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https://doi.org/10.5664/jcsm.8444

The Relationship Between Military Occupation and Diagnosed Insomnia Following Combat Deployment

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Disclosure Statement: All authors have seen and approved the manuscript. The authors report no conflicts of interest.

Number of tables: 3

Number of figures: 1

Number of supplement tables: 1

Abstract word count: 215

Brief summary word count: 71

Manuscript word count: 2,934

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Report No. 19-71 was supported by the U.S. Navy Bureau of Medicine and Surgery under work unit no. 60808. The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government.

The study protocol was approved by the Naval Health Research Center Institutional Review Board in compliance with all applicable Federal regulations governing the protection of human subjects. Research data were derived from an approved Naval Health Research Center Institutional Review Board protocol, number NHRC.2003.0025.

ABSTRACT

Study Objectives: Our objective was to investigate the relationship between military occupation and diagnosed insomnia following combat deployment.

Methods: This retrospective cohort study was conducted using existing electronic military databases. Eligible participants were military personnel with a deployment to Iraq, Afghanistan, or Kuwait between 2005 and 2009. A total of 66,869 US Navy and Marine Corps service members comprised the study sample and were categorized by military occupation. Military medical databases were used to abstract information on insomnia diagnoses and prescription medications.

Results: The overall prevalence of diagnosed insomnia was 3.4%. In multivariable logistic regression, law enforcement (odds ratio [OR] = 1.62, 95% confidence interval [CI] = 1.28–2.04), motor transport (OR = 1.38, 95% CI = 1.14–1.66), and healthcare occupations (OR = 2.24, 95% CI = 1.85–2.71) had significantly higher odds of an insomnia diagnosis following deployment than infantry occupations. These results remained unchanged after excluding those who reported posttraumatic stress disorder symptoms. Non-benzodiazepine sedative/hypnotics were prescribed for 44.2% of those with insomnia, and prescription patterns differed by occupation.

Conclusions: These results suggest that military occupation may play a primary role in the onset and management of insomnia. The findings provide rationale for targeting individuals in insomnia-susceptible occupations with better methods to prevent and/or minimize sleep issues during and after combat deployment.

Keywords: hypnotic; insomnia; military; occupation; sedative

BRIEF SUMMARY

Current Knowledge/Study Rationale: The rate of insomnia increased significantly in the military during the post-9/11 conflicts in Iraq and Afghanistan. The role of military occupation in the diagnosis and treatment of insomnia has not been previously explored.

Study Impact: The results highlight that military occupation may have a role in the diagnosis and treatment of insomnia. This could lead to occupation-specific interventions to target improvements in sleep that enhance military readiness.

INTRODUCTION

Difficulty sleeping is a common occurrence, with more than half of adults in the United States reporting one or more current symptoms of insomnia.[1] Both short- and long-term sleep loss are associated with a wide range of health consequences and present a significant public health concern.[2] Due to the nature of military operations, obtaining sufficient sleep may be additionally challenging, thus, sleep disorders may be exacerbated in this community. Initial studies from Operations Iraqi and Enduring Freedom identified significant levels of insufficient sleep during, immediately after, and up to 1 year following a combat deployment.[3–6] Moreover, medical surveillance data indicate that during the years 2001–2009, insomnia rates increased for all military branches.[7] Insomnia may also increase the risk of psychiatric disorders, as Wang and colleagues evaluated three brigade combat teams that deployed to Afghanistan and found that insomnia prior to deployment contributed to postdeployment posttraumatic stress disorder (PTSD) and suicidal ideation.[8]

Little is known regarding the role of military occupation in the development of insomnia. During a combat deployment, occupations can vary significantly. Infantry personnel have the primary role of directly engaging the enemy and are exposed to the rigors of combat, which can lead to PTSD and sleep problems.[3,9,10] Other occupations, such as healthcare personnel, may have irregular work schedules, reflecting the need for these capabilities to be available 24 hours a day. In civilian populations, the prevalence of insomnia has been reported to be higher in occupations with shift work.[11] Insufficient sleep can be an occupational health hazard; it increases the risk of motor vehicle accidents, medical-related errors, and mishaps.[11–14] Over half of respondents to a military survey reported that sleep problems interfered with their work.[15]

Identification of high-risk occupations may help direct future preventive strategies and insomnia treatment efforts.

Although sleep medications are the frontline therapy for acute insomnia and commonly prescribed in theater,[15] successful management of insomnia requires targeted evaluation and treatment strategies. The American Academy of Sleep Medicine and American College of Physicians both recommend cognitive behavioral therapy (CBT) as the primary intervention for chronic insomnia.[16,17] Sleep medications can have side effects that may be undesirable and can further exacerbate insomnia. Possible side effects of sleep medications can also impact operational performance and readiness, and include parasomnias, dizziness, anxiety, drowsiness, depression, disinhibition, impaired decision-making, and problems with attention and concentration.[18] Specific work duties may increase the risk of a mishap or accident from these side effects, making the prescribing patterns by occupation a potentially relevant area to investigate.

Civilian literature suggests that insomnia rates may be higher in certain occupations,[19,20] though no study to date has specifically assessed the prevalence of insomnia within military occupations. This information may help to identify groups in need of focused intervention. Further, knowledge of medication treatment patterns by occupation may inform future clinical practice guidelines and improve education within susceptible military occupations. Therefore, the aims of this study were to (1) determine the prevalence of insomnia by military occupation, (2) identify specific occupations at increased odds of insomnia after adjusting for demographic and deployment-related characteristics, and (3) determine the patterns of sleep medication use across occupations.

METHODS

Study Sample and Data Sources

The study sample was identified from electronic deployment records maintained by the Defense Manpower Data Center (DMDC). Eligible for the study were US Navy and Marine Corps enlisted personnel with a deployment to Iraq, Afghanistan, or Kuwait between January 2005 and December 2009. For those with more than one deployment during this time period, only the most recent deployment was used. For inclusion, deployment length had to be greater than 30 days, but less than 18 months, and all personnel needed to have completed a Post-Deployment Health Assessment (PDHA). The PDHA is a health screening questionnaire given to military personnel at the end of deployment that asks a variety of questions regarding the service member's physical and mental health, as well as queries them about specific deployment-related exposures. The PDHA was instituted in 2003 and a revised PDHA was implemented in 2008.[21] After excluding those with a previous sleep or mental health disorder, the final study sample consisted of 66,869 military personnel. This protocol received approval from the Institutional Review Board at Naval Health Research Center.

Occupation Classification

Occupation was identified from DMDC records using the Department of Defense Occupational Conversion Index. Nine categories were defined: infantry, equipment repair, law enforcement, motor transport, healthcare, administration, intelligence, craftsworkers, and other. The equipment repair occupations included electric, mechanical, and electronic repair specialties; intelligence occupations included communications specialties; and administration occupations included other functional support personnel.

Demographic and Deployment-Related Variables

Demographic variables were identified from DMDC records and included age (18–24 years or 25 and older), service branch (Marine Corps or Navy), marital status (married or not married), and military pay grade (E1–E5 or E6–E9). Sex was also abstracted from DMDC records. Deployment length was calculated by subtracting deployment begin and end dates and was categorized based on 4th quartile and termed "longer deployment" if the deployment was greater than 213 days. Deployment location was indicated on the DMDC records as Kuwait or Iraq/Afghanistan. Previous deployment was identified as a record for deployment prior to the one of interest.

Combat exposure was classified based on three separate questions from the PDHA that query the service member on exposure to dead/wounded bodies, whether they discharged their weapon in direct combat, and whether they felt in great danger of being killed. Specific wording of these PDHA items are detailed in Table S1. Total number of positive responses to these questions was summed, and the final variable was categorized as 0, 1, or 2–3 combat exposures. PTSD was assessed in order to conduct a subgroup analysis after removing those whose insomnia may have been a consequence of their PTSD. Symptoms of PTSD were ascertained using the Primary Care PTSD Screen on the PDHA.[22] This screening instrument consists of four questions that query the service member on the four key domains of PTSD: re-experiencing, avoidance, hyperarousal, and feeling detached. The questions comprising the PTSD screening instrument are shown in Table S1. Those who answered in the affirmative to any of the four questions were classified as reporting PTSD symptoms.

Insomnia

Insomnia diagnosis was identified from electronic inpatient and outpatient medical records in the Military Health System Data Repository (MDR) within 2 years from deployment end date, and was defined as presence of an *International Classification of Diseases, Ninth Revision* (ICD-9) code of 307.41, 307.42, 327.02, 327.09, or 780.52.[23] Service members with a prior diagnosis for insomnia, other sleep disorder (ICD-9 327.20, 327.21, 327.26, 327.39, 327.51, 327.53, 347.0, 347.1, 780.50, 780.51, 780.53, 780.55, 780.57, 780.58, 780.59, 788.30, 788.36) or mental health disorder (ICD-9 290–319, excluding 305.1 tobacco addiction) were excluded from the analysis (n = 17,145).

Prescription Medications

The Pharmacy Data Transaction Service (PDTS) was used to identify Food and Drug Administration-approved sleep prescriptions within 90 days of insomnia diagnosis. Prescriptions were classified as non-benzodiazepine sedative/hypnotics, benzodiazepine sedative/hypnotics, sedative antidepressants, and melatonin receptor hypnotics. Records from PDTS were searched for a specific drug name to indicate one of these categories: (1) non-benzodiazepine sedative/hypnotics indicated by the documentation of zolpidem tartrate (Ambien), eszopiclone (Lunesta), and zaleplon (Sonata); (2) a sedative antidepressant, which included trazodone (Oleptro, Desyrel); (3) benzodiazepine sedative/hypnotics, which included triazolam (Halcion) and temazepam (Restoril); and (4) melatonin receptor hypnotics, which included ramelteon (Rozerem).

Statistical Analysis

Demographic and deployment-related variables were described for the study sample, and insomnia prevalence rates were reported both for the total sample and by occupation. Chi-square testing was used to compare insomnia prevalence across occupations. Multivariable logistic regression was used to examine the association between occupation and insomnia while adjusting for demographic and deployment-related variables. Model 1 contained occupation with demographic variables only (i.e., age, rank, service branch, and marital status), and Model 2 contained the same variables as Model 1 with deployment-related variables added (i.e., previous combat deployment, combat exposures, deployment location, and long deployment). A separate logistic regression model, Model 3, contained all the variables in Model 2, but removed personnel who reported PTSD symptoms on the PDHA. Odds ratios (ORs) and 95% confidence intervals (CIs) were reported, and all models were tested for goodness-of-fit with the Hosmer-Lemeshow test using an alpha level of 0.10. Patterns of prescription medication use within 90 days post-insomnia diagnosis were examined by occupation, and differences were tested using chi-square tests.

RESULTS

Characteristics of the study sample of 66,869 enlisted service members are shown in Table 1. The sample was primarily aged 18–24 years, junior rank (E1–E4), male, unmarried, and in the Marine Corps. Regarding the most recent deployment, 59.4% were deployed to Iraq or Afghanistan, and approximately 35% reported at least one combat exposure. Nearly one in three (30.7%) were employed in infantry occupations, followed by equipment repair (21.4%) and administration (11.1%).

Figure 1 details the prevalence of insomnia in the total sample and by occupation. Prevalence of insomnia differed significantly across occupations ($P < .001$). The overall prevalence of insomnia for the entire study population was 3.4% (2,265 of 66,869), with the highest prevalence among healthcare occupations (7.7%, 322 of 4,184). The only other occupations exceeding the sample average was law enforcement (5.4%, 90 of 1,666) and motor transport (4.3%, 143 of 3,359).

Results for multivariable logistic regression are shown in Table 2. After controlling for all demographic and deployment-related variables, service members in healthcare (OR = 2.24, 95% CI = 1.85–2.70), law enforcement (OR = 1.62, 95% CI = 1.28–2.04), and motor transport occupations (OR = 1.38, 95% CI = 1.14–1.66) had significantly higher odds of insomnia diagnosis relative to those in infantry occupations. These results remained the same after excluding 8,947 personnel who reported PTSD symptoms on the PDHA. The strongest demographic predictor was female sex (OR = 1.48, 95% CI = 1.23–1.76), and the strongest deployment-related predictor was reporting 2–3 combat exposures relative to no combat exposures (OR = 2.03, 95% CI = 1.82–2.26). All models were indicated as a good fit by the Hosmer-Lemeshow test.

Table 3 presents the results of the prescription medication analysis. Within 90 days of insomnia diagnosis, 44.2% of insomnia cases were prescribed non-benzodiazepine sedative/hypnotics, 1.2% benzodiazepine sedative hypnotics, 17.0% sedative antidepressants, and < 1% melatonin hypnotics. Patterns of prescription medication differed across occupations for non-benzodiazepine sedative/hypnotics and sedative antidepressants ($P < .001$ and $P = .005$ respectively), but not for benzodiazepine sedative hypnotics. Most notably, law enforcement personnel had the highest rate of sedative antidepressant prescription frequency (22.2%), and the

second highest rate of non-benzodiazepine sedative/hypnotic prescription frequency (52.2%). Craftsworkers had the lowest rate of non-benzodiazepine sedative/hypnotic prescription frequency (35.0%) and administration personnel had the highest (53.0%).

DISCUSSION

Insomnia is a growing concern among US military personnel. The present study found that military occupation was associated with insomnia diagnosis, with the highest rates among healthcare, law enforcement, and motor transport personnel. To the best of our knowledge, this is the first study to establish a prescription pattern for diagnosed insomnia cases in the military, and to show differences in prescribed medications across occupational groups. The results identify high-risk occupations that may benefit from targeted sleep interventions aimed at reducing the potential for lost work days, decreased job performance, and workplace accidents.

The primary finding of the present study was the increased odds of insomnia diagnosis among healthcare, law enforcement, and motor transport personnel compared with infantry. Infantry personnel, though exposed to high levels of combat, may be more resilient or less apt to present for care, possibly due to perceived stigma.[24] One study among UK military personnel showed greater concerns of perceived stigma and barriers to care among those with increased combat exposure.[25] Our finding among healthcare personnel aligns with military surveillance data showing healthcare personnel with the highest levels of insomnia.[7] Healthcare workers may have a greater realization of their own clinical symptoms, reduced stigma, and greater access to care, all of which could contribute to the higher odds of insomnia. Alternatively, it might also reflect the adverse effect of irregular work schedules, given that healthcare facilities in the field need to be staffed throughout the day and night for emergencies.[26] This may also similarly affect

motor transport and law enforcement personnel, who often may be performing their duties outside of routine work hours. A comprehensive occupational survey is needed to determine the extent to which schedule irregularities, such as shift work or longer hours, contribute to insomnia within the military population.[27,28]

The Spielman model of chronic insomnia can be used as a framework to understand the effect of occupation on insomnia in service members.[29–31] Occupational factors that occur during deployment, such as combat exposure, operational stress, and irregular work schedules, can all act as precipitating factors for acute insomnia.[15] Individuals then sometimes develop compensatory behaviors, such as excessive consumption of caffeine, energy drinks, and alcohol, that may perpetuate the problem and lead to chronic insomnia.[31] Occupation may also perpetuate insomnia if irregular or long work hours, shift work, and related insufficiencies in sleep develop into a pattern. Future research should examine modifiable factors that can curb the development of chronic insomnia among high-risk military occupations.

Just under half of those diagnosed with insomnia received a prescription for non-benzodiazepine sedative/hypnotics. In contrast, Shayegani et al. found that only 7.6% of a large cohort of veterans were prescribed zolpidem, the most prevalent of this class of medications.[32] The rate was not reported, however, for those with a diagnosis of insomnia, which explains the discordance with the present study. They also found that 77.3% of individuals with a zolpidem prescription had evidence of long-term use beyond the recommended maximum of 30 days. Future studies are needed to determine whether the same issue exists within the active duty military population, and how this might affect the safety and health of those occupations with higher prescription rates. High-risk work duties need to be considered when prescribing this class of medications because side effects can be harmful.[33–35]

This study has many implications for improving sleep quality in military service members. First, it is important to educate those in high-risk occupations about behaviors that can maintain healthy sleep resiliency and factors that interfere with restful sleep. Second, it is paramount to educate healthcare workers on screening for insomnia and other sleep disorders, and providing evidenced based treatment. There is an underutilization of CBT for insomnia (CBT-I), mainly due to a lack of trained providers and limited staff resources in military treatment facilities, especially in deployed settings.[36] Many primary care providers are not adequately screening for insomnia nor making referrals for CBT-I due to lack of knowledge and treatment beliefs.[36] Interdisciplinary collaboration is also essential because many service members with insomnia have comorbid sleep and psychiatric disorders, and successful treatment addresses both.[7] Finally, it is crucial to educate leadership on the operational imperative of promoting healthy sleep, especially by increasing awareness and reducing cultural barriers.

There were secondary findings of interest. The significantly higher odds of insomnia among women is potentially important, particularly with the recent decision to incorporate women into all military occupations.[37] Studies on sex differences in insomnia must determine whether this is a result of differences in treatment-seeking behavior or reflects a genetic predisposition to insomnia in women.[38] The association between longer deployment length is not altogether surprising, and may be the result of unplanned tour extensions. Combat exposure was strongly linked to insomnia diagnosis, though not unexpectedly, given that combat exposure is one of the stronger predictors of mental health disorders.[39] Further, the overall 3.4% prevalence rate of insomnia mirrored that of a large population of individuals receiving care through the Veterans Health Administration.[40]

The major strength of this study was the use of electronic military databases to select the study sample, which resulted in a large sample size of deployed military personnel. Additionally, linking data from the MDR allowed for the exclusion of those with previously diagnosed sleep and mental health disorders, and data from PDHAs facilitated the adjustment for combat exposure and the ability to account for PTSD symptoms.

There were also limitations of note. Using provider-diagnosed insomnia, rather than screening measures or self-report, may have underestimated the true prevalence of insomnia in this population because service members would need to present for medical care to obtain a diagnosis. As such, the lack of a formal sleep evaluation is a primary limitation of this study, and the reported prevalence of insomnia should be interpreted with caution. The information on pharmacological treatment for insomnia was based on an administrative prescription database, thus we could not confirm whether the medication was actually taken. We also could not delineate whether the prescription given was for insomnia or another comorbid condition. Further, though we were able to classify personnel by military occupation, we did not have information regarding individual duties performed, nor could we account for potential differences in healthcare utilization across occupations. Future studies are needed to address these concerns.

In conclusion, this is the first study to examine the role of military occupation on insomnia diagnosis and pharmacological treatment. The results indicate the need for sleep education and evidence-based treatments for insomnia targeted at high-risk military occupations. A comprehensive occupational survey is needed to elucidate occupation-specific etiologies of insomnia. The use of pharmacological sleep aids across the military needs to be further defined, as do potential risks of these medications on performance in the workplace. In a continued effort

to maximize military readiness, more research is needed to determine whether irregular work schedules, scope of duties, or other job-related stressors act as perpetuating factors for insomnia.

ABBREVIATIONS

CI, confidence interval

DMDC, Defense Manpower Data Center

ICD, International Classification of Diseases

MDR, Military Health System Data Repository

OR, odds ratio

PDHA, Post-Deployment Health Assessment

PDTS, Pharmacy Data Transaction Service

PTSD, posttraumatic stress disorder

ACKNOWLEDGMENTS

The authors thank the epidemiologists and data analysts in the Expeditionary Medical Outcomes Research Division at Naval Health Research Center for their assistance with this project.

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Figure 1—Insomnia prevalence rates by military occupation (n = 66,869).

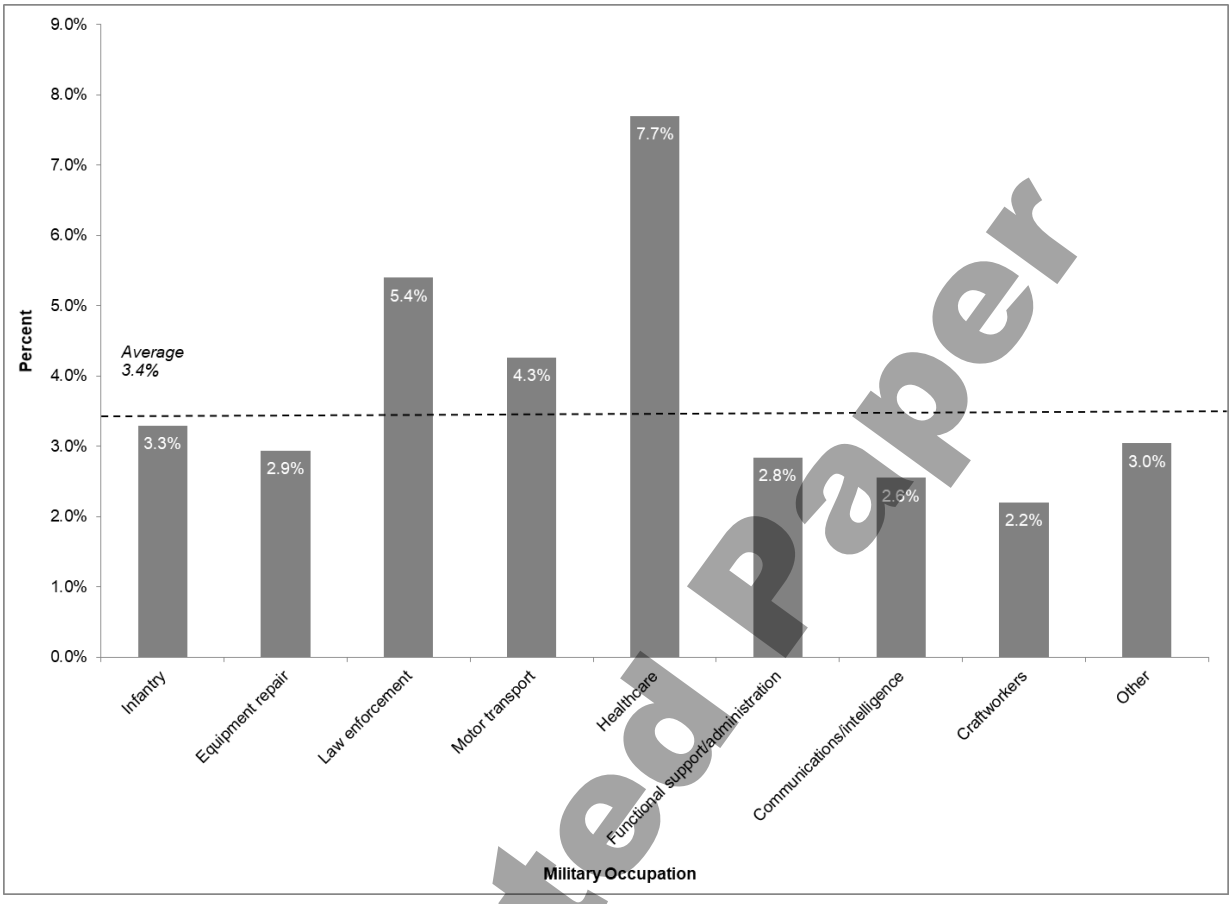

Table 1—Descriptive characteristics of the study sample (n = 66,869).

Characteristic	n	%
Age, years		
18–24	45,969	68.7
25 and older	20,900	31.3
Rank		
E1–E5	57,165	85.5
E6–E9	9,704	14.5
Service branch		
Marine Corps	52,812	79.0
Navy	14,057	21.0
Marital status		
Not married	36,766	55.0
Married	30,103	45.0
Sex		
Male	63,796	95.4
Female	3,073	4.6
Previous combat deployment		
No	39,054	58.4
Yes	27,815	41.6
Combat exposures		
0	42,961	64.3
1	12,401	18.6
2–3	11,507	17.2
Deployment location		
Kuwait	27,136	40.6
Iraq/Afghanistan	39,733	59.4
Long deployment (> 213 days)		
No	51,280	76.7
Yes	15,589	23.3
Military occupation		
Infantry	20,504	30.7
Equipment repair	14,320	21.4
Law enforcement	1,666	2.5
Motor transport	3,359	5.0
Healthcare	4,184	6.3
Administration	7,418	11.1
Intelligence	5,346	8.0
Craftsworkers	4,549	6.8
Other	5,523	8.3

Table 2—Multivariable logistic regression models, insomnia diagnosis, 2005–2009 (n = 66,869).

	Model 1		Model 2		Model 3	
Variable	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Age, years						
18–24	REF		REF		REF	
25 and older	1.02	0.91–1.15	1.02	0.91–1.15	1.02	0.89–1.17
Rank						
E1–E5	REF		REF		REF	
E6–E9	0.93	0.80–1.08	0.91	0.78–1.06	0.93	0.78–1.11
Service branch						
Marine Corps	REF		REF		REF	
Navy	1.04	0.91–1.20	1.02	0.88–1.18	0.97	0.82–1.15
Marital status						
Not married	REF		REF		REF	
Married	1.09	1.00–1.19	1.11	1.01–1.21***	1.07	0.96–1.09
Sex						
Male	REF		REF		REF	
Female	1.37	1.15–1.64*	1.48	1.23–1.76*	1.63	1.34–1.98*
Previous combat deployment						
No	–		REF		REF	
Yes			0.91	0.83–0.99***	0.91	0.82–1.01
Combat exposures						
0	–		REF		REF	
1			1.41	1.26–1.57*	1.31	1.15–1.48*
2–3			2.03	1.82–2.26*	1.50	1.29–1.73*
Deployment location						
Kuwait	–		REF		REF	
Iraq/Afghanistan			0.93	0.85–1.01	0.90	0.81–1.00
Long deployment (> 213 days)						
No	–		REF		REF	
Yes			1.24	1.12–1.36*	1.14	1.01–1.27***
Military occupation						
Infantry	REF		REF		REF	
Equipment repair	0.87	0.77–0.99	1.06	0.93–1.21	1.10	0.94–1.27
Law enforcement	1.61	1.27–2.03*	1.62	1.28–2.04*	1.58	1.19–2.11**
Motor transport	1.29	1.07–1.55**	1.38	1.14–1.66*	1.50	1.20–1.86*
Healthcare	2.26	1.87–2.74*	2.24	1.85–2.70*	2.37	1.88–2.97*
Administration	0.82	0.70–0.96***	0.96	0.81–1.14	0.96	0.79–1.16
Intelligence	0.75	0.62–0.90**	0.84	0.70–1.02	0.88	0.71–1.09
Craftsworkers	0.63	0.50–0.79*	0.78	0.62–0.98***	0.80	0.62–1.04
Other	0.89	0.75–1.06	0.99	0.83–1.19	1.07	0.87–1.30

Model 1 = demographics only, Model 2 = all variables, Model 3 = all variables excluding 8,947 personnel who reported at least one PTSD symptom on the Post-Deployment Health Assessment. CI = confidence interval, OR = odds ratio. *P < .001. **P = .001 to .009. ***P = .01 to < .05.

Table 3—Prescription frequency by military occupation among those with diagnosed insomnia (n = 2,265).

		Prescription (%)			
Occupation	**n**	**Non-Benzodiazepine***	**Benzodiazepine**	**Antidepressant****	**Melatonin**
Infantry	674	36.8	1.3	21.7	< 1
Equipment repair	421	46.1	1.2	13.3	< 1
Law enforcement	90	52.2	2.2	22.2	2.2
Motor transport	143	48.3	0	16.8	1
Healthcare	322	48.1	1.0	13.0	< 1
Administration	211	53.6	1.0	13.3	< 1
Intelligence	136	44.1	0	16.2	0
Craftworkers	100	35.0	3.0	19.0	0
Other	168	48.2	1.8	16.7	0
Total	2,265	44.2	1.2	17.0	< 1

*P value for difference across occupations < .001. **P value for difference across occupations = .005.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
08/12/2019	Journal Article	Dec 2018- Jul 2019

4. TITLE AND SUBTITLE
The Relationship Between Military Occupation and Diagnosed Insomnia Following Combat Deployment

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
MacGregor, Andrew; Markwald, Rachel; Dougherty, Amber; Seda, Gilbert

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER
60808

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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19-71

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10. SPONSOR/MONITOR'S ACRONYM(S)
BUMED/NMRC

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
19-838

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES
J Clin Sleep Med . 2020 Jul 15;16(7):1125-1132. doi: 10.5664/jcsm.8444.

14. ABSTRACT
Study Objectives: To investigate the relationship between military occupation and diagnosed insomnia following combat deployment.
Conclusions: Results suggest that military occupation may play a primary role in the onset and management of insomnia. The findings provide rationale for targeting individuals in insomnia-susceptible occupations with better methods to prevent and/or minimize sleep issues during and after combat deployment.

15. SUBJECT TERMS
hypnotic, insomnia, military, occupation, sedative

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Commanding Officer
					19b. TELEPHONE NUMBER *(Include area code)*
UNCL	UNCL	UNCL	UNCL	27	COMM/DSN: (619) 553-8429