	979	3 557 179	330.3	11.6	313.9
Asian	0.7 (0.6-0.8) ^f	286	1 217 486	281.9	4.0	286.3
Other	1.0 (0.8-1.1) ^f	162	610 162	318.6	2.0	400.9
χ^2 Value	245.4	NA	NA	NA	NA	NA
Educational level						
<High school ^g	2.0 (2.0-2.1) ^f	2888	3 878 088	893.6	12.6	693.3
High school	1 [Reference]	6380	23 503 980	325.7	76.5	324.8
Some college	0.7 (0.6-0.8) ^f	191	1 704 591	134.5	5.5	237.1
≥College	0.6 (0.5-0.7) ^f	191	1 628 591	140.7	5.3	194.9
χ^2 Value	1076.7 ^f	NA	NA	NA	NA	NA
Marital status						
Never	1.0 (1.0-1.0)	5441	12 589 441	518.6	41.0	373.1
Currently	1 [Reference]	3974	16 814 774	283.6	54.7	384.1
Previously	0.9 (0.8-1.1)	235	1 311 035	215.1	4.3	351.3
χ^2 Value	1.6					
Total	NA	9650	30 715 250	377.0	100	NA

Abbreviations: NA, not applicable; OR, odds ratio; SR, standardized risk; STARRS, Study to Assess Risk and Resilience in Servicemembers.

^a Data are from the 2004-2009 Historical Administrative Data Study sample (n = 163 178). The sample of enlisted soldiers is a subset of the total sample (n = 193 617 person-months) that includes all regular Army soldiers (ie, excluding those in the US Army National Guard and Army Reserve) with a suicide attempt in their administrative records from 2004 through 2009, plus a 1:200 stratified probability sample of all other active-duty regular Army person-months in the population exclusive of soldiers with a suicide attempt or other nonfatal suicidal event (eg, suicidal ideation) and person-months associated with death (ie, 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 undersampling of months not associated with suicide attempt. The analysis included a dummy predictor variable for calendar month and year to control for secular trends.

^b Total includes cases (ie, soldiers with a suicide attempt) and control person-months.

^c Indicates rate 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).

^d Indicates the proportion of all enlisted soldiers represented by each category of each predictor, calculated by dividing the total number of each row by the overall total number in the last row of table. Percentages have been rounded and may not total 100.

^e Calculated as suicide attempters per 100 000 person-years, assuming other predictors were at their samplewide means.

^f Indicates statistical significance ($P < .05$).

^g 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. Multivariate Associations of Sociodemographic Characteristics With Suicide Attempts by Officers in the Army STARRS^a

Characteristic	OR (95% CI)	No. of Cases	Total ^b	Rate ^c	Population, % ^d	SR Estimate ^e
Sex						
Male	1 [Reference]	89	5 127 689	20.8	84.6	21.3
Female	2.8 (2.0-4.1) ^f	52	932 052	66.9	15.4	60.2
χ^2_1 Value	31.5 ^f	NA	NA	NA	NA	NA
Age at army entry, y						
<21	1.1 (0.7-1.8)	26	1 221 426	25.5	20.2	26.6
21-24	1 [Reference]	73	3 615 273	24.2	59.7	23.0
≥25	2.0 (1.3-3.1) ^f	42	1 223 042	41.2	20.2	46.9
χ^2_2 Value	11.3 ^f	NA	NA	NA	NA	NA
Current age, y						
≤24	1.2 (0.7-2.3)	18	564 018	38.3	9.3	38.3
25-29	1.1 (0.7-1.8)	38	1 313 238	34.7	21.7	34.6
30-34	1 [Reference]	32	1 254 832	30.6	20.7	31.1
35-39	1.1 (0.7-1.7)	32	1 239 632	31.0	20.4	33.1
≥40	0.5 (0.3-0.8) ^f	21	1 688 021	14.9	27.9	14.1
χ^2_5 Value	12.2 ^f	NA	NA	NA	NA	NA
Race or ethnicity						
White	1 [Reference]	93	4 451 893	25.1	73.5	26.5
Black	1.0 (0.6-1.6)	20	799 820	30.0	13.2	25.4
Hispanic	1.4 (0.8-2.6)	11	348 011	37.9	5.7	38.1
Asian	0.9 (0.4-1.9)	7	283 007	29.7	4.7	23.6
Other	2.2 (1.1-4.2) ^f	10	177 010	67.8	2.9	59.8
χ^2_4 Value	6.3	NA	NA	NA	NA	NA
Educational level						
<High school ^g	3.1 (0.7-12.5)	4	98 604	48.7	1.6	43.5
High school	1 [Reference]	4	360 604	13.3	6.0	14.7
Some college	1.4 (0.3-6.5)	3	217 003	16.6	3.6	19.5
≥College	2.0 (0.7-5.7)	130	5 383 530	29.0	88.8	28.7
χ^2_3 Value	2.8	NA	NA	NA	NA	NA
Marital status						
Never	1.3 (0.9-1.9)	53	1 500 853	42.4	24.8	32.3
Currently	1 [Reference]	81	4 306 281	22.6	71.1	25.5
Previously	1.2 (0.5-2.5)	7	252 607	33.3	4.2	30.2
χ^2_2 Value	1.5	NA	NA	NA	NA	NA
Total	NA	141	6 059 741	27.9	100	NA

Abbreviations: NA, not applicable; OR, odds ratio; SR, standardized risk; STARRS, Study to Assess Risk and Resilience in Servicemembers.

^a Data are from the 2004-2009 Historical Administrative Data Study sample (n = 30 439). The sample of officers (including warrant officers) is a subset of the total sample (n = 193 617 person-months) that includes all regular Army soldiers (ie, excluding those in the US Army National Guard and Army Reserve) with a suicide attempt in their administrative records from 2004 through 2009, plus a 1:200 stratified probability sample of all other active-duty regular Army person-months in the population exclusive of soldiers with a suicide attempt or other nonfatal suicidal event (eg, suicidal ideation) and person-months associated with death (ie, 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 undersampling of months not associated with suicide attempt. The analysis included a dummy predictor variable for calendar month and year to control for secular trends.

^b Total includes cases (ie, soldiers with a suicide attempt) and control person-months.

^c Indicates rate 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).

^d Indicates the proportion of all officers represented by each category of each predictor, calculated by dividing the total number of each row by the overall total number in the last row of table. Percentages have been rounded and may not total 100.

^e Calculated as suicide attempters per 100 000 person-years, assuming other predictors were at their samplewide means.

^f Indicates statistical significance ($P < .05$).

^g 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.

Mental Health Diagnosis

Among those who attempted suicide, 5774 enlisted soldiers (59.8%) and 99 officers (70.2%) had a previous mental health

diagnosis. Among attempters with a history of diagnosis, 3516 enlisted soldiers (60.9%) and 65 officers (65.7%) were most recently diagnosed in the month before their attempt. When we

Table 3. Multivariate Associations of Length of Service, Deployment Status, and Time Since Most Recent Mental Health Diagnosis With Suicide Attempts by Enlisted Soldiers in the Army STARRS^{a,b}

	OR (95% CI)	No. of Cases	Total ^c	Rate ^d	Population, % ^e	SR Estimate ^f
Length of service, y						
1-2	2.4 (2.2-2.6) ^g	5416	8 560 616	759.2	27.9	585.6
3-4	1.5 (1.4-1.6) ^g	2278	6 819 878	400.8	22.2	369.7
5-10	1 [Reference]	1542	8 322 742	222.3	27.1	245.1
≥11	0.5 (0.4-0.5) ^g	414	7 012 014	70.8	22.8	106.3
χ^2_3 Value	589.3 ^g	NA	NA	NA	NA	NA
Deployment status						
Never	2.8 (2.6-3.0) ^g	5894	12 421 294	569.4	40.4	443.9
Currently	1 [Reference]	940	7 173 140	157.3	23.4	165.7
Previously	2.6 (2.4-2.8) ^g	2816	11 120 816	303.9	36.2	423.8
χ^2_2 Value	839.3 ^g	NA	NA	NA	NA	NA
Time since most recent mental health diagnosis, mo						
No diagnosis	1 [Reference]	3876	23 156 276	200.9	75.4	191.0
1	18.2 (17.4-19.1) ^g	3516	1 150 916	3665.9	3.7	3490.7
2-3	5.8 (5.4-6.3) ^g	833	856 033	1167.7	2.8	1127.7
4-12	2.9 (2.7-3.1) ^g	887	1 989 887	534.9	6.5	552.6
≥13	1.4 (1.3-1.6) ^g	538	3 562 138	181.2	11.6	276.4
χ^2_4 Value	15 255.6 ^g	NA	NA	NA	NA	NA

Abbreviations: NA, not applicable; OR, odds ratio; SR, standardized risk; STARRS, Study to Assess Risk and Resilience in Servicemembers.

^a In separately examining the effects of length of service, deployment status, and mental health diagnosis, we controlled for the basic sociodemographic variables reported in Tables 1 and 2 (sex, age at entry into the Army, current age, race, educational level, and marital status). All analyses also included a dummy predictor variable for calendar month and year to control for secular trends.

^b Data are from the 2004-2009 Historical Administrative Data Study sample (n = 163 178). The sample of enlisted soldiers is a subset of the total sample (n = 193 617 person-months) that includes all regular Army soldiers (ie, excluding those in the US Army National Guard and Army Reserve) with a suicide attempt in their administrative records from 2004 through 2009, plus a 1:200 stratified probability sample of all other active-duty regular Army person-months in the population exclusive of soldiers with a suicide attempt or other nonfatal suicidal event (eg, suicidal ideation) and person-months

associated with death (ie, 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 undersampling of months not associated with suicide attempt.

^c Includes cases (ie, soldiers with a suicide attempt) and control person-months.

^d Indicates rate 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).

^e Indicates the proportion of all enlisted soldiers represented by each category of each predictor, calculated by dividing the total number of each row by the overall total number (30 715 250) in the last row of Table 1.

^f Calculated as suicide attempters per 100 000 person-years, assuming other predictors were at their samplewide means.

^g Indicates statistical significance ($P < .05$).

controlled for sociodemographic characteristics, enlisted soldiers with a diagnosis in the previous month had the highest odds of suicide attempt (OR, 18.2 [95% CI, 17.4-19.1]) compared with those without a diagnosis, with odds decreasing as the time since the most recent diagnosis increased from 2 to 3 months (OR, 5.8 [95% CI, 5.4-6.3]) to 13 months or more (OR, 1.4 [95% CI, 1.3-1.6]) (Table 3). All additional pairwise comparisons between time intervals were also significant (χ^2_1 values, 153.2-2910.4; $P < .001$ for all comparisons). Officers with a mental health diagnosis in the previous month similarly had the greatest likelihood of attempt (OR, 90.2 [95% CI, 59.5-136.7]), and longer intervals resulted in increasingly smaller ORs, ranging from 14.8 (95% CI, 7.3-29.8) for 2 to 3 months to 2.3 (95% CI, 1.0-4.9) for 13 months or more (Table 4). Most pairwise analyses of these intervals were significant (χ^2_1 values, 12.0-96.0; $P < .001$ for all comparisons), except for 2 to 3 months vs 4 to 12 months ($\chi^2_1 = 0.9$; $P = .35$). The elevated risk in the month after the diagnosis was more than 4 times higher for enlisted soldiers than officers (RR, 4.2 [95% CI, 3.3-5.3]). The population-attributable risk proportions for previous mental health diag-

nosis (ie, the proportion of observed suicide attempts associated with the predictor)²⁵ based on these models were 54.0% for enlisted soldiers and 66.5% for officers. The presence of a mental health diagnosis did not change the significant sociodemographic findings noted above.

Discussion

Using comprehensive data on administratively documented US Army suicide attempts, this study identified segments of the active-duty regular Army population at greatest risk for suicide attempts, highlighting pathways for further inquiry and intervention. The findings suggest that enlisted soldiers and officers require unique considerations in research and prevention. Beyond potentially important differences in sociodemographic characteristics (eg, higher educational levels among officers), training, and occupational responsibilities, these groups also have distinct risk distributions. Enlisted soldiers constituted approximately 84% of the Army and nearly 99% of sui-

Table 4. Multivariate Associations of Length of Service, Deployment Status, and Time Since Most Recent Mental Health Diagnosis With Suicide Attempts by Officers in the Army STARRS^{a,b}

	OR (95% CI)	No. of Cases	Total ^c	Rate ^d	Population, % ^e	SR Estimate ^f
Length of service, y						
1-2	1.8 (1.0-3.4)	29	654 829	53.1	10.8	55.5
3-4	1.4 (0.8-2.3)	24	680 824	42.3	11.2	40.9
5-10	1 [Reference]	39	1 487 839	31.5	24.6	29.1
≥11	0.7 (0.4-1.2)	49	3 236 249	18.2	53.4	18.8
χ^2_3 Value	6.3	NA	NA	NA	NA	NA
Deployment status						
Never	1.3 (0.8-2.2)	62	2 293 862	32.4	37.9	27.9
Currently	1 [Reference]	22	1 169 622	22.6	19.3	23.3
Previously	1.3 (0.8-2.1)	57	2 596 257	26.3	42.8	30.3
χ^2_2 Value	1.2	NA	NA	NA	NA	NA
Time since most recent mental health diagnosis, mo						
No diagnosis	1 [Reference]	42	5 107 442	9.9	84.3	9.6
1	90.2 (59.5-136.7) ^g	65	105 265	741.0	1.7	836.2
2-3	14.8 (7.3-29.8) ^g	10	93 610	128.2	1.5	143.9
4-12	10.1 (5.6-18.3) ^g	16	216 216	88.8	3.6	100.7
≥13	2.3 (1.0-4.9) ^g	8	537 208	17.9	8.9	22.0
χ^2_4 Value	484.4 ^g	NA	NA	NA	NA	NA

Abbreviations: NA, not applicable; OR, odds ratio; SR, standardized risk; STARRS, Study to Assess Risk and Resilience in Servicemembers.

^a In separately examining the effects of length of service, deployment status, and mental health diagnosis, we controlled for the basic sociodemographic variables reported in Tables 1 and 2 (sex, age at entry into the Army, current age, race, educational level, and marital status). All analyses also included a dummy predictor variable for calendar month and year to control for secular trends.

^b Data are from the 2004-2009 Historical Administrative Data Study sample (n = 30 439). The sample of officers (including warrant officers) is a subset of the total sample (n = 193 617 person-months) that includes all regular Army soldiers (ie, excluding those in the US Army National Guard and Army Reserve) with a suicide attempt in their administrative records from 2004 through 2009, plus a 1:200 stratified probability sample of all other active-duty regular Army person-months in the population exclusive of soldiers with a suicide attempt or other nonfatal suicidal event (eg, suicidal ideation) and

person-months associated with death (ie, 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 undersampling of months not associated with suicide attempt.

^c Includes cases (ie, soldiers with a suicide attempt) and control person-months.

^d Indicates rate 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).

^e Indicates the proportion of all officers represented by each category of each predictor, calculated by dividing the total number of each row by the overall total number (6 059 741) in the last row of Table 2.

^f Calculated as suicide attempters per 100 000 person-years, assuming other predictors were at their samplewide means.

^g Indicates statistical significance ($P < .05$).

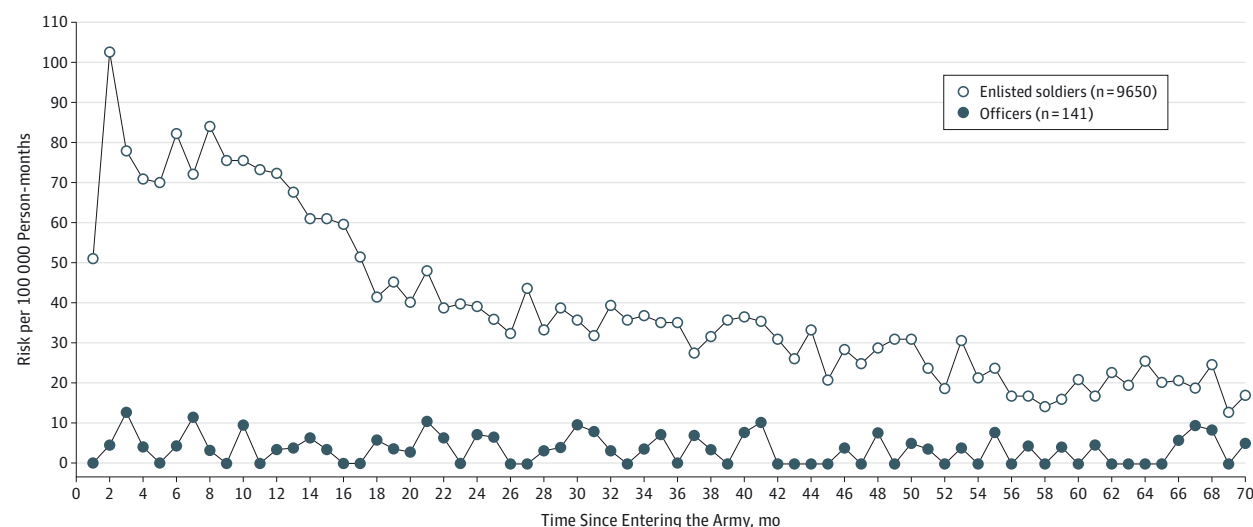
cide attempters, with an overall rate of 377.0 per 100 000 person-years from 2004 through 2009. Comparisons with US general population rates are challenging because demographic differences and less comprehensive ascertainment of civilian suicide attempts can result in substantial bias.²⁶ Based on data from the Centers for Disease Control and Prevention, the rate of nonfatal self-injury among men aged 18 to 34 years was 213.8 per 100 000 persons from 2004 through 2009 (273.6 per 100 000 persons for women).²⁷ However, the data from the Centers for Disease Control and Prevention only capture self-injury treated in US hospital emergency departments, suggesting that they underestimate the true general population rate.

For clinicians assessing individual risk, distinguishing between who they are likely to see in practice vs who is at highest risk in the population is important. Similarly, program planners seeking to have the greatest effect on population health must consider where risk is concentrated within the population when developing interventions. For example, female enlisted soldiers are more than twice as likely as male enlisted soldiers to attempt suicide but constitute only 13.7% of the ac-

tive-duty regular Army. The consistency of sex as a predictor suggests that examination of risk in men and women separately may be beneficial.⁹ Identification of sex-specific risk profiles would assist in the development and targeting of interventions, particularly for women because they may require prevention programs that differ from those designed for a male-dominated Army population. In contrast, race was only associated with suicide attempts among enlisted soldiers, with non-Hispanic white soldiers at greater risk than black, Hispanic, or Asian soldiers. Enlisted soldiers and officers were at increased risk if they entered Army service at 25 years or older, suggesting the importance of early intervention (eg, additional training, education, and/or mental health resources) for new soldiers in this age group.

Length of Army service was also important among enlisted soldiers. Risk was elevated during the first tour of duty, particularly the initial months after entering Army service. Prior Army STARRS survey findings indicate that nearly 39% of new soldiers report a preenlistment history of common internalizing or externalizing mental health disorders,²⁸ and preen-

Figure. Risk for Suicide Attempt by Month Since Entering Army Service Among Enlisted Soldiers and Officers



Data are from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS) Historical Administrative Data Study (HADS) Sample, 2004 to 2009. The sample of 193 617 person-months includes all regular Army soldiers (ie, excluding those in the US Army National Guard and Army Reserve) with a suicide attempt in the administrative records from 2004 to 2009 (n = 9791), plus a 1:200 stratified probability sample of all other active-duty regular Army

person-months in the population exclusive of soldiers with a suicide attempt or other nonfatal suicidal event (eg, suicidal ideation) and person-months associated with death (ie, 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 undersampling of months not associated with suicide attempt.

listment suicidal ideation, plans, and attempts are reported by 14.1%, 2.3%, and 1.9%, respectively.²⁹ The combination of high population prevalence and high risk for suicide attempts among early-career enlisted soldiers suggests that enhanced surveillance and evidence-based prevention targeting this segment of the Army population could have the greatest effect on rates of suicide attempts.

Currently deployed enlisted soldiers were less likely than other enlisted soldiers to attempt suicide. Numerous studies have documented adverse mental health outcomes after deployment,³⁰⁻³⁴ although our finding of higher risk among previously vs currently deployed enlisted soldiers differs from a recent Army STARRS study of suicide deaths that found risk was comparable between these groups.²² That prior study of suicide fatalities also contrasts with our finding that the risk for suicide attempts was greatest in soldiers who were never deployed. Additional research is needed to examine the role of deployment status in fatal vs nonfatal suicidal behaviors and whether predeployment mental health screening may have contributed to decreased risk for suicide attempts in those currently deployed (ie, a healthy deployed-soldier effect).³⁵ To better understand the relationship between deployment and suicide attempts, studies should examine variables such as time to (anticipated) future deployment among those never deployed, time since deployment among those currently deployed, and time since redeployment among those previously deployed.

Mental health diagnoses, which are among the most consistent risk factors for suicidal behaviors,⁴ increased dramatically in the US military during the past decade of war.³⁶ In the present study, suicide attempts among enlisted soldiers and officers were associated with a history of receiving a mental

health diagnosis, particularly in the previous month. We found that 59.8% of enlisted soldiers (5774 of 9650 suicide attempts) and 70.2% of officers (99 of 141 suicide attempts) received a diagnosis before their suicide attempt, suggesting that many at-risk soldiers have already been identified by the Army health care system as needing mental health services and providing opportunities for further risk assessment and intervention. Future research should examine which mental health disorders carry the greatest risk among soldiers and the trajectories of diagnoses over time, as well as systems-level factors, such as quantity, quality, and continuity of care.

Many of the significant sociodemographic predictors among enlisted soldiers are consistent with the literature on civilian suicide attempts,³⁷ including female sex, being younger, non-Hispanic white race, and lower educational attainment. The findings regarding sex, rank, and history of mental health disorder are also generally supported by Army STARRS survey results¹⁰ but not the associations with age, race, and deployment history. However, caution is warranted in making these comparisons owing to important methodologic differences between studies. In addition to the use of self-report survey data, the prior Army STARRS study did not stratify by rank or include soldiers who were in basic combat training or currently deployed. The prior study also examined predictors of suicide attempts with first onset after enlistment whereas we could not account for preenlistment history. Finally, survey participation is affected by the high probability that soldiers with a psychiatric hospitalization will be involuntarily separated from the Army.³⁸

A limitation of the present study is that we focused only on suicide attempts documented by the Army health care system. Undocumented suicide attempts, including self-pay treat-

ment at civilian health care facilities, may have different risk and protective factors. We were also unable to examine suicide attempts among those who recently left the Army, an important period of transition and readjustment.³⁹ In addition, we focused on a circumscribed set of sociodemographic and military predictors. Future studies should examine suicide attempt risk in the context of other military characteristics (eg, military occupational specialty, number of previous deployments, history of promotion and demotion) and mental health indicators (eg, number and types of psychiatric diagnoses, treatment history).⁴

Conclusions

Enlisted soldiers in their first tour of duty account for most medically documented suicide attempts. Risk is particularly high among soldiers with a recent mental health diagnosis. A concentration of risk strategy⁴⁰ that incorporates factors such as sex, rank, age, length of service, deployment status, and mental health diagnosis into targeted prevention programs may have the greatest effect on population health within the US Army.

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