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ABSTRACT The purpose of this study was to examine the role of military occupation on new-onset post-traumatic stress disorder (PTSD) and depression among U.S. combat veterans recently returned from deployment to Iraq. Enlisted, active duty Navy and Marine Corps personnel without a history of mental disorder were identified from deployment records and linked to medical databases ($n = 40,600$). Multivariate logistic regression was used to examine the association between occupation and postdeployment PTSD and depression diagnoses by branch of service. Navy health care specialists had higher odds of new-onset PTSD (odds ratio [OR] 4.53, 95% confidence interval [CI] 2.58–7.94) and depression (OR 2.58, 95% CI 1.53–4.34) compared with Navy functional support/other personnel. In addition, Marine combat specialists had higher odds of new-onset PTSD (OR 1.91, 95% CI 1.48–2.47) and depression (OR 1.36, 95% CI 1.10–1.68) compared with Marine functional support/other personnel. Occupation is associated with the development of new-onset PTSD and depression. The high rates of PTSD and depression among health care specialists warrant further investigation into the potential effects of caregiver stress on mental health.

INTRODUCTION

Mental health disorders are a leading source of morbidity, hospitalization, and attrition among U.S. military personnel.^{1–3} Post-traumatic stress disorder (PTSD) and depression are two of the most common mental health disorders afflicting combat veterans from Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF).^{4–7} Previous research shows that combat exposure is a risk factor for mental health problems and that sex, branch of service, and military rank may moderate this relationship.^{8–13} Few studies, however, have examined military occupation in relation to combat exposure or how occupation may mediate mental health issues.

The indistinct front lines of battle and widespread use of improvised explosive devices in OEF and OIF may have exposed personnel in noncombat occupations to many combat experiences. In a large study of 222,620 soldiers and Marines deployed to OIF, 65% reported combat exposure and 50% felt in great danger of being killed.⁴ Little is known about the combat experiences of personnel serving in noninfantry occupations or how rates of mental health disorders may differ across occupational groups. Previous studies provide conflicting results and include populations of nondeployed individuals. One study assessed new-onset PTSD in deployed and nondeployed populations and found occupation had no effect,⁹ whereas a similar study by Wells et al¹⁰ found that health care

specialists and service supply and functional personnel were at greater risk of new-onset depression compared with combat specialists. The authors proposed that the lower risk of depression among combat specialists in comparison with health care and support personnel could partly be due to psychological hardiness. Health care and support personnel may not be as prepared to handle the stresses of combat in comparison with combat specialists because of differences in training. The idea that appropriate training may promote psychological hardiness is supported by Renshaw's study¹⁴ on protective factors for PTSD, which found that personnel with low levels of predeployment preparation consistently reported high levels of perceived threat, regardless of combat exposure, whereas those with high levels of preparation only reported high levels of perceived threat when severely exposed to combat.

The intensity and types of combat exposure vary by occupation. Infantrymen are exposed to more direct forms of combat, such as engaging the enemy, whereas health care personnel are exposed to the aftereffects of combat, such as caring for the wounded. Hoge et al⁸ reported that 6% to 20% of infantrymen met the criteria for PTSD and 7% to 15% met the criteria for depression. A separate study on health care personnel reported that 9% met the criteria for PTSD and 5% for depression.¹⁵ Although both studies lacked a comparison group, they provide insight into the rates of mental health problems for these occupational groups.

There is currently a gap in knowledge regarding military occupation, and the degree to which military personnel in various occupations are exposed to combat and experience poor mental health outcomes. The purpose of the present study was to assess the risk of new-onset PTSD and depression among a large population of OIF combat veterans, with particular interest in military occupation as a covariate.

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METHODS

Study Population

The study population consisted of enlisted, active duty men serving in the Navy and Marine Corps whose first career deployment occurred between January 1, 2005, and November 30, 2008, in support of OIF. Deployed personnel were identified from the Department of Defense (DoD) deployment file, which included demographic data, beginning and ending deployment dates, and service-specific characteristics. For inclusion, personnel had to be on deployment greater than 1 month but no more than 18 months. Personnel who began a second deployment within 365 days of ending their first deployment were excluded to allow for a full year of follow-up time. To investigate new-onset PTSD and depression diagnosed within the year after returning home from deployment, personnel who received any mental health diagnosis, as defined by the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM, codes 290–319, excluding tobacco dependence, 305.1), before deployment were also excluded. Race/ethnicity was incorporated into analyses to control for any potential differences in mental health outcomes.

Measures

Outcome variables

Personnel who were diagnosed with PTSD or depression during the year after deployment were identified from the Standard Inpatient Data Record and Standard Ambulatory Data Record. Personnel who had ICD-9-CM code 309.81 listed in either database within 1 year of the end of their first deployment date were classified as having a diagnosis of PTSD. The ICD-9-CM codes used to identify depression were 296.2 (major depressive disorder, single episode), 296.3 (major depressive disorder, recurrent episode), 298.0 (depressive type psychosis), 300.4 (dysthymic disorder), 309.0 (adjustment disorder with depression), 309.1 (prolonged depressive reaction), and 311 (depressive disorder, not elsewhere classified).

Predictor variables

Demographic and military-specific information including age, race/ethnicity, education, marital status, rank, and occupation were obtained from DoD deployment data. Marital status was dichotomized into married versus not married as a proxy for family support at the beginning of deployment. Divorced personnel were included as not married because of small counts. Military rank was categorized as junior enlisted (E1–E3), noncommissioned officers (E4–E5), and senior enlisted (E6–E9). Enlisted occupation codes, defined by the DoD Occupational Conversion Index,¹⁶ were used to identify specific occupational areas and, in some cases, combined to create categories of similar professions. Occupation was categorized as follows: functional support/other (functional sup-

port and administration, other technical and allied specialists, and nonoccupational); communications/intelligence; health care specialists; combat specialists; service and supply; and craft/repair specialists (craftworkers, electrical/mechanical equipment repairers, and electronic equipment repairers).

The Expeditionary Medical Encounter Database, formerly the Navy-Marine Corps Combat Trauma Registry, was used to identify Navy and Marine Corps personnel who were injured in combat. The Expeditionary Medical Encounter Database is a deployment health database maintained by Naval Health Research Center (NHRC) in San Diego, California, which contains clinical records of illness, battle and nonbattle injury encounters of deployed U.S. service members.¹⁷ Clinical records are completed at or near the point of injury, and copies are provided to staff at NHRC. Professional clinical coders at NHRC review the clinical record, including incident details and provider notes, and assign ICD-9-CM codes, injury severities, and ICD-9-CM external cause of injury codes (E code). Battle-injured personnel were identified primarily by means of a clinical record indicating battle injury. We also used E codes indicating injury from operations of war including E990.9 (fire from unspecified source), E991.3 (antipersonnel bomb [fragments]), E991.9 (other and unspecified fragments), E993 (explosion), E999.0 (late effect of injury as a result of war), and North Atlantic Treaty Organization standardized agreement codes for cause of injury reflecting instrumentalities of war.

Statistical Analysis

Descriptive statistics were used to show a comparison of the population by service. Inclusion of the variable “battle injury” was used to control for combat exposure in the absence of self-report. A breakdown of battle injury by occupation provided the proportion of each occupation by service that was injured in combat. Multivariate logistic regression was performed to examine the association between deployment characteristics and new-onset PTSD and depression. A separate model was created for each outcome variable. For analyses stratified on service, odds ratios (ORs) and 95% confidence intervals (CIs) were reported. All analyses were conducted using SAS software, version 9.2 (SAS Institute, Cary, North Carolina).

RESULTS

We identified 45,999 enlisted, active duty men in the Navy and Marine Corps with full demographics whose first career deployment was greater than 30 days in OIF from January 1, 2005 through November 30, 2008, and who did not redeploy within a year. Of these, 5,399 had a diagnosed mental health disorder before deployment and were excluded.

The final study population consisted of 32,196 (79.3%) individuals serving in the Marine Corps and 8,404 (20.7%) in the Navy (Table I). Compared with the Navy, Marines were younger (average 23.2 versus 26.8 years of age), proportionately more of white race/ethnicity (84.6% versus 68.0%), unmarried (63.0% versus 50.1%), high school educated or

TABLE I. Demographic Characteristics of Study Population by Service

Characteristics	Marine Corps (n = 32,196)	Navy (n = 8,404)
Age, Years, Mean (SD)	23.2 (4.7)	26.8 (6.6)
Race/Ethnicity, n (%)		
Black	3,373 (10.5)	1,363 (16.2)
White	27,230 (84.6)	5,715 (68.0)
Other	1,593 (5.0)	1,326 (15.8)
Marital Status, n (%)		
Married	11,916 (37.0)	4,192 (49.9)
Not Married	20,280 (63.0)	4,212 (50.1)
Education, n (%)		
High School or Less/Equivalent	31,092 (96.6)	7,791 (92.7)
Some College or More	1,104 (3.4)	613 (7.3)
Rank, n (%)		
E1-E3	19,833 (61.6)	3,348 (39.8)
E4-E5	9,247 (28.7)	3,182 (37.9)
E6-E9	3,116 (9.7)	1,874 (22.3)
Battle Injured, n (%)		
No	31,588 (98.1)	8,322 (99.0)
Yes	608 (1.9)	82 (1.0)
Occupation, n (%)		
Functional Support/Other	5,256 (16.3)	1,021 (12.1)
Communications/Intelligence	2,203 (6.8)	346 (4.1)
Health Care Specialists		3,225 (38.4)
Combat Specialists	9,936 (30.9)	497 (5.9)
Service and Supply	4,968 (15.4)	559 (6.7)
Craft/Repair Specialists	9,833 (30.5)	2,756 (32.8)

equivalent (96.6% versus 92.7%), and E1-E3 rank (61.6% versus 39.8%). Battle injury was not common among personnel in either service. The predominant occupation among Marines was combat specialists (30.9%), compared with health care specialists in the Navy (38.4%). Only 6% of Navy personnel were classified as combat specialists. There were not any health care specialists in the sample of Marines because the Navy provides medical support and care for Marine Corps personnel.

Among battle-injured personnel, there were differences in occupation by service (Table II). Of the 608 battle-injured Marines, 411 (67.6%) were combat specialists. There were 82 battle-injured personnel in the Navy, 68 (82.9%) of whom were health care specialists. Of note, there were no Navy combat specialists injured in battle.

As shown in Table III, Navy health care specialists had higher odds of new-onset PTSD (OR 4.53; 95% CI 2.58-

7.94) compared with Navy functional support/other personnel, after adjusting for age, race/ethnicity, marital status, education, rank, and battle injury. In a similar model for the Marines, combat specialists and service and supply personnel had higher odds of new-onset PTSD (OR 1.91; 95% CI 1.48-2.47 and OR 1.72; 95% CI 1.29-2.29, respectively) compared with Marine functional support/other personnel. Both Navy and Marine Corps personnel injured in battle were more likely to be diagnosed with PTSD than those not injured (OR 6.50; 95% CI 3.84-11.00 and OR 10.05; 95% CI 8.12-12.43, respectively). In addition, Marines of higher rank and black race/ethnicity had lower odds of receiving a new-onset PTSD diagnosis, whereas married Marines had higher odds.

In Table IV, the adjusted model for depression showed higher odds of new-onset depression diagnosis for Navy health care and combat specialists compared with functional support/other (OR 2.58; 95% CI 1.53-4.34 and OR 2.09; 95% CI 1.05-4.13, respectively). Marine Corps combat specialists were also more likely to be diagnosed with depression (OR 1.36; 95% CI 1.10-1.68) compared with functional support/other. Battle-injured Navy and Marine Corps personnel were significantly more likely to be diagnosed with depression compared with nonbattle-injured personnel (OR 3.70; 95% CI 1.99-6.87 and OR 3.84; 95% CI 2.98-4.94, respectively). Those with higher rank in the Navy and Marine Corps had lower odds of being diagnosed with new-onset depression, whereas married Marines had higher odds.

DISCUSSION

In this study, we examined the mediating effect of occupation on the development of PTSD and depression among a large population of first-time deployers to OIF. Our findings show that occupation is associated with the development of new-onset PTSD and depression for both the Navy and Marine Corps. Specifically, we found personnel enlisted in Navy health care and Marine Corps combat occupations were significantly more likely to be diagnosed with PTSD and depression. When compared, however, our results indicated a larger percentage of Navy health care specialists than Marine Corps combat specialists were diagnosed with PTSD and depression (PTSD 6.3% versus 4.1% and depression 5.2% versus 4.2%, respectively).

The finding of increased PTSD and depression diagnoses in Navy health care specialists is intriguing. A number of studies have documented that deployed personnel with combat exposure report symptoms of PTSD and depression in greater frequency than those deployed without combat exposure.^{8-12,18} Typically, engaging the enemy in direct ground combat is reserved for infantry units of the Army and Marine Corps whose personnel consistently report very high levels of combat exposure.⁸ Enlisted medical specialists in the Navy (or corpsmen), however, often deploy with Marine Corps infantry units with the dual role of caregiver and combatant.¹⁹⁻²¹ In our study, we found 4% of Marine combat specialists and 2% of Navy health care specialists were battle injured, evidence of

TABLE II. Number and Percent of Battle-Injured Personnel by Occupation and Service

Occupation	Marine Corps, n (%)	Navy, n (%)
Functional Support/Other	31 (0.6)	7 (0.7)
Communications/Intelligence	26 (1.2)	1 (0.3)
Health Care Specialists		68 (2.1)
Combat Specialists	411 (4.1)	0 (—)
Service and Supply	76 (1.5)	0 (—)
Craft/Repair Specialists	64 (0.7)	6 (0.2)

TABLE III. Percentage and Adjusted Odds of New-Onset PTSD Stratified by Service

Characteristics	Marine Corps		Navy	
	%	OR (95% CI)	%	OR (95%CI)
Age, Years		1.00 (0.97–1.04)		1.01 (0.98–1.04)
Race/Ethnicity				
Black	1.3	0.59 (0.43–0.80)	3.7	0.90 (0.66–1.25)
White	2.8	1.00	3.4	1.00
Other	1.8	0.77 (0.53–1.12)	3.9	0.87 (0.63–1.20)
Marital Status				
Married	2.3	1.26 (1.08–1.48)	3.4	1.07 (0.81–1.39)
Not Married	2.8	1.00	3.6	1.00
Education				
High School or Less/Equivalent	2.6	1.00	3.6	1.00
Some College or More	1.4	0.62 (0.37–1.06)	3.1	0.85 (0.52–1.40)
Rank				
E1–E3	3.4	1.00	4.5	1.00
E4–E5	1.4	0.44 (0.36–0.54)	3.0	0.88 (0.64–1.20)
E6–E9	0.8	0.27 (0.15–0.47)	2.8	0.86 (0.50–1.49)
Battle Injured				
No	2.2	1.00	3.3	1.00
Yes	22.5	10.05 (8.12–12.43)	25.6	6.50 (3.84–11.00)
Occupation				
Functional Support/Other	1.4	1.00	1.4	1.00
Communications/Intelligence	1.7	1.07 (0.72–1.59)	2.6	1.96 (0.84–4.58)
Health Care Specialists			6.3	4.53 (2.58–7.94)
Combat Specialists	4.1	1.91 (1.48–2.47)	2.6	1.97 (0.92–4.23)
Service and Supply	2.9	1.72 (1.29–2.29)	2.0	1.47 (0.66–3.28)
Craft/Repair Specialists	1.7	1.05 (0.79–1.38)	1.6	1.19 (0.65–2.20)

TABLE IV. Percentage and Adjusted Odds of New-Onset Depression Stratified by Service

Characteristics	Marine Corps		Navy	
	%	OR (95% CI)	%	OR (95% CI)
Age, Years		0.97 (0.95–1.00)		1.00 (0.97–1.04)
Race/Ethnicity				
Black	2.4	0.82 (0.65–1.04)	3.7	0.96 (0.69–1.32)
White	3.5	1.00	3.3	1.00
Other	2.6	0.85 (0.62–1.16)	3.2	0.77 (0.54–1.08)
Marital status				
Married	3.1	1.33 (1.16–1.53)	3.0	1.06 (0.81–1.38)
Not Married	3.4	1.00	3.7	1.00
Education				
High School or Less/Equivalent	3.3	1.00	3.3	1.00
Some College or More	2.8	1.14 (0.78–1.66)	3.9	1.39 (0.89–2.18)
Rank				
E1–E3	4.3	1.00	4.6	1.00
E4–E5	1.8	0.42 (0.35–0.51)	3.2	0.81 (0.59–1.10)
E6–E9	1.3	0.37 (0.23–0.59)	1.5	0.36 (0.20–0.67)
Battle Injured				
No	3.1	1.00	3.2	1.00
Yes	12.7	3.84 (2.98–4.94)	15.9	3.70 (1.99–6.87)
Occupation				
Functional Support/Other	2.4	1.00	1.7	1.00
Communications/Intelligence	3.2	1.29 (0.96–1.73)	1.5	0.96 (0.35–2.62)
Health Care Specialists			5.2	2.58 (1.53–4.34)
Combat Specialists	4.2	1.36 (1.10–1.68)	3.4	2.09 (1.05–4.13)
Service and Supply	3.4	1.25 (0.97–1.59)	2.5	1.41 (0.69–2.90)
Craft/Repair Specialists	2.9	1.10 (0.89–1.37)	2.2	1.16 (0.67–2.01)

similar exposure to combat for both occupations. But what distinguishes the combat experience of a Navy corpsman from that of a Marine combat specialist is the addition of caring for the wounded, including members of their unit, during and after combat.

In civilian studies, PTSD has been identified in medical specialists who treat those with severe trauma, including emergency services personnel^{22,23} and those involved in disaster relief efforts.^{24,25} Furthermore, research shows that caregiver stress, also referred to as compassion fatigue or secondary stress disorder, is common among military health care providers.²⁶⁻²⁸ The symptoms of caregiver stress can mimic those of PTSD and depression.^{26,28} The potential effect caregiver stress can have in combination with combat stress is unknown and warrants further investigation.

Despite the fact that high rates of mental health problems exist among personnel deployed to OIF, research shows that many do not seek treatment.^{8,29,30} One explanation for the high rate of new-onset PTSD and depression we found among Navy health care specialists is an increased willingness to seek and receive care for mental health issues in comparison with Marine Corps combat specialists. A recent study concluded that military health care workers with PTSD were more likely to present for mental health care than combat personnel.¹⁵ It is unknown whether health care specialists also perceive stigma as an impediment to care, as has been documented among infantrymen,⁸ and if so, to what degree compared with other military occupations. It is possible that health care specialists may be more likely to seek treatment because they work in proximity to other health care providers or possibly because they are trained to recognize mental health problems, such as combat stress.

There were secondary findings of note. Marine Corps service and supply personnel were also more likely to be diagnosed with PTSD. This may be a result of increased combat exposure. We found 1.5% of Marine service and supply personnel were battle injured, the third largest proportion after Marine combat specialists and Navy health care specialists. Marine service and supply personnel have the task of conducting logistical convoys that put them at risk for enemy attack. Battle injury was a strong predictor of PTSD and depression, which is consistent with previous literature.^{31,32} The finding that married Marines had higher odds of PTSD and depression than did unmarried Marines may be the result of reduced stigma because of spousal support and encouragement to seek treatment. Although marriage was not associated with mental health diagnoses in the Navy, the finding may be exceptional to the Marines and the highly publicized rates of PTSD and depression.

A unique strength of the present study was the ability to adjust for battle injury as an indicator of combat exposure. In addition, the use of medical diagnoses instead of self-report symptoms permit interpretations about utilization of care and the presence of stigma as it relates to occupation. The removal of personnel with prior mental health diagnoses from the study

population allowed for the prospective detection of newly diagnosed PTSD and depression in a large deployed population. This also controlled for the confounding effect that a history of mental health problems has on the likelihood of subsequent mental health illness. Lastly, a variety of ICD-9-CM codes were utilized to capture a broad range of clinically significant levels of depression.

A major limitation of the present study was the inability to determine if and when personnel separated from military service. This affects the assumption that all personnel were followed for an entire year postdeployment. Our control for combat exposure, based on battle injury, was fairly strict and did not account for other forms of combat exposure, such as receiving enemy fire or seeing dead bodies, and future studies should incorporate these measures. Nevertheless, in the absence of self-report data, which is subject to recall bias, the assessment for battle injury and occupation as well as stratification by service was a strong alternative to control differential combat exposures. In addition, the findings may not generalize because we excluded those whose first career deployment was to a theater other than OIF and those who did not spend at least a year at home after their first deployment.

CONCLUSIONS

We found military occupation was associated with the development of new-onset PTSD and depression. Our results add to the literature by elucidating patterns in mental health diagnoses by occupation. This information may be useful in developing service- and occupation-specific resiliency training programs. Future research should address the potential for other mediating factors, such as caregiver stress, in mental health care-seeking behavior by occupation.

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14. ABSTRACT

Objective: To examine the role military occupation has on new-onset posttraumatic stress disorder (PTSD) and depression among personnel deployed to Iraq.

Methods: We analyzed 39,019 Navy and Marine Corps personnel without history of mental health disorder for PTSD and depression diagnosed within a year after returning from deployment to Iraq. Multivariate logistic regression was used to examine the association between occupation and postdeployment PTSD and depression diagnoses by branch of service.

Results: Navy health care specialists had higher odds of new-onset PTSD (odds ratio [OR]=4.57; 95% confidence interval [CI]=2.55, 8.19) and depression (OR=2.60; 95% CI=1.52, 4.45) compared with Navy functional support/other personnel. In addition, Marine Corps combat specialists had higher odds of new-onset PTSD (OR=1.95; 95% CI=1.50, 2.55) and depression (OR=1.35; 95% CI=1.09, 1.67) compared with Marine functional support/other personnel.

Conclusion: Occupation plays a significant role in the development of new-onset PTSD and depression. The high rates of PTSD and depression among health care specialists warrant further investigation into the potential effects of caregiver stress on mental health.

15. SUBJECT TERMS
military occupation, PTSD, depression, OIF

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