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Prevalence, Predictors, and Correlates of Insomnia in U.S. Army Soldiers

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Abstract

The objective of this study was to investigate the rates, predictors, and correlates of insomnia in a national sample of U.S. Army Soldiers. Data were gathered from the cross-sectional survey responses of the All-Army Study (AAS), of the Army Study to Assess Risk and Resilience in Service members. Participants were a representative sample of 21,499 U.S. Army soldiers who responded to the AAS self-administered questionnaire between 2011 and 2013. Insomnia was defined by selected DSM-5 criteria using the Brief Insomnia Questionnaire. Results highlight significant functional difficulties associated with insomnia among U.S. Soldiers as well as insights into predictors of insomnia specific to this population. Insomnia was present in 22.76% of the sample. Predictors of insomnia status in logistic regression included greater number of current mental health disorders, less perceived open lines of communication with leadership, less unit member support, and less education. Insomnia had global, negative associations with health, social functioning, support, morale, work performance, and Army career intentions. Results provide the strongest evidence to-date that insomnia is common in a military population and is associated with a wide array of negative factors in the domains of health, military readiness, and intentions to remain in military careers.

Keywords

Insomnia; Military; Population Health

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INTRODUCTION

Insomnia disorder affects roughly 5–10% of the adult population, while a more episodic presentation of insomnia symptoms has been observed in approximately 30% (Mai et al., 2008; Ohayon, 2002). Insomnia appears to be more prevalent in active duty military and Veterans than in the general population. The Johns Hopkins National Veteran Sleep Survey, a web-based survey, reported a striking 76% of respondents who had insufficient sleep duration, with approximately 70% reporting difficulty falling or staying asleep (Vet Advisor, 2013). Using DSM-IV criteria, approximately 74% met clinical criteria for a diagnosis of insomnia based on survey responses. A sample of active duty military personnel reported a lower prevalence rate of 25%, however the sample included only those personnel referred for polysomnography, and thus may not represent overall prevalence (Mysliwiec et al., 2013). Similarly, 20–30% of active duty personnel reported trouble sleeping as defined by trouble falling or staying asleep of at least moderate severity (Seelig et al., 2010). Taylor and colleagues (2016) reported an insomnia prevalence rate of 19.9% among pre-deployment military service members, though relied exclusively on the Insomnia Severity Index (ISI) for documentation of insomnia symptoms.

Identifying and treating insomnia in military personnel is important in light of its consequences. Sleep problems are one of the most common reasons for military personnel seeking behavioral health care, exceeding combat-related causes (Army Live, 2011). In a recent study, 17% of service members reported that sleep problems impaired daytime functioning (Troxel et al., 2015). In a longitudinal examination, insomnia symptoms predicted poorer health, greater health care utilization, more days of lost work, and greater odds of early discharge in military personnel (Seelig et al., 2016). In one of the largest samples analyzed, predeployment insomnia symptoms were associated with greater odds of developing postdeployment PTSD, depression, or anxiety (Gehrman et al., 2013). This is important, as psychological climate can substantially influence morale and intentions to leave the Army (Langkamer et al., 2008). However, there is a dearth of research on whether and how insomnia is associated with either morale or Army career intentions. Extant research on morale has likewise shown that lower levels of morale are linked to greater levels of PTSD in the military; however, insomnia was not assessed (Jones et al., 2012). It is yet unknown whether and how insomnia and morale are related. Given the aforementioned findings of insomnia's detrimental effect on both functioning and psychological health, it was hypothesized that participants with insomnia would have worse morale.

In light of evidence of the negative consequences of insomnia, understanding its prevalence, biopsychosocial predictors, and functional correlates among military personnel is critical. Unfortunately, most research has been conducted on civilians; there are far fewer studies on active duty military samples. This is a significant gap: demographics and characteristics of military populations are different from those of civilians in meaningful ways (e.g., age, sex, combat exposure; Troxel et al., 2015). In addition, the aforementioned estimates of insomnia disorder prevalence and correlates in active duty personnel are restricted to treatment-seeking samples and/or isolated symptoms rather than full disorder symptomatology. Therefore, the current study aimed to address these gaps by examining a nationally

representative sample of 21,499 active duty soldiers in the U.S. Army, one of the largest active duty research samples to date. This report presents the prevalence of insomnia, its biopsychosocial predictors, and its functional correlates, including indicators of Army career retention.

METHODS

Data Collection

Data were obtained from the All Army Study (AAS) of the Army Study to Assess Risk and Resilience in Service members (STARRS; Ursano et al., 2015; Heeringa et al., 2013; Kessler et al., 2013). The AAS was a cross-sectional survey conducted from 2011 to 2013. Stratified probability sampling of Army units and sub-units was conducted without replacement to identify a representative sample reflective of the active duty U.S. Army force. After being selected for participation, soldiers were given information, frequently asked questions, and a toll-free number for additional questions and ordered to attend the informed consent session. Approximately 76.5% of these attended the consent session; the remainder did not attend due to conflicting duty assignments. During the consent session, soldiers were informed of the purposes, procedures, confidentiality, and voluntary nature of the survey including the right to withdraw, and were given the opportunity to have questions answered. Approximately 96% of these consented to participate, and of those, 98% completed the AAS, yielding a total sample of 21,499. All procedures were approved by the Human Subjects Committees of organizations involved; data analysis was determined by the local institution to be exempt from review. Please see Kessler, et al., 2013 and Heeringa et al., 2013 for a full discussion on the STARRS data collection methodology and field procedures.

Measures

The AAS questionnaire comprised items from scales selected to be both efficient and informative in this large scale survey (Ursano et al., 2015). The questionnaire consisted of approximately 173 questions; the items and response options utilized for the current study are included in Tables 1–5 for reference (see also Army Study to Assess Risk and Resilience in Servicemembers, 2016 for a full copy of the questionnaire). In addition to examining insomnia status, we chose to examine data from sections of the STARRS survey that reflected risk factors and correlates based on the literature of insomnia development in the military.

Operationalization of risk factors and correlates—To generate operational definitions of risk factors and correlates, we utilized the extant literature as well as the World Health Organization’s definitions (WHO, 2017) which identify risk factors as an individual’s traits, characteristics, or exposures that increase the likelihood that he/she will develop insomnia symptoms, and correlates as such traits, characteristics, or exposures that frequently accompany insomnia symptoms. Given the cross sectional nature of the data and the inability to establish temporal precedence, it is important to note that in our analyses, it is indeed possible that certain traits or behaviors can fit operational definitions of both risk factors and correlates. For the purposes of this study, to determine risk factors, we relied on previous literature on the characteristics, traits, and exposures that place individuals at risk

of developing insomnia (e.g., demographics, Roth et al., 2011; substance use, Drake et al., 2013 and Brower, 2003; mental disorders, Drake, Roehrs, & Roth, 2003; McLay et al., 2010, and Staner et al., 2010; low social support, Taylor et al., 2016). Regarding insomnia correlates, we selected functional problems including those participants perceived as due to sleep problems (e.g., Kuppermann et al., 1995); morale; and Army career intentions. We selected morale and Army career intentions as correlates given that no published study to date has established links between insomnia symptoms and both of these constructs, and thus we have no prior literature basis from which to support a risk factor classification.

Insomnia status—Insomnia status was measured with the Brief Insomnia Questionnaire (BIQ; Kessler et al., 2010), which assesses (1) frequency (number of nights per week) of insomnia symptoms in the past 30 days (i.e., taking more than 30 minutes to fall asleep, waking three or more times during a single night, waking at night and taking more than 30 minutes to get back to sleep, waking more than 30 minutes too early in the morning, and feeling tired or unrested in the morning even after a full night of sleep). The measure also assesses (2) degree of functional impairment due to sleep problems, with the item, “How much did your sleep problems interfere with your daytime functioning in each of the following ways over the past 30 days. Areas assessed included daytime fatigue, somatic problems, moodiness, reduced performance at work/school, and accident-proneness on a 5-point Likert scale. Also assessed was (3) the number of months out of the past year that sleep has interfered in these areas. Finally, (4) age at first onset of sleep problems for one month or longer was queried with a write-in response. Current (past 30-day) insomnia status was operationalized based on selected DSM-5 criteria if a participant had: a) insomnia symptoms 3 or more nights per week; b) reported that sleep problems interfered with functioning at least “a lot”; and c) sleep problems occurred at least 3 months out of the past year. Given the fact that insomnia disorder could not be diagnosed with the information provided in the questionnaire, insomnia status may represent either the full disorder or a collection of subthreshold symptoms.

Risk factors

Mental health, cigarettes and caffeine, energy, and alcohol drink use: The Composite International Diagnostic Interview (CIDI) screening scales for mental health disorders were used to determine number of current and lifetime mental health disorders. The CIDI Substance Abuse Module (CIDI SAM) assesses tobacco, alcohol, drug and caffeine usage in the past 30 days. This measure was developed for clinical and research use, including epidemiological studies; it has demonstrated adequate validity and reliability (Kessler and Ustun, 2004; Cottler et al., 1989).

Social support: Unit member and leadership support were assessed with five items, each used in prior research studies by the Office of the Surgeon General of the Army’s Mental Health Advisory Team (Army Live, 2011; Army Medicine, 2009). Supportive leadership behaviors was a composite of four items (Army Medicine, 2009); total possible scores range from 4 to 20, with higher scores indicating more supportive leadership.

Correlates

Functional Problems: We examined participants' responses to the BIQ item that asked the degree to which, in the past 30 days, sleep problems impacted daytime functioning in the areas of daytime fatigue, somatic problems, moodiness, reduced performance at work/school, and accident-proneness. Additionally, functional problems in the last 30 days were examined per responses to individual items from the Patient Health Questionnaire (Spitzer et al., 1999; Kroenke et al., 2010). The degree to which physical, mental, and substance use problems interfere with functioning in the last 30 days was assessed with the Sheehan Disability Scale (Sheehan et al., 1996). One's ability to cope with stress since deployment was assessed with a one-item question previously used in studies of deployed Soldiers (Hurricane Katrina Community Advisory Group, 2016). Of note, this measure was administered to a subset of respondents due to deployment status (n=15,421).

Morale and Army career intentions: Morale and Army career intentions are direct indicators of Army retention. Therefore, these were each assessed with items previously used in the J-MHAT7 (Army Live, 2011). Morale was assessed with a single item, "How would you rate your morale?" on a 5-point Likert scale ranging from 1 (very low) to 5 (very high). Army career intentions were assessed with two items, the first assessing the participant's intention to stay in the Army until retirement vs. leaving the Army after his/her present obligation rated on a 5-point Likert scale ranging from 1 (will definitely leave Army) to 5 (will definitely stay in Army); the second assessing the likelihood of leaving the Army before the end of his/her present obligation rated on a 5-point Likert scale ranging from 1 (definitely would not leave) to 5 (definitely would leave). This latter question was asked of a subset of participants (n=8,072)

Data Analysis

Soldiers meeting selected criteria for insomnia disorder were compared to those who did not meet these criteria. Chi-square tests of independence were used for comparisons of sex; education; race; ethnicity; residence in barracks; months with unit; and number of deployments. Mann-Whitney U tests were used to compare groups on age; number of cigarettes, caffeinated, energy, and alcohol drinks; mental health; social support; functional problems; morale; and Army career intentions. All available data were used for each comparison, resulting in different samples sizes for each test. Given the large sample size, it was anticipated that many analyses would yield statistically significant results, even if the magnitude of effects were very small. As such, effect sizes (Phi and r) were also computed and classified as follows: 0.10=small; 0.30=medium; 0.50=large (Field, 2009). Bonferroni corrections for multiple comparisons were calculated for each section of the STARRS.

Logistic regression analysis was used to investigate the independent and additive contribution of demographics, cigarette use, mental health, and social support on insomnia status. Only those variables with effect sizes of at least a small magnitude and that were statistically significant after Bonferroni correction in bivariate analyses were entered into this model. Spearman's rank-ordered correlation was used to examine bivariate relations among predictors. Examination of tolerance values indicated that none were below the recommended cutoff of .20 (Rovai et al., 2014, p. 581). Variables in the logistic regression

with effect sizes of at least small are interpreted in the discussion. There were a total of 18,416 respondents with complete data in the regression analysis; less than 10% of data were missing for each item. For the subsample in the logistic regression analysis, the pattern of effect size magnitudes and statistical significance in the bivariate tests was very similar to that of the larger sample.

RESULTS

Of the overall sample of 21,499 soldiers, 4,881 (22.76%) met the selected insomnia criteria. Among these, 748 (15.32%) were age 17 or younger when they first experienced sleep problems; 4,133 (84.68%) were age 18 or older, and of those, median age of onset was 23.00 (interquartile range 20.00–28.00). The most frequently endorsed duration of insomnia on the BIQ was 10–12 months (42.88%; median=8–9 months, interquartile range 6 to 10–12 months), indicating that insomnia was a persistent problem over most of the prior year for most individuals.

Risk Factors

Demographics—Demographics are presented in Table 1. After Bonferroni correction, there was a statistically significant difference of small magnitude between those with and without current insomnia on highest education achieved, such that those without insomnia had more education than those with insomnia. Significant but very small magnitude differences were found between groups on age, sex, race, ethnicity, residence in barracks, number of months in current unit, and number of deployments.

Cigarettes, Caffeinated, Energy, and Alcohol Drinks—Data on daily use of substances are presented in Table 2. Soldiers with insomnia consumed more caffeinated, energy, and alcohol beverages than those without insomnia, but these differences were of a very small magnitude. Compared to soldiers without insomnia, soldiers with insomnia used more cigarettes, at a difference of a small magnitude.

Mental Health and Social Support—Psychosocial factors are presented in Table 3. Soldiers with insomnia endorsed more difficulties with each of the psychosocial factors examined, and experienced greater number of current and lifetime mental health disorders. They also perceived less support from other unit members and leaders and had less respect for both commissioned and non-commissioned officers.

Logistic Regression—Risk factor variables that were of at least a small magnitude and significant after Bonferroni correction were entered into the model predicting insomnia status (see Table 4). Lower levels of education significantly predicted insomnia, with the comparison between post-baccalaureate degree and high school or general education development, some post-high school, and associate's degree meeting the effect size cutoff. Responses to the question "I can rely on unit members for help if needed" significantly predicted insomnia status; the comparison between strongly agree and strongly disagree met the effect size cutoff such that those who strongly disagreed had greater odds of insomnia. Responses to the question "I can open up and talk to my first line leaders for help if needed" significantly predicted insomnia status; the comparison between strongly agree and strongly

disagree met the effect size cutoff such that those who strongly disagreed had greater odds of insomnia. Greater number of cigarettes per day significantly predicted insomnia, with the comparison between 31 or more and none or 1–2 meeting the effect size cutoff. Both greater number of current and lifetime mental health disorders significantly predicted insomnia, but only number of current mental health disorders met the effect size cutoff. More supportive leadership behaviors significantly predicted insomnia, but did not meet the effect size cutoff. Respect for unit commissioned and non-commissioned officers and leaders taking a personal interest in the well-being of soldiers were no longer significant when entered into the regression model.

Correlates

Frequency and duration of functional problems due to sleep problems among those with insomnia—We examined the percentage of Soldiers with insomnia who endorsed sleep problems as interfering “a lot” or “extremely” with their daytime functioning in the past 30 days, per responses on the BIQ. Most frequently endorsed by those with insomnia was daytime fatigue/sleepiness/low motivation (77.84%), followed by moodiness (irritability, nerves, worry, or depression; 62.76%), headaches, upset stomach, diarrhea, or constipation (34.70%), reduced performance at work/school (28.82%), and accident-proneness (9.38%).

Differences in frequency of functional problems and functional correlates between those with and without insomnia—See Table 5 for differences in functional problems. When compared to those without insomnia, Soldiers with insomnia endorsed a greater frequency of functional difficulties in the past 30 days in every domain examined. When asked how much their physical, mental, and substance use problems interfered with their functioning, soldiers with insomnia endorsed significantly more functional consequences than those without insomnia, in every domain. Soldiers with insomnia also reported less of an ability to cope with stress after deployment than those without insomnia.

Differences in morale and Army career intentions between those with and without insomnia—The relationship between morale and insomnia status was significant, such that fewer of those with insomnia had medium and high morale than those without insomnia; conversely, more of those with insomnia had very low and low morale. Soldiers with insomnia were unsure if they would choose to leave the Army before the end of their present obligation if given the option, while those without insomnia would likely stay in the Army until the end of their obligation. There was a significant difference in post-obligation Army career intentions between groups, such that those with insomnia were undecided whether to stay in the Army after their present obligation, those that did not have insomnia decided to definitely stay in the Army beyond their present obligation but not necessarily until retirement.

DISCUSSION

In a large, representative sample of active duty Army Soldiers, insomnia had global and negative associations with health, functioning, morale, and Army career intentions. Nearly

one quarter of participants met the selected DSM-5 insomnia criteria, over twice that of the estimated prevalence in the general population (Mai et al., 2008). While lower than the rate of insomnia in Veterans (Vet Advisor, 2013), results are consistent with rates reported in other studies of active duty personnel (Mysliwiec et al., 2013; Seelig et al., 2010; Taylor et al., 2016). Duration typically lasted at least 6–12 months.

Risk Factors

Consistent with prior literature (Staner et al., 2010; Taylor et al., 2016) mental health problems were robust predictors of insomnia. Stressors that challenge good sleep may be perceived to be the responsibility of and/or mitigated by soldiers' superiors, and lack of support by fellow unit members may potentiate the sleep-disturbing effects of stressors. Sleep leadership is associated with sleep quality, unit climate, morale, cohesion, and depressive symptoms (Gunia et al., 2015). Thus, open lines of communication with leaders may have benefits that extend beyond sleep characteristics and into psychosocial and emotional positives. Future research should explore characteristics of effective communication regarding insomnia prevention and management. Taken with literature on insomnia and unit cohesion (Taylor et al., 2016), results illustrate the need to further explore how unit member support may reduce insomnia risk.

While certain military duties that precipitate insomnia tend to be held by those with less education, prior research has not found strong differences in sleep problems by military occupation (Seelig et al., 2016). Poor sleep environment is the most-endorsed cause of sleep disturbance in the Army (Army Live, 2011); yet in this study, living in barracks was only very weakly associated with insomnia status. The single item measure on living quarters (barracks: yes/no) may not be sensitive enough regarding relevant environmental characteristics. Education status may be a marker of resilience or rank, both unmeasured in this study. Future research should focus on disentangling insomnia's association with education and rank.

Finally, to the extent that cigarettes are used in an attempt to cope with stress, cigarette use may represent a degree of emotional burden that can perpetuate insomnia among those with otherwise poor coping strategies. Future studies that can establish temporal precedence should investigate the interplay between cigarette use and one's perceived stress coping ability.

Correlates

Over a third of those with insomnia experienced physical and psychological consequences associated with the disorder. Compared to those without insomnia, they reported greater dysfunction in every domain examined, including quality of work on duty. This supports research connecting insomnia with daytime impairment and lower unit readiness to perform military operations (Army Live, 2011). Compared to those without insomnia, nearly four times as many military soldiers with insomnia endorsed very low morale; they also had greater indecision about remaining in the Army both until the end of their present obligation and beyond.

Limitations

The data available in this study did not allow for a full determination of DSM-5 criteria for insomnia disorder (i.e., other conditions could have entirely explained participants' insomnia; duration was assessed per number of months in the past year that participants had insomnia, rather than three months or longer). Therefore, insomnia as it was assessed in this study may represent either a full disorder or subthreshold symptoms. However, a strength of the study is that the measure used to form the insomnia status variable was more comprehensive and closer to DSM-5 than prior large-scale studies on active duty U.S. military personnel; future studies should include procedures to account for full DSM-5 criteria.

Temporal precedence of insomnia onset and risk factors could not be established. Similarly, there was variation in time frames for items analyzed in our regression model (e.g., cigarette usage in the past 30 days and insomnia present for months/years). It is possible that some risk factors may represent consequences of insomnia, and vice versa; future longitudinal research should explore the possible cyclical nature of such factors. Finally, results suggest that the relation between insomnia and morale should be further probed; multiple-item measures should be used to more fully define this construct.

Of note, only a limited number of participants responded to certain questions (e.g., coping with stress since deployment, leaving the Army prior to the end of their obligation). Therefore, while measures were taken to recruit a sample representative of the active duty U.S. Army, results may not generalize to all soldiers due to incomplete responses on the survey or nonparticipation due to conflicting duty assignments. Due to the nature of the survey, data were unavailable on the degree of functional impairment due to sleep problems among individuals with sleep problems two nights or less per week. Finally, this survey was not anonymous; although participants were informed of confidentiality protections, there could have been a bias toward underreporting. Although we cannot rule out this possibility, even in this sample, insomnia was consistently associated with poorer functioning and career retention indicators.

Conclusions

In this large sample of active duty U.S. Army Soldiers, the prevalence of insomnia was over twice that of the general population with negative associations with functioning, morale, and Army career intentions. Within the context of existing literature, insomnia is consistently linked to a wide array of negative factors, including soldier's readiness and ability to successfully perform military operations; these factors may be particularly important for military retention and decisions to discontinue military careers. Considering evidence that treating insomnia can improve physical and mental health (Karlin et al., 2013; Kyle et al., 2010; Taylor et al., 2014), education on evidence-based insomnia prevention strategies and opportunities to practice healthy sleep patterns are needed. While it is recommended that sleep hygiene be incorporated into Basic Combat Training, it is unclear how consistently these practices are implemented (Army Live, 2011). Results underscore the importance of stress coping education and longitudinal research to determine whether ability to cope with stress after deployment contributes to or is a result of insomnia (or both). While mental

illness was a strong correlate of insomnia and could identify those at greatest risk, it is important to consider that within military culture, self-identifying as a Soldier with a mental health disorder may have negative occupational consequences (Brown et al., 2016). Therefore, open lines of communication with leaders and advocacy for insomnia prevention and treatment are warranted.

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Table 1

Sample characteristics by insomnia status

	Insomnia	No Insomnia	Z or X ²	df	p	ES [†]
	<i>n/N (%) or Median (Interquartile Range)</i>	<i>n/N (%) or Median (Interquartile Range)</i>				
Age (years)	27.00 (23.00 to 32.00)	27.00 (23.00 to 33.00)	Z = -2.81		<0.01	-0.02
Sex:			X ² = 51.39	1	<0.001	<0.05
Male	4,134/4,845 (85.33%)	14,656/16,449 (89.10%)				
Female	711/4,845 (14.67%)	1,793/16,449 (10.90%)				
Highest Education ¹			X² = -16.70	1	<0.001	0.12
<i>High school or GED²</i>	428/4,846 (8.83%)	887/16,415 (5.40%)				
<i>Some post-high school</i>	3,443/4,846 (71.05%)	10,513/16,415 (64.05%)				
Associates degree	482/4,846 (9.95%)	1,692/16,415 (10.31%)				
<i>4-year college</i>	378/4,846 (7.80%)	2,388/16,415 (14.55%)				
<i>Post-Baccalaureate</i>	115/4,846 (2.37%)	935/16,415 (5.70%)				
Race ¹			X ² = 33.53	6	<0.001	0.04
<i>White</i>	3,157/4,780 (66.05%)	11,055/16,251 (68.03%)				
Black	760/4,780 (15.90%)	2,493/16,251 (15.34%)				
<i>Asian</i>	115/4,780 (2.41%)	547/16,251 (3.37%)				
<i>American Indian/Alaskan Native</i>	72/4,780 (1.51%)	185/16,251 (1.14%)				
Pacific Islander	51/4,780 (1.07%)	157/16,251 (0.97%)				
<i>Multiracial</i>	242/4,780 (5.06%)	628/16,251 (3.86%)				
Other	383/4,780 (8.01%)	1,186/16,251 (7.30%)				
Hispanic	2,510/4,792 (15.43%)	732/16,270 (15.28%)	X ² = 37.16	1	0.80	0.04
Residence in barracks	975/3,627 (26.88%)	3,918/12,450 (31.47%)	X ² = 27.93	1	<0.001	0.04
Months with unit			X ² = 41.40	1	<0.001	0.06
12 or less	1,033/2,863 (36.08%)	4,683/10,959 (42.73%)				
Greater than 12	1,830/2,863 (63.92%)	6,276/10,959 (57.27%)				
Number of deployments to peacekeeping mission or combat theatre			X ² = 55.40	2	<0.001	0.06

	Insomnia <i>n/N (%) or Median (Interquartile Range)</i>	No Insomnia <i>n/N (%) or Median (Interquartile Range)</i>	Z or X²	df	p	ES[†]
None	98/4,061 (24.18%)	4,225/13,997 (30.19%)				
1-5	<i>2,905/4,061 (71.53%)</i>	<i>9,205/13,997 (65.76%)</i>				
5 or more	<i>174/4,061 (4.28%)</i>	<i>567/13,997 (4.05%)</i>				

Note. Bold text indicates both a statistically significant difference between groups after Bonferroni correction and an effect size of at least a small magnitude. Ethnicity is coded independently of race as Hispanic/Non-Hispanic.

[†] ES=Effect Size (Phi or r); 0.10 = small effect, 0.30 = medium effect, and 0.50 = large effect.

¹ Test statistic represents omnibus test; subcategories are italicized if frequencies are significantly different between those with and without insomnia per a post-hoc 2x2 (race category y/n by insomnia y/n) X² at p<0.05.

² GED refers to passing the general educational development tests to earn high school equivalency credential.

Table 2
Cigarettes, Caffeinated, Energy, and Alcohol Drinks per Day in Past 30 Days

	Insomnia		No Insomnia		Z	p	ES [†]
	Median (Interquartile Range)	n/N (%)	Median (Interquartile Range)	n/N (%)			
Cigarettes (#/day)	3 (1-5)		2 (1-4)		-20.18	<0.001	-0.14
		n/N (%)		n/N (%)			
1=None	1,715/4,720 (36.33%)		7,646/15,931 (47.99%)				
2=1-2	489/4,720 (10.36%)		2,143/15,931 (13.45%)				
3=3-5	601/4,720 (12.73%)		2,083/15,931 (13.08%)				
4=6-10	708/4,720 (15.00%)		1,937/15,931 (12.16%)				
5=11-20	746/4,720 (15.81%)		1,506/15,931 (9.45%)				
6=21-30	284/4,720 (6.02%)		362/15,931 (2.27%)				
7=31 or more	177/4,720 (3.75%)		254/15,931 (1.59%)				
	Median (Interquartile Range)		Median (Interquartile Range)		Z	p	ES[†]
Caffeinated Drinks (#/day)	2 (2-3)		2 (2-3)		-12.81	<0.001	-0.09
		n/N (%)		n/N (%)			
1=None	486/4,503 (10.79%)		1,931/14,706 (13.13%)				
2=1-2	2,232/4,503 (49.57%)		8,555/14,706 (58.17%)				
3=3-5	1,114/4,503 (24.74%)		2,696/14,706 (18.33%)				
4=6-10	245/4,503 (5.44%)		549/14,706 (3.73%)				
5=11-20	112/4,503 (2.49%)		278/14,706 (1.89%)				
6=21-30	131/4,503 (2.91%)		312/14,706 (2.12%)				
7=31 or more	183/4,503 (4.06%)		385/14,706 (2.62%)				
	Median (Interquartile Range)		Median (Interquartile Range)		Z	p	ES[†]
Energy Drinks (#/day)	2 (2-2)		2 (1-2)		-12.27	<0.001	-0.09
		n/N (%)		n/N (%)			
1=None	898/4,248 (2.14%)		3,699/13,757 (26.89%)				
2=1-2	2,521/4,248 (59.35%)		8,465/13,757 (61.53%)				
3=3-5	449/4,248 (10.57%)		826/13,757 (6.00%)				

4=6-10	105/4,248 (2.47%)	192/13,757 (1.40%)			
5=11-20	70/4,248 (1.65%)	155/13,757 (1.13%)			
6=21-30	65/4,248 (1.53%)	103/13,757 (0.75%)			
7=31 or more	140/4,248 (3.30%)	317/13,757 (2.30%)			
	Median (Interquartile Range)	Median (Interquartile Range)	Z	P	ES[†]
Alcohol Drinks (#/day)	2 (1-3)	2 (1-3)	-9.01	<0.001	-0.07
	<i>n/N (%)</i>	<i>n/N (%)</i>			
1=None	1,554/4,187 (37.11%)	5,747/13,758 (41.77%)			
2=1-2	1,201/4,187 (28.68%)	4,341/13,758 (31.55%)			
3=3-5	718/4,187 (17.15%)	2,185/13,758 (15.88%)			
4=6-10	395/4,187 (9.43%)	881/13,758 (6.40%)			
5=11-20	150/4,187 (3.58%)	263/13,758 (1.91%)			
6=21-30	57/4,187 (1.36%)	65/13,758 (0.47%)			
7=31 or more	112/4,187 (2.67%)	276/13,758 (2.01%)			

Note: Bold text indicates both a statistically significant difference between groups after Bonferroni correction and an effect size of at least a small magnitude.

[†]ES=Effect Size (r); 0.10 = small effect, 0.30 = medium effect, and 0.50 = large effect

Table 3

Mental health and social support

	Insomnia	No Insomnia	Z	p	ES [†]
	Median (Interquartile Range)	Median (Interquartile Range)			
# Current Mental Health Disorders	1 (0-2)	0 (0-0)	-65.46	<0.001	-0.45
# Lifetime Mental Health Disorders	4 (2-6)	1 (0-2)	-63.83	<0.001	-0.45
	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES [†]
I can rely on other members of unit for help if needed¹	4 (2-4)	4 (3-5)	-31.71	<0.001	-0.23
	<i>n/N</i> (%)	<i>n/N</i> (%)			
1=Strongly disagree	504/4,163 (12.11%)	406/15,407 (2.64%)			
2=Disagree	553/4,163 (13.28%)	839/15,407 (5.45%)			
3=Neither agree nor disagree	981/4,163 (23.56%)	2,631/15,407 (14.08%)			
4=Agree	1,416/4,163 (34.01%)	6,530/15,407 (42.38%)			
5=Strongly agree	709/4,163 (17.03%)	5,001/15,407 (32.46%)			
	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES [†]
I can open up and talk to first line leaders for help if needed¹	3 (2-4)	4(3-5)	-31.35	<0.001	-0.22
	<i>n/N</i> (%)	<i>n/N</i> (%)			
1=Strongly disagree	706/4,151 (17.01%)	703/15,379 (4.57%)			
2=Disagree	565/4,151 (13.61%)	1,030/15,379 (6.70%)			
3=Neither agree nor disagree	863/4,151 (20.79%)	2,468/15,379 (16.05%)			
4=Agree	1,234/4,151 (29.73%)	5,854/15,379 (38.06%)			
5=Strongly agree	783/4,151 (18.86%)	5,324/15,379 (34.62%)			
	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES [†]
I respect the Non-Commissioned Officers in my unit¹	3 (3-4)	4 (3-5)	-39.54	<0.001	-0.23
	<i>n/N</i> (%)	<i>n/N</i> (%)			
1=Strongly disagree	551/4,146 (13.29%)	507/15,370 (3.29%)			
2=Disagree	482/4,146 (11.63%)	827/15,370 (5.38%)			
3=Neither agree nor disagree	1,131/4,146 (27.28%)	2,929/15,370 (19.06%)			
4=Agree	1,280/4,146 (30.87%)	6,111/15,370 (39.76%)			

5=Strongly agree	702/4,146 (16.93%)	4,996/15,370 (32.50%)	Z	p	ES [†]
I respect the Commissioned Officers in my unit¹	3 (3-4)	4 (3-5)	-30.08	<0.001	-0.22
	<i>n/N (%)</i>	<i>n/N (%)</i>			
1=Strongly disagree	559/4,135 (13.52%)	559/15,360 (3.64%)			
2=Disagree	441/4,135 (10.67%)	791/15,360 (5.15%)			
3=Neither agree nor disagree	1,145/4,135 (27.69%)	3,054/15,360 (19.88%)			
4=Agree	1,309/4,135 (31.66%)	6,202/15,360 (40.38%)			
5=Strongly agree	681/4,135 (16.47%)	4,754/15,360 (30.95%)			
	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES[†]
My leaders take a personal interest in the well-being of all unit Soldiers¹	3 (2-4)	4 (3-5)	-34.28	<0.001	-0.25
	<i>n/N (%)</i>	<i>n/N (%)</i>			
1=Strongly disagree	933/4,135 (22.56%)	1,031/15,362 (6.71%)			
2=Disagree	668/4,135 (16.15%)	1,348/15,362 (8.77%)			
3=Neither agree nor disagree	1,125/4,135 (27.21%)	3,673/15,362 (23.91%)			
4=Agree	887/4,135 (21.45%)	5,361/15,362 (34.90%)			
5=Strongly agree	522/4,135 (12.62%)	3,949/15,362 (25.71%)			
	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES[†]
Supportive leader behaviors²	12.00 (9.00-14.00)	14.00 (12.00-17.00)	-37.55	<0.001	-0.27

Note. Bold text indicates both a statistically significant difference between groups after Bonferroni correction and an effect size of at least a small magnitude.

[†]ES=Effect Size (r); 0.10 = small effect, 0.30 = medium effect, and 0.50 = large effect

²Responses on a composite measure of frequency supportive leader behaviors, with total possible scores ranging from 4 to 20, where higher scores indicate more frequent supportive behaviors

Table 4

Logistic regression analysis of biopsychosocial variables on insomnia status (n=18,416)

	Insomnia Status (no=1/yes=2)			
Overall Model	<i>Nagelkerke R² = .36</i>			
Variable	β (SE)	Wald Test	p	OR (95% CI)
Highest education¹		41.25	<0.001	
High school or GED	0.64 (0.15)	18.58	<0.001	1.90 (1.42–2.54)
Some post-high school	0.54 (0.12)	18.73	<0.001	1.71 (1.34–2.19)
Associates degree	0.44 (0.14)	9.99	<0.005	1.55 (1.18–2.03)
4-year college	0.18 (0.14)	1.79	0.18	1.20 (0.92–1.58)
# Current Mental Health Disorders	0.55 (0.03)	328.39	<0.001	1.74 (1.64–1.85)
I can rely on unit members for help if needed²		15.15	<0.005	
Strongly disagree	0.48 (0.13)	13.81	<0.001	1.61 (1.25–2.07)
Disagree	0.20 (0.11)	3.73	0.05	1.22 (1.00–1.50)
Neither agree nor disagree	0.09 (0.09)	0.96	0.33	1.09 (0.92–1.29)
Agree	0.08 (0.08)	0.97	0.33	1.08 (0.93–1.25)
I can open up and talk to my first line leaders for help if needed²		15.61	<0.005	
Strongly disagree	0.41 (0.12)	12.39	<0.001	1.50 (1.20–1.88)
Disagree	0.28 (0.10)	7.25	<0.01	1.32 (1.08–1.61)
Neither agree nor disagree	0.22 (0.09)	6.10	<0.05	1.25 (1.05–1.48)
Agree	0.10 (0.09)	1.54	0.22	1.10 (0.95–1.29)
# Lifetime Mental Health Disorders	0.26 (0.01)	513.80	<0.001	1.30 (1.27–1.33)
I respect my unit commissioned officers²		5.13	0.28	
Strongly disagree	0.25 (0.13)	3.87	0.05	1.29 (1.00–1.66)
Disagree	0.11 (0.12)	0.82	0.37	1.11 (0.88–1.40)
Neither agree nor disagree	0.03 (0.10)	0.10	0.76	1.03 (0.85–1.25)
Agree	0.07 (0.09)	0.56	0.46	1.07 (0.89–1.28)
Leaders take personal interest in well-being of all unit Soldiers²		8.29	0.08	
Strongly disagree	0.20 (0.13)	2.20	0.14	1.22 (0.94–1.57)
Disagree	0.17 (0.12)	2.03	0.15	1.18 (0.94–1.48)
Neither agree nor disagree	0.02 (0.10)	0.04	0.84	1.02 (0.84–1.25)
Agree	–0.06 (0.09)	0.37	0.55	0.95 (0.79–1.13)
I respect my unit non-commissioned officers²		1.75	0.78	
Strongly disagree	–0.01 (0.14)	<0.01	0.97	0.10 (0.76–1.31)
Disagree	0.06 (0.12)	0.27	0.60	1.07 (0.84–1.35)
Neither agree nor disagree	0.05 (0.10)	0.26	0.61	1.05 (0.86–1.29)
Agree	–0.03 (0.09)	0.10	0.76	0.97 (0.81–1.17)
Supportive leader behaviors³	–0.29 (0.03)	73.15	<0.001	0.75 (0.70–0.80)

	Insomnia Status (no=1/yes=2)			
Overall Model	<i>Nagelkerke R² = .36</i>			
Variable	β (SE)	Wald Test	p	OR (95% CI)
Cigarettes (#/day)⁴		43.46	<0.001	
None	-0.43 (0.14)	9.59	<0.005	0.65 (0.49–0.85)
1–2	-0.40 (0.15)	7.22	<0.01	0.67 (0.50–0.90)
3–5	-0.33 (0.15)	5.12	<0.05	0.72 (0.54–0.96)
6–10	-0.25 (0.15)	2.90	0.09	0.78 (0.58–1.04)
11–20	-0.14 (0.15)	0.92	0.34	0.87 (0.65–1.16)
21–30	0.13 (0.17)	0.58	0.45	1.14 (0.81–1.61)

Note. OR=odds ratio; 95% CI=95% confidence interval; Bold text indicates an effect size of at least a small magnitude (odds ratios of 0.70 or lower or 1.5 or greater are comparable to a small effect size [Cohen's d of .20]; Borenstein, Hedges, Higgins, & Rothstein, 2009)

¹ Post-Baccalaureate degree is the reference; GED refers to passing the general educational development tests to earn high school equivalency credential

² Strongly agree is the reference

³ Higher scores indicate more supportive leadership behaviors

⁴ Smoking 31 or more cigarettes per day is the reference

Table 5

Functioning, Morale, and Army Career Aspirations

	Insomnia		No Insomnia		Z	p	ES [†]
	Median (Interquartile Range)	n/N (%)	Median (Interquartile Range)	n/N (%)			
Frequency of functional problems (in past 30 days):							
Feeling restless/tense	3 (2-4)		2 (1-2)		-66.75	<0.001	-0.46
	<i>n/N (%)</i>		<i>n/N (%)</i>				
1=None of the time	522/4,862 (10.74%)		7,961/16,475 (48.32%)				
2=A little of the time	806/4,862 (16.58%)		4,502/16,475 (27.33%)				
3=Some of the time	1,358/4,862 (27.93%)		2,910/16,475 (17.66%)				
4=Most of the time	1,372/4,862 (28.22%)		927/16,475 (5.63%)				
5=All or almost all of the time	804/4,862 (16.54%)		175/16,475 (1.06%)				
Frequency of functional problems (in past 30 days):							
Poor appetite/overeating	3 (2-4)		1 (1-2)		-64.29	<0.001	-0.44
	<i>n/N (%)</i>		<i>n/N (%)</i>				
1=None of the time	833/4,866 (17.12%)		9,705/16,492 (58.85%)				
2=A little of the time	867/4,866 (17.82%)		3,542/16,492 (21.48%)				
3=Some of the time	1,245/4,866 (25.59%)		2,217/16,492 (13.44%)				
4=Most of the time	1,154/4,866 (23.72%)		801/16,492 (4.86%)				
5=All or almost all of the time	767/4,866 (15.76%)		227/16,492 (1.38%)				
Frequency of functional problems (in past 30 days):							
Memory problems	3 (2-4)		1 (1-2)		-57.27	<0.001	-0.36
	<i>n/N (%)</i>		<i>n/N (%)</i>				
1=None of the time	884/4,860 (18.19%)		9,052/16,488 (54.90%)				
2=A little of the time	1,025/4,860 (21.09%)		4,036/16,488 (24.48%)				
3=Some of the time	1,353/4,860 (27.84%)		2,392/16,488 (14.51%)				
4=Most of the time	984/4,860 (20.25%)		786/16,488 (4.77%)				
5=All or almost all of the time	614/4,860 (12.63%)		222/16,488 (1.35%)				
Frequency of functional problems (in past 30 days):							
Difficulty concentrating	3 (2-4)		1 (1-2)		-65.97	<0.001	-0.45

	<i>n/N</i> (%)	<i>n/N</i> (%)	<i>n/N</i> (%)	Z	p	ES [†]
1=None of the time	562/4,856 (11.57%)	8,356/16,464 (50.75%)				
2=A little of the time	935/4,856 (19.25%)	4,545/16,464 (27.61%)				
3=Some of the time	1,544/4,856 (31.80%)	2,737/16,464 (16.62%)				
4=Most of the time	1,189/4,856 (24.49%)	679/16,464 (4.12%)				
5=All or almost all of the time	626/4,856 (12.89%)	147/16,464 (0.89%)				
Frequency of functional problems (in past 30 days):						
Irritability						
	3 (2-4)	1 (1-3)		-65.52	<0.001	-0.45
	<i>n/N</i> (%)	<i>n/N</i> (%)				
1=None of the time	274/4,861 (5.64%)	5,384/16,473 (32.68%)				
2=A little of the time	489/4,861 (10.06%)	4,610/16,473 (27.99%)				
3=Some of the time	1,442/4,861 (29.66%)	4,623/16,473 (28.06%)				
4=Most of the time	1,679/4,861 (34.54%)	1,542/16,473 (9.36%)				
5=All or almost all of the time	977/4,861 (20.10%)	314/16,473 (1.91%)				
Frequency of functional problems (in past 30 days):						
Tired out/low energy						
	4 (3-5)	2 (1-3)		-73.86	<0.001	-0.51
	<i>n/N</i> (%)	<i>n/N</i> (%)				
1=None of the time	113/4,868 (2.32%)	4,140/16,512 (25.07%)				
2=A little of the time	354/4,868 (7.27%)	5,639/16,512 (34.15%)				
3=Some of the time	1,296/4,868 (26.62%)	4,707/16,512 (28.51%)				
4=Most of the time	1,771/4,868 (36.38%)	1,666/16,512 (10.09%)				
5=All or almost all of the time	1,334/4,868 (27.40%)	360/16,512 (2.18%)				
Frequency of functional problems (in past 30 days):						
Easily fatigued						
	3 (2-4)	1 (1-2)		-72.66	<0.001	-0.50
	<i>n/N</i> (%)	<i>n/N</i> (%)				
1=None of the time	470/4,866 (9.66%)	8,676/16,493 (52.60%)				
2=A little of the time	892/4,866 (18.33%)	4,663/16,493 (28.27%)				
3=Some of the time	1,377/4,866 (28.30%)	2,284/16,493 (13.85%)				
4=Most of the time	1,274/4,866 (26.18%)	708/16,493 (4.29%)				
5=All or almost all of the time	853/4,866 (17.53%)	162/16,493 (0.98%)				

Frequency of functional problems (in past 30 days):	Median (Interquartile Range)	Z	p	ES [†]
Talking/moving more slowly than usual	1 (1–2)	-59.54	<0.001	-0.41
	<i>n/N</i> (%)			
1=None of the time	1,447/4,847 (29.85%)			
2=A little of the time	1,345/4,847 (27.75%)			
3=Some of the time	1,140/4,847 (23.52%)			
4=Most of the time	588/4,847 (12.13%)			
5=All or almost all of the time	327/4,847 (6.75%)			
Degree to which physical, mental, and substance use problems interfere with functioning in (in past 30 days):	Median (Interquartile Range)	Z	p	ES[†]
Home management	3 (2–5)	-52.48	<0.001	-0.36
	<i>n/N</i> (%)			
0=No interference	1,831/4,843 (37.81%)			
1,2,3=Mild interference	1,250/4,843 (25.81%)			
4,5,6=Moderate interference	1,258/4,843 (25.98%)			
7,8,9=Severe interference	412/4,843 (8.51%)			
10=Very severe interference	92/4,843 (1.90%)			
Degree to which physical, mental, and substance use problems interfere with functioning in (in past 30 days):	Median (Interquartile Range)	Z	p	ES[†]
Quality of work on duty	3 (0–5)	-57.85	<0.001	-0.40
	<i>n/N</i> (%)			
0=No interference	1,403/4,851 (28.92%)			
1,2,3=Mild interference	1,350/4,851 (27.83%)			
4,5,6=Moderate interference	1,348/4,851 (27.79%)			
7,8,9=Severe interference	575/4,851 (11.85%)			
10=Very severe interference	175/4,851 (3.61%)			
Degree to which physical, mental, and substance use problems interfere with functioning in (in past 30 days):	Median (Interquartile Range)	Z	p	ES[†]
Social life	3 (0–6)	-59.05	<0.001	-0.41
	<i>n/N</i> (%)			
0=No interference	1,426/4,839 (29.47%)			

1,2,3=Mild interference	1,153/4,839 (23.83%)	3,327/16,396 (20.29%)			
4,5,6=Moderate interference	1,307/4,839 (27.01%)	1,254/16,396 (7.66%)			
7,8,9=Severe interference	745/4,839 (15.40%)	308/16,396 (1.89%)			
10=Very severe interference	208/4,839 (4.30%)	85/16,396 (0.52%)			
Degree to which physical, mental, and substance use problems interfere with functioning in (in past 30 days):	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES[†]
Close personal relationships	4 (0-6)	0 (0-1)	-59.25	<0.001	-0.40
	<i>n/N (%)</i>	<i>n/N (%)</i>			
0=No interference	1,287/4,844 (26.57%)	10,920/16,400 (66.59%)			
1,2,3=Mild interference	1,080/4,844 (22.30%)	3,460/16,400 (21.10%)			
4,5,6=Moderate interference	1,283/4,844 (26.49%)	1,451/16,400 (8.85%)			
7,8,9=Severe interference	881/4,844 (18.19%)	453/16,400 (2.76%)			
10=Very severe interference	313/4,844 (6.46%)	116/16,400 (0.71%)			
	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES[†]
Ability to cope with stress since deployment[†]	4 (2-5)	2 (1-4)	-25.64	<0.001	-0.21
	<i>n/N (%)</i>	<i>n/N (%)</i>			
1=A lot better	605/3,534 (17.12%)	3,713/11,887 (31.24%)			
2=Somewhat better	554/3,534 (15.68%)	2,271/11,887 (19.10%)			
3=A little better	540/3,534 (15.28%)	1,662/11,887 (13.98%)			
4=No difference	933/3,534 (26.40%)	3,563/11,887 (29.97%)			
5=A little worse	349/3,534 (9.88%)	431/11,887 (3.63%)			
6=Somewhat worse	309/3,534 (8.74%)	193/11,887 (1.62%)			
7=A lot worse	244/3,534 (6.90%)	54/11,887 (0.45%)			
	Median (Interquartile Range)	Median (Interquartile Range)	Z	p	ES[†]
How would you rate your morale	3 (2-3)	3 (3-4)	35.73	<0.001	0.26
	<i>n/N (%)</i>	<i>n/N (%)</i>			
1=Very low	794/4112 (19.31%)	754/15,220 (4.95%)			
2=Low	989/4112 (24.05%)	2,030/15,220 (13.34%)			
3=Medium	1,455/4112 (35.38%)	5,416/15,220 (35.58%)			
4=High	566/4112 (13.76%)	4,753/15,220 (31.23%)			

5=Very high	308/4112 (7.49%)	2,267/15,220 (14.89%)	Z	p	ES [†]
Which best describes your Army career intentions	3 (1-5)	4 (3-6)	26.26	<0.001	0.18
	<i>n/N (%)</i>	<i>n/N (%)</i>			
1=Will definitely leave Army after present obligation	1,460/4,852 (30.09%)	2,088/16,445 (29.70%)			
2=Will probably leave Army after present obligation	534/4,852 (11.01%)	1,533/16,445 (9.32%)			
3=Undecided whether will stay in Army after present obligation	919/4,852 (18.94%)	3,380/16,445 (20.55%)			
4=Will definitely stay in Army beyond present obligation but not necessarily until retirement	337/4,852 (6.95%)	1,478/16,445 (8.99%)			
5=Will probably stay in Army until retirement	674/4,852 (13.89%)	2,995/16,445 (18.21%)			
6=Will definitely stay in Army until retirement	928/4,852 (19.13%)	4,971/16,445 (30.23%)			
	3 (2-4)	2 (1-3)	-18.07	<0.001	-0.20
If given the option, would you leave the Army before the end of your present obligation²	<i>n/N (%)</i>	<i>n/N (%)</i>			
1=Definitely would not leave	370/1,608 (23.00%)	2,495/6,464 (38.60%)			
2=Probably would not leave	284/1,608 (17.66%)	1,595/6,464 (24.68%)			
3=Undecided	361/1,608 (22.45%)	1,268/6,464 (19.62%)			
4=Probably would leave	248/1,608 (15.42%)	626/6,464 (9.68%)			
5=Definitely would leave	345/1,608 (21.46%)	480/6,464 (7.43%)			

Note. Bold text indicates both a statistically significant difference between groups after Bonferroni correction and an effect size of at least a small magnitude.

[†]ES=Effect Size (r); 0.10 = small effect, 0.30 = medium effect, and 0.50 = large effect

¹This item was asked only of participants who had deployed

²This item was included in one administration version of the survey to a subset of participants