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Sex Differences in US Army Suicide Attempts During the Wars in Iraq and Afghanistan

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Objective: To examine sex differences in risk for administratively documented suicide attempt (SA) among US Army soldiers during the Iraq/Afghanistan wars.

Method: Using administrative person-month records of Regular Army enlisted soldiers from 2004 to 2009, we identified 9650 person-months with a first documented SA and an equal-probability control sample (n = 153,528 person-months). Person-months were weighted to the population and pooled over time. After examining the association of sex with SA in a logistic regression analysis, predictors were examined separately among women and men.

Results: Women (an estimated 13.7% of the population) accounted for 25.2% of SAs and were more likely than men to attempt suicide after adjusting for sociodemographic, service-related, and mental health diagnosis (MHDx) variables (odds ratio = 1.6; 95% confidence interval, 1.5–1.7). Women with increased odds of SA in a given person-month were younger, non-Hispanic White, less educated, in their first term of enlistment, never or previously deployed (vs. currently deployed), and previously received a MHDx. The same variables predicted SA among men. Interactions indicated significant but generally small differences between women and men on 6 of the 8 predictors, the most pronounced being time in service, deployment status, and MHDx. Discrete-time survival models examining risk by time in service demonstrated that patterns for women and men were similar, and that women's initially higher risk diminished as time in service increased.

Conclusions: Predictors of documented SAs are similar for US Army women and men. Differences associated with time in service, deployment status, and MHDx require additional research. Future research should consider stressors that disproportionately affect women.

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Across diverse populations, women tend to have higher risk of making a nonfatal suicide attempt (SA) than men, and men tend to have higher risk of dying by suicide than women.[1,2] The same sex differences are present in the US Army,[3,4] where rates of suicidal behavior increased substantially during the wars in Iraq and Afghanistan[5–7] and remain elevated.[8,9] Representative survey data collected from 2011 to 2013 indicate that, among active duty soldiers, the lifetime prevalence of self-reported SA is 5.1% for women and 2.5% for men.[10] Similarly, a study of administrative records from 2004 to 2009 found that the odds of medically documented SA among Regular Army enlisted soldiers are nearly 2.5 times higher for women versus men, and the risk for women remains higher regardless of deployment status; that is, among those never deployed, currently deployed (in-theater), and previously deployed.[11] However, given that the majority of soldiers are men, with women comprising ~15% of the US Army in 2018,[12] female soldiers have been an understudied population in suicidal behaviors research. Little is known about the extent to which risk factors for SA may differ between women and men on active duty. Addressing this gap is necessary for the development and delivery of interventions tailored to the needs of female soldiers, whose experiences and stressors are both similar to, and different from, those of male soldiers.[13]

Although representative survey research has examined predictors of self-reported SAs separately among women and men in the US Air Force[14] and US Army,[10,15] less is known about sex-specific risk factors for medically documented SAs among active duty soldiers. Given that individuals may or may not have received medical care following self-reported SA, documented SAs have particular clinical importance as events diagnosed and treated within the military health care system. In the Regular Army, the vast majority of soldiers who make a documented SA are enlisted personnel (99%), with officers comprising only 1%.[3] Documented SAs in the Regular Army enlisted population are more likely among soldiers who are younger, non-Hispanic White, less educated, in their first term of enlistment (particularly the first 2 y of service), either never deployed or previously deployed (vs. currently deployed), and those who previously received a mental health diagnosis (MHDx).[3] However, these findings are based on an enlisted population predominantly composed of men. It is not known if the same risk factors are associated with documented SAs among women.

The current study used administrative data from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)[16] to examine associations of sociodemographic, service-related, and mental health predictors with medically documented SAs among female Regular Army enlisted soldiers. For comparison, we examined the same predictors among male soldiers and the extent to which associations of those predictors with SA differed by sex. In addition, we examined sex differences in SA risk patterns as a function of time in service.

METHODS

Sample

This longitudinal, retrospective cohort study used data from the Army STARRS Historical Administrative Data Study (HADS), which integrates 38 Army and Department of Defense (DoD) administrative data systems, including every system that documents suicidal events. The HADS includes individual-level person-month records for all soldiers who were on active duty at some point between January 1, 2004 and December 31, 2009 (n = 1.66 million soldiers).[17] For soldiers who were on active duty during this period but began service before 2004, records date back to January 1, 2000. Person-month records were created by coding each month of a soldier's career separately for each administrative variable and allowing values to change over time for an individual soldier.[18,19] Creation and analysis of the consolidated and deidentified HADS database was approved by the Institutional Review Boards of the Uniformed Services University of the Health Sciences, University of Michigan Institute for Social Research, University of California—San Diego, and Harvard Medical School.

The analytic sample for this study included all 9650 Regular Army enlisted soldiers who attempted suicide from 2004 to 2009 (excluding Army National Guard and Reserve), plus an equal-probability sample of 153,528 control person-months (person-months in which a documented SA did not occur). Data were analyzed using a discrete-time survival framework with person-month as the unit of analysis, such that each month in a soldier's career was treated as a separate observational record.[18,19] 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.[20] Therefore, in order to reduce computational intensity, we selected an equal-probability 1:200 sample of control person-months after stratifying the population by sex, rank, time in service, and deployment status (never, currently, or previously deployed). Control person-months excluded all soldiers with a documented SA or other nonfatal suicidal event (eg, suicide ideation)[5] and person-months in which a soldier died. Each control person-month was assigned a weight of 200 (the inverse probability of selection) to adjust for undersampling.

Measures

SAs were identified using Army/DoD administrative records from: the DoD Suicide Event Report (DoDSER),[21] a DoD-wide surveillance mechanism that aggregates information on suicidal behaviors by a standardized form completed by medical providers at DoD treatment facilities; and ICD-9-CM diagnostic codes E950–E958 (indicating self-inflicted poisoning or injury with suicidal intent) from the Military Health System Data Repository (MDR), Theater Medical Data Store (TMDS), and TRANSCOM (Transportation Command) Regulating and Command and Control Evacuating System (TRAC^{2}ES), which together provide health care encounter information from military and civilian treatment facilities, combat operations, and aeromedical evacuations (eTable 1, Supplemental Digital Content 1, http://links.lww.com/MLR/C105). Although use of the DoDSER began in 2008, its

database includes records from its Army-specific predecessor, the Army Suicide Event Report (ASER), which was active from 2004 to 2007. The ICD-9-CM E959 code (late effects of a self-inflicted injury) was excluded, as it confounds temporal relationships between predictor variables and the SA.[22] For soldiers with multiple SAs, we selected the first attempt using a hierarchical classification scheme prioritizing DoDSER records (details available elsewhere[5]).

We used administrative records to construct indicators for sociodemographic characteristics (sex, current age, race/ethnicity, education, marital status), service-related characteristics [age at entry into Army service, time in service, deployment status (never deployed, currently deployed, previously deployed)], and presence/recency of MHDx (eTable 1, Supplemental Digital Content 1, http://links.lww.com/MLR/C105). The MHDx variable was created from ICD-9-CM mental disorder codes, excluding postconcussion syndrome, tobacco use disorder, and supplemental V-codes (eg, stressors/adversities, marital problems) (eTable 2, Supplemental Digital Content 1, http://links.lww.com/MLR/C105). Recency of diagnosis was determined based on number of months between the most recent diagnostic record and the SA (cases) or sampled person-month (controls).

Missing Values

During creation of the HADS integrated database, some item-level administrative data were missing for particular person-months. In most cases, these data could be recovered by cross-checking other data systems or other months in the same soldiers' records. The few missing values that could not be recovered through cross-checking were assigned imputed values equal to subgroup modes.[6]

Analysis Methods

Analyses were conducted using SAS version 9.4.[23] Person-month records were pooled over the 2004–2009 study period. The weighted sample was used to estimate population percentages for all variables. We used logistic regression models to examine the association of sex with SA in a given person-month before and after adjusting for all other predictors. We then examined the 2-way interaction between sex and each of the other predictors. Each interaction was examined in a separate multivariate model that adjusted for the main effects all other predictors. To correct for multiple comparisons, we conducted the false discovery rate (FDR) using PROC MULTTEST in SAS 9.4.[23] The sample was then stratified by sex. Within each stratum, logistic regression analyses examined multivariate associations of the predictor variables with SA in a given person-month. Logistic regression coefficients were exponentiated to obtain odds ratio (OR) and 95% confidence interval (CI). Final model coefficients were then used to calculate standardized risk estimates[24] (SREs; expressed as the number of suicide attempters per 100,000 person-years) for each category of each predictor variable. An SRE is an estimate of the SA rate expected under the model if the distributions of all other predictors were the same in each category of a given predictor. All logistic regression models included a dummy predictor for calendar month and year to control for secular trends. Coefficients of other predictors can consequently be interpreted as averaged within-month associations. To further examine changes in risk across time in service for women and men, discrete-time survival models were used to estimate risk (suicide attempters per 100,000 person-months) in each month since entering the Army.

RESULTS

Women comprised 13.7% of all enlisted person-months pooled over the study period (population percentages estimated based on the weighted sample) and 25.2% of person-months with a first SA. Across person-months, most women were younger than 30 (70.8%), Black, Hispanic, Asian, or other (non-White) race/ethnicity (59.6%), high school-educated (75.6%), and never married (54.2%). Most women had entered Army service before age 21 (61.3%), more than half (53.3%) were in their first term of enlistment (first 4 y of service), and 44.2% were in-theater (currently deployed) or had returned from deployment (previously deployed). More than 34% had previously received a MHDx (Table 1).

Enlisted men, who comprised 86.3% of all enlisted person-months and 74.8% of person-months with a first SA, were mostly younger than 30 (67.9%), non-Hispanic White (62.9%), high school-educated (76.7%), currently married (57.4%), and younger than 21 when they entered service (62.3%). Approximately half (49.5%) were in their first term of enlistment, and 62.0% were currently or previously deployed. Approximately 23% had a MHDx history (Table 1).

Annually, rates of first-recorded SA ranged from 363/100,000 person-years (2004) to 841/100,000 person-years (2008) for women, versus 183/100,000 person-years (2004) to 405/100,000 (2008) for men. In 2009, rates for women and men decreased 11.5% and 9.9%, respectively, relative to their 2008 peak during the study period (Fig. 1). The overall 2004–2009 SA crude rate was significantly higher for women (695/100,000 person-years) than men (327/100,000 person-years) (rate ratio = 2.1; 95% CI, 2.1–2.2). Women had higher odds of SA in a given person-month (OR = 2.2; 95% CI, 2.1–2.3), even after controlling for sociodemographic, service-related, and MHDx variables (OR = 1.6; 95% CI, 1.5–1.7).

A within-sex multivariate logistic regression analysis found that, in a given person-month pooled over time, women with significantly elevated odds of SA were younger, non-Hispanic White, less educated, in their first term of enlistment, and never or previously deployed (vs. currently deployed) as of that person-month. They were also more likely to have received a MHDx, with odds of SA increasing monotonically as time since most recent diagnosis decreased (univariate results in eTable 3, Supplemental Digital Content 1, http://links.lww.com/MLR/C105). Women with the highest standardized risk in a given person-month were younger than 21 (953/100,000 person-years), less than high school-educated (1072/100,000 person-years), and in their first 2 years of service (1175/100,000 person-years). SREs for women with a MHDx history before a given person-month ranged from 4172/100,000 person-years for women diagnosed in the previous month to 520/100,000 person-years for those most recently diagnosed more than a year prior. Women with no

TABLE 1. Distributions of Sociodemographic, Service-related, and Mental Health Predictors Among Regular Army Enlisted Women and Men*

	Women (n = 23,461 Person-Months)		Men (n = 139,717 Person-Months)	
Predictor Variables	**Suicide Attempt Cases, N (%)**	**Total Population, N† (%‡)**	**Suicide Attempt Cases, N (%)**	**Total Population, N† (%‡)**
Sociodemographic predictors				
Current age				
< 21	1020 (41.9)	747,420 (17.8)	2295 (31.8)	3,877,495 (14.6)
21–24	818 (33.6)	1,290,018 (30.7)	2681 (37.2)	7,940,681 (30.0)
25–29	367 (15.1)	939,567 (22.3)	1389 (19.3)	6,180,189 (23.3)
30–34	137 (5.6)	519,337 (12.3)	498 (6.9)	3,720,098 (14.0)
35–39	62 (2.5)	414,062 (9.8)	238 (3.3)	2,930,438 (11.1)
40+	32 (1.3)	297,032 (7.1)	113 (1.6)	1,858,913 (7.0)
Race/ethnicity				
White	1407 (57.8)	1,696,807 (40.3)	5401 (74.9)	16,661,201 (62.9)
Black	588 (24.1)	1,665,188 (39.6)	827 (11.5)	5,307,227 (20.0)
Hispanic	281 (11.5)	540,481 (12.8)	698 (9.7)	3,016,698 (11.4)
Asian	108 (4.4)	206,508 (4.9)	178 (2.5)	1,010,978 (3.8)
Other	52 (2.1)	98,452 (2.3)	110 (1.5)	511,710 (1.9)
Education				
< High school§	583 (23.9)	344,983 (8.2)	2305 (32.0)	3,533,105 (13.3)
High school	1727 (70.9)	3,180,127 (75.6)	4653 (64.5)	20,323,853 (76.7)
Some college	67 (2.8)	342,467 (8.1)	124 (1.7)	1,362,124 (5.1)
≥ College	59 (2.4)	339,859 (8.1)	132 (1.8)	1,288,732 (4.9)
Marital status				
Never married	1603 (65.8)	2,280,403 (54.2)	3838 (53.2)	10,309,038 (38.9)
Currently married	740 (30.4)	1,600,940 (38.1)	3234 (44.8)	15,213,834 (57.4)
Previously married	93 (3.8)	326,093 (7.8)	142 (2.0)	984,942 (3.7)
Service-related predictors				
Age at Army entry				
< 21	1650 (67.7)	2,580,050 (61.3)	4821 (66.8)	16,515,621 (62.3)
21–24	506 (20.8)	977,106 (23.2)	1633 (22.6)	6,554,633 (24.7)
25+	280 (11.5)	650,280 (15.5)	760 (10.5)	3,437,560 (13.0)
Time in service (y)				
1–2	1646 (67.6)	1,295,846 (30.8)	3770 (52.3)	7,264,770 (27.4)
3–4	453 (18.6)	948,453 (22.5)	1825 (25.3)	5,871,425 (22.1)
5–10	265 (10.9)	1,145,665 (27.2)	1277 (17.7)	7,177,077 (27.1)
> 10	72 (3.0)	817,472 (19.4)	342 (4.7)	6,194,542 (23.4)
Deployment status				
Never deployed	1826 (75.0)	2,349,026 (55.8)	4068 (56.4)	10,082,268 (38.0)
Currently deployed	223 (9.2)	678,023 (16.1)	717 (9.9)	6,495,117 (24.5)
Previously deployed	387 (15.9)	1,180,387 (28.1)	2429 (33.7)	9,940,429 (37.5)
Mental health predictors				
Time since most recent mental health diagnosis (mo)				
No diagnosis	970 (39.8)	2,770,570 (65.8)	2906 (40.3)	20,385,706 (76.9)
1	857 (35.2)	224,257 (5.3)	2659 (36.9)	926,659 (3.5)
2–3	226 (9.3)	169,426 (4.0)	607 (8.4)	686,607 (2.6)
4–12	252 (10.3)	399,652 (9.5)	635 (8.8)	1,590,235 (6.0)
≥ 13	131 (5.4)	643,531 (15.3)	407 (5.6)	2,918,607 (11.0)
Total	2436 (100)	4,207,436 (100)	7214 (100)	26,507,814 (100)

*The sample of person-months from Regular Army enlisted soldiers (n = 9650 suicide attempt person-months, 153,528 control person-months) is a subset of the total Regular Army sample (n = 193,617 person-months) from the Army STARRS Historical Administrative Data Study. Control person-months were assigned a weight of 200 to adjust for undersampling.

†Includes both cases (ie, person-months with a first suicide attempt) and weighted control person-months.

‡Weighted percent of the population within each stratum (ie, females and males).

§ < 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.

Army STARRS indicates Army Study to Assess Risk and Resilience in Servicemembers.

MHDx history as of a given person-month had an SRE of 374/100,000 person-years (Table 2).

Interaction terms indicated that associations of current age ($\chi^2_5 = 24.1$; FDR $P = 0.0004$), race/ethnicity ($\chi^2_4 = 10.4$; FDR $P = 0.0465$), time in service ($\chi^2_3 = 71.9$; FDR $P < 0.0001$), deployment status ($\chi^2_2 = 47.2$; FDR $P < 0.0001$), and MHDx ($\chi^2_4 = 160.7$; FDR $P < 0.0001$) with SA differed by sex (Table 2). Significant interactions were explored with pairwise analyses. Although there were statically significant pairwise differences on a number of risk factors, the ORs for women and men were in the same direction and most differences were small, as can be seen in Table 2. In a given person-month, Black ($\chi^2_1 = 4.0$; $P = 0.047$) and

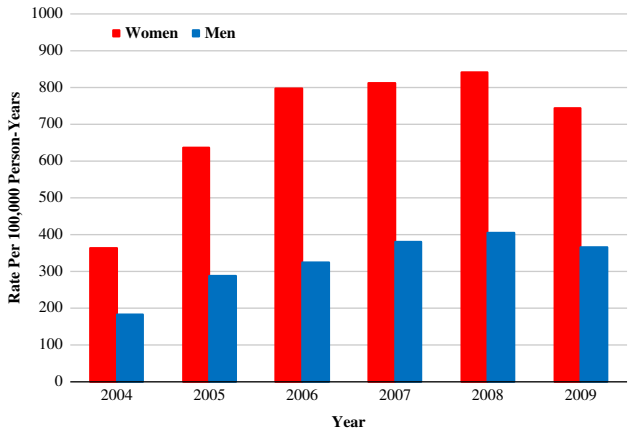

FIGURE 1. Annual rate of first-recorded suicide attempt among Regular Army enlisted women and men.* *This sample of female (n = 2436 cases, 21,025 control person-months) and male (n = 7214 cases, 132,503 control person-months) enlisted soldiers from the Army STARRS Historical Administrative Data Study 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 during the years 2004–2009, plus a 1:200 stratified probability sample of all other Regular Army enlisted person-months. Control person-months were assigned a weight of 200 to adjust for undersampling.

Asian ($\chi^2_1 = 7.4$; $P = 0.006$) race/ethnicity were more protective for men than women. The OR associated with time in service of 1–2 years was larger for women than men ($\chi^2_1 = 40.7$; $P < 0.0001$). In contrast, the ORs were larger among men for deployment status of never deployed ($\chi^2_1 = 15.2$; $P < 0.0001$) or previously deployed ($\chi^2_1 = 47.0$; $P < 0.0001$), and for MHDx at all recency levels ($\chi^2_1 = 22.5$–146.4; all P's < 0.0001). Despite a significant interaction between sex and current age, pairwise analyses comparing women and men within the same age group were nonsignificant.

Women had higher SREs than men across all predictor categories (Table 2). However, once sex differences in the population base rate of SA were accounted for, most SREs represented an increase or decrease in risk that was proportional between women and men (ie, for most predictor categories, women and men had SREs that were comparably larger or smaller than their respective base rates). Receipt of a MHDx in the previous month was associated with the largest sex difference relative to the base rates of women and men. That is, the SRE for women with a previous-month MHDx (4174/100,000 person-years) was 6.0 times higher than women's base rate (695/100,000 person-years), whereas the SRE for men with a previous-month MHDx (3210/100,000 person-years) was 9.8 times higher than men's base rate (327/100,000 person-years). Also noteworthy, the SRE for currently deployed women (535/100,000 person-years) was 23% lower than women's base rate, whereas the SRE for currently deployed men (171/100,000 person-years) was 48% lower than their base rate.

Discrete-time survival models further examined sex differences in SA risk as a function of time in service (Fig. 2). The overall pattern of risk was similar for women and men, peaking during the second month of service and then decreasing as time in service increased. During the first 12 months of service, women had an average monthly risk that was 2.6 times that of men. Sex differences in risk diminished as time in service increased, particularly during the first term of enlistment (approximately the first 48 mo of service). During the fifth year of service (the start of the second term of enlistment for many soldiers), the average monthly risk for women was 1.4 times that of men. The diminished difference between women and men over time was the result of a sharper decrease in risk among women than men. For example, from the point of peak risk (second month) to the end of the first term of enlistment (48th month), risk decreased 84.8% among women and 64.6% among men.

DISCUSSION

For both women and men in the Regular Army enlisted population, medically documented SA rates increased overall during the 2004–2009 study period. Women comprised <14% of the enlisted population but more than 25% of suicide attempters. Consistent with previous research,[3] women were more likely than men to have a documented SA after adjusting for other sociodemographic characteristics, service-related variables, and MHDx. Importantly, the risk factors for SA were similar for women and men. Women who attempted suicide were more likely to be younger, non-Hispanic White, less educated, in their first term of enlistment, never or previously deployed, and previously given a MHDx. The same characteristics were risk factors among men. Although 6 of the 8 predictors statistically differed by sex, their associations with SA were in the same direction and generally similar in magnitude. Exploratory analyses indicated that the largest differences were related to time in service, deployment status, and recency of mental health diagnosis. Specifically, being in the first 2 years of service had a stronger association with SA among women, whereas deployment status and recent MHDx had a stronger association with SA among men. Additional research is needed to confirm and understand these differences. Consistent with the overall difference between women and men in SA base rates, women had higher standardized risk across all categories of the predictor variables. Thus, in each segment of the population defined by our predictors, the average woman was at greater risk than the average man.

Among both women and men, those who were never deployed or previously deployed had higher odds of SA relative to those currently deployed (in-theater), consistent with research on the total enlisted population.[3,11] Standardized risk was comparable between never and previously deployed women (712 vs. 737/100,000 person-years, respectively), and the same was true for men (371 vs. 350/100,000 person-years, respectively). However, the relative decrease in risk during deployment was more substantial for men than women. Specifically, risk among currently deployed women was 25%–27% lower compared with women who were never or previously deployed, whereas risk among currently deployed men was 51%–54% lower compared with never or previously deployed men. Previous research has highlighted

TABLE 2. Multivariate Associations of Sociodemographic, Service-related, and Mental Health Predictors With First Suicide Attempt Among Regular Army Enlisted Women and Men†

	Women (n = 23,461)			Men (n = 139,717)			
Predictor Variables	**OR**	**95% CI**	**SRE‡**	**OR**	**95% CI**	**SRE‡**	**Predictor by Sex Interaction§**
Sociodemographic predictors							
Current age							$\chi^2_5 = 24.1$* (FDR $P = 0.0004$)
< 21	1.8*	1.3–2.5	953	2.0*	1.7–2.4	475	
21–24	1.3	1.0–1.7	666	1.4*	1.2–1.6	323	
25–29	1.0	0.8–1.3	548	1.2*	1.0–1.3	275	
30–34	1.0	—	528	1.0	—	235	
35–39	0.7*	0.5–0.9	351	0.9	0.7–1.0	205	
40+	0.6*	0.4–0.9	318	0.8*	0.6–1.0	184	
Within-sex association	$\chi^2_5 = 45.4$* ($P < 0.0001$)			$\chi^2_5 = 131.9$* ($P < 0.0001$)			
Race/ethnicity							$\chi^2_4 = 10.4$* (FDR $P = 0.0465$)
White	1.0	—	732	1.0	—	344	
Black	0.9*	0.8–1.0	639	0.8*	0.7–0.9	274	
Hispanic	0.8*	0.7–1.0	618	0.9*	0.8–0.9	293	
Asian	1.1	0.9–1.3	770	0.8*	0.7–0.9	273	
Other	1.0	0.8–1.4	757	1.0	0.8–1.2	348	
Within-sex association	$\chi^2_4 = 12.8$* ($P = 0.0123$)			$\chi^2_4 = 52.3$* ($P < 0.0001$)			
Education							$\chi^2_3 = 3.8$ (FDR $P = 0.32$)
< High school‖	1.7*	1.5–1.8	1072	1.6*	1.5–1.7	459	
High school	1.0	—	648	1.0	—	292	
Some college	0.8*	0.6–1.0	493	0.8*	0.7–1.0	246	
≥ College	0.6*	0.4–0.8	370	0.7*	0.6–0.9	215	
Within-sex association	$\chi^2_3 = 134.9$* ($P < 0.0001$)			$\chi^2_3 = 320.3$* ($P < 0.0001$)			
Marital status							$\chi^2_2 = 16.5$* (FDR $P = 0.0004$)
Never married	1.1	1.0–1.2	709	1.0	0.9–1.0	322	
Currently married	1.0	—	662	1.0	—	333	
Previously married	1.1	0.9–1.4	743	0.9	0.8–1.1	311	
Within-sex association	$\chi^2_2 = 2.6$ ($P = 0.27$)			$\chi^2_2 = 1.8$ ($P = 0.41$)			
Service-related predictors							
Age at Army entry							$\chi^2_2 = 1.1$ (FDR $P = 0.58$)
< 21	1.0	0.8–1.1	684	1.0	0.9–1.1	325	
21–24	1.0	—	716	1.0	—	328	
25+	1.0	0.8–1.2	723	1.0	0.9–1.1	336	
Within-sex association	$\chi^2_2 = 0.45$ ($P = 0.80$)			$\chi^2_2 = 0.28$ ($P = 0.87$)			
Time in service (y)							$\chi^2_3 = 71.9$* (FDR $P < 0.0001$)
1–2	3.7*	3.1–4.5	1175	2.3*	2.1–2.6	511	
3–4	1.6*	1.3–1.9	493	1.5*	1.3–1.6	324	
5–10	1.0	—	315	1.0	—	222	
> 10	0.7*	0.5–0.9	210	0.5*	0.4–0.5	103	
Within-sex association	$\chi^2_3 = 264.3$* ($P < 0.0001$)			$\chi^2_3 = 349.3$* ($P < 0.0001$)			
Deployment status							$\chi^2_2 = 47.2$* (FDR $P < 0.0001$)
Never deployed	1.3*	1.2–1.5	712	2.2*	2.0–2.4	371	
Currently deployed	1.0	—	535	1.0	—	171	
Previously deployed	1.4*	1.2–1.6	737	2.0*	1.9–2.2	350	
Within-sex association	$\chi^2_2 = 17.3$* ($P = 0.0002$)			$\chi^2_2 = 352.9$* ($P = 0.0001$)			
Mental health predictors							
Time since most recent mental health diagnosis (mo)							$\chi^2_4 = 160.7$* (FDR $P < 0.0001$)
No diagnosis	1.0	—	374	1.0	—	160	
1	11.2*	10.2–12.4	4174	20.2*	19.1–21.3	3210	
2–3	4.0*	3.5–4.6	1496	6.6*	6.0–7.2	1050	
4–12	2.2*	1.9–2.6	832	3.4*	3.2–3.8	549	
≥ 13	1.4*	1.2–1.7	520	1.9*	1.7–2.1	306	
Within-sex association	$\chi^2_4 = 2567.8$* ($P < 0.0001$)			$\chi^2_4 = 11{,}860.7$* ($P < 0.0001$)			

†The sample of Regular Army enlisted soldiers (n = 9650 cases, 153,528 control person-months) is a subset of the total Regular Army sample (n = 193,617 person-months) from the Army STARRS Historical Administrative Data Study. Control person-months were assigned a weight of 200 to adjust for undersampling.

‡Each 2-way interaction was examined separately in a model that included all other predictor variables, but not other interactions. *P*-values for the interactions were corrected using FDR.

§SRE (number of soldiers with a suicide attempt per 100,000 person-years) were calculated assuming other predictors were at their sample-wide means.

‖ < 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.

Army STARRS indicates Army Study to Assess Risk and Resilience in Servicemembers; CI, confidence interval; FDR, false discovery rate; OR, odds ratio; SRE, standardized risk estimates.

*$P < 0.05$.

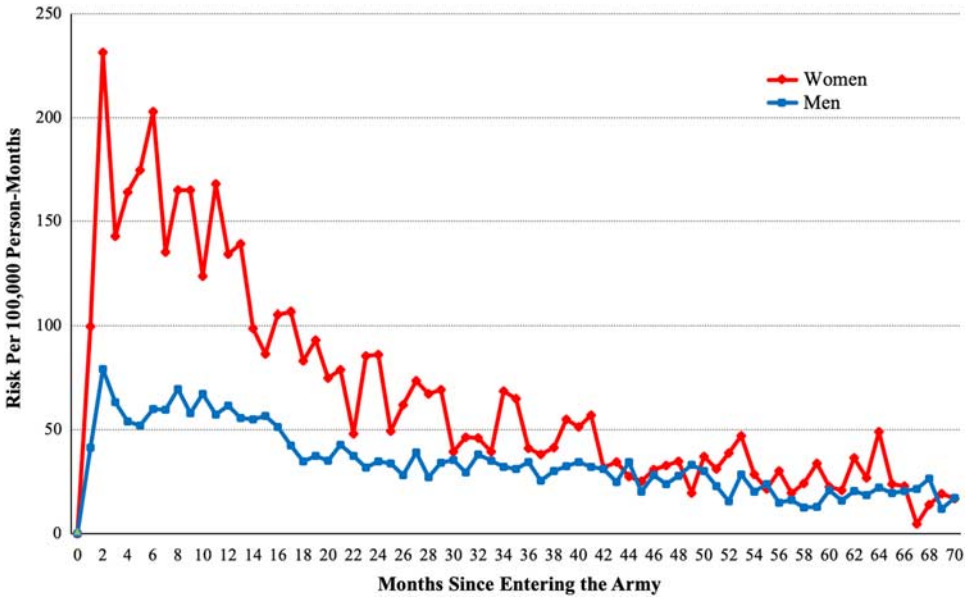

FIGURE 2. Risk of suicide attempt time in service among Regular Army enlisted women and men.* *This sample of female (n = 2436 cases, 21,025 control person-months) and male (n = 7214 cases, 132,503 control person-months) enlisted soldiers from the Army STARRS Historical Administrative Data Study includes all Regular Army soldiers (ie, excluding those in the US Army National Guard and Army Reserve) with a suicide attempt in their administrative records during the years 2004–2009, plus a 1:200 stratified probability sample of all other Regular Army enlisted person-months. Control person-months were assigned a weight of 200 to adjust for undersampling.

the importance of deployment in suicide deaths among women.[4,25] Given that men are more likely than women to report exposure to combat and postbattle stressors (eg, seeing dead bodies, caring for wounded),[26] our finding that risk decreased more substantially among men than women in-theater highlights the importance of considering other deployment-related experiences that may disproportionately affect women. In addition to women's elevated risk of experiencing sexual trauma in-theater,[27,28] studies have found that women are more likely to report lower social support from unit members before and during deployment, as well as lower perceived preparedness for deployment,[26,29] factors which are associated with elevated mental health risk.[27,29–33] Our finding that a smaller proportion of women had deployed relative to men (44% vs. 62%) was likely due to sex differences in factors that are associated with selection for deployment, particularly military occupation. The extent to which this selection process affected our findings is not yet known and may have important implications for understanding sex-related similarities and differences in mental health and SA risk during the deployment cycle. Addressing this issue is particularly important given the significant change in Army policy in 2013 that lifted the ban on women serving in ground combat units.[34] As more women begin to serve in direct combat roles, there will be even greater need for research on mental health and suicide risk in this population.

Approximately one third (34%) of all women had a MHDx history, compared with 23% of men. In contrast, ~60% of both female and male suicide attempters had previously received a MHDx. Thus, although a larger proportion of enlisted women received a MHDx, women and men who attempted suicide were equally likely to have previously received attention from the mental health care system. Although the reason for this is not yet known, the types of MHDx received by women versus men may be related to SA risk following diagnosis. Previous research indicates that male soldiers have a higher prevalence of intermittent explosive disorder and substance use disorder, both of which are associated with SA risk.[15] Men with those externalizing disorders may engage in behaviors that are more likely to be noticed by leaders and clinicians before a SA.

The association of recent MHDx with SA was stronger among men than women. Whereas women with a previous-month diagnosis had standardized SA risk that was 6 times higher than women's population base rate, men with a previous-month diagnosis had risk that was nearly 10 times their base rate. Previous research has found that male soldiers with a self-reported mental disorder are less likely than women to perceive a need for treatment.[35] This raises the possibility that male soldiers who come to the attention of clinicians and receive a MHDx are more severely distressed and/or impaired (resulting in higher SA risk) than women who receive a MHDx. However, this is an empirical question requiring investigation. As our findings also highlight, it is important for future research to address the significant challenge of identifying and intervening with the 40% female and male soldiers who were never diagnosed before attempting suicide.[36]

Time in service was associated with important similarities and differences in the patterns of risk for women and men. Previous research on the total enlisted population during

the same time period demonstrated greatly elevated risk during the first term of enlistment, with the highest risk occurring during the second month of service, toward the end of basic training.[3] We found that this general pattern was present in both sexes and that women and men differed primarily in level of risk. The higher SA risk among women was most pronounced during the first year of service, with risk differences between women and men diminishing as time in service increased. Women are more likely than men to begin Army service with a self-reported history of mental disorders and suicidal thoughts and behaviors,[37,38] which may help account for our finding that sex differences in SA risk were greatest toward the beginning of service.

This study has 5 noteworthy limitations. First, administrative records are limited to events that come to the Army's attention and are subject to classification and coding errors. Unreported and/or undiagnosed SAs and mental disorders were not captured. Because of this, sex differences in health care utilization and/or delivery[39] may have affected our findings. In addition, efforts to identify and document suicidal behavior among service members increased during the 2004–2009 study period,[5,21] and it is not known whether those changes differentially affected women and men. Second, we were unable to account for nonsuicidal self-injury,[40] a clinically important outcome relevant to SA,[41] for which there is no specific ICD-9-CM code. Third, pre-enlistment risk factors,[42–44] which may help identify soldiers at greatest risk,[45] are not captured in administrative records. Fourth, our findings may not generalize to other time periods (eg, different phases of Iraq/Afghanistan wars, other military conflicts) or populations (eg, other military branches, veterans, civilians). Fifth, soldiers were categorized based on the binary classification of gender in Army administrative records, which does not account for transgender soldiers or those with other, nonbinary gender identities who may experience unique stressors and elevated suicide risk.[46,47]

As demonstrated in the current study, accounting for sociodemographic characteristics, service-related characteristics, and MHDx attenuates, but does not eliminate, the higher odds of documented SA among women in the US Army. It is important for future research to expand the range of risk factors that may help explain the elevated risk among female soldiers to more effectively target interventions. Particular consideration should be given to stressors disproportionately experienced by military women. For example, female service members and veterans are more likely than men to report experiencing sexual assault, harassment, and gender discrimination during military service.[48] Sexual assault and harassment during Army service are associated with increased risk for suicidal thoughts and behaviors, as well as other negative health and career outcomes (eg, demotion, attrition from service).[49,50] Even after service has ended, veterans with a history of military sexual trauma have elevated risk of dying by suicide.[51] It may also be valuable to examine familial factors that differ between women and men. For example, there is evidence that active duty women are more likely than men to be single parents, and nearly half of married military women (48%) have a spouse who is also a service member, versus only 7% of military men who are married.[52] Importantly, documented family violence during service is associated with increased SA risk among both female and male soldiers, but those associations may be modified depending a soldier's role as a victim or perpetrator of family violence.[53] For example, male perpetrators were found to have higher odds of SA than male victims, but female perpetrators and victims did not differ in risk.[53] It is also important to recognize the importance of premilitary trauma exposure.[54] Women entering Army service are more likely than men to report frequent childhood sexual, physical, and emotional maltreatment, experiences associated with increased SA risk before enlistment.[42]

CONCLUSIONS

The Regular Army enlisted population examined in this study accounts for the majority of documented US Army SAs. However, it is noteworthy that similar sex-based risk discrepancies have been observed in Regular Army officers and activated officers and enlisted personnel in the US Army Reserve Components (Army National Guard and Army Reserve),[3,55] indicating a need for focused research on women throughout the total Army population. Although the elevated risk among women may be partially explained by sociodemographic, service-related, and mental health variables, women continued to have higher odds of attempt even after accounting for these variables. Importantly, we found that risk factors for SA were generally similar regardless of sex. These findings reinforce the importance of examining sex differences across a broader array of potential risk factors (eg, specific mental disorders, stressors before and during military service, familial and other interpersonal relationships). Research focused on the mental health of military women will become even more important as women begin to occupy combat roles not historically available to them.

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