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Gender differences in sleep disorders in the US military☆,☆☆,★

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ABSTRACT

Objectives: The purpose of this study is to compare sleep disorders between male and female military personnel. Comorbid behavioral health disorders and chronic pain were also studied in relation to sleep disorders.
Design: We conducted a retrospective review of military personnel who underwent a sleep medicine evaluation and an in-laboratory attended polysomnography. Initial sleep questionnaires, demographics, polysomnographic variables, and comorbid disorders of interest were reviewed and compared for each sex.
Setting: All patients were referred to the Wilford Hall Ambulatory Surgical Center Sleep Disorders Center for evaluation of sleep disturbance.
Participants: Our cohort consisted of 209 military personnel with 51.7% men. The cohort was relatively young with a mean age of 34.3 years. Men had a significantly higher body mass index at 29.4 vs 27.3 in women.
Results: Insomnia was diagnosed in 72 women and 41 men ($P < .001$), whereas obstructive sleep apnea (OSA) was diagnosed in 92 men and 50 women ($P < .001$). Depression and anxiety were more common in women. Women had an average of 1.76 ± 1.36 comorbid conditions compared with 1.08 ± 1.19 in men. In patients diagnosed with both insomnia and OSA, women were more likely to have post-traumatic stress disorder, depression, and anxiety. Neither the Epworth Sleepiness Scale (12.8 ± 4.88) nor the Insomnia Severity Index (16.9 ± 5.33) differed between sexes.
Conclusions: Gender-related differences in sleep disorders are present in active-duty personnel. Behavioral health disorders were frequent comorbid disorders, and women diagnosed with both insomnia and OSA manifested greater psychiatric comorbidity. The frequent association between sleep and behavioral health disorders in military personnel requires further study.
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Introduction

Sleep disturbances are associated with multiple physical as well as behavioral health disorders. Poor sleep negatively impacts mood, cognition, decision making, and moral reasoning.[1] In addition, in military populations, sleep disturbances can lead to increased body mass index (BMI), failure to meet exercise standards, suboptimal nutritional status, and poorer self-reported health.[2] Thus, the importance of sleep is increasingly recognized throughout society as well as the military.

The prevalence of specific sleep disorders differs between men and women. Studies in the general population reveal that women are more likely to have insomnia and generalized sleep disturbances than men.[3,4] Specifically, women are twice as likely to be diagnosed with insomnia, with this difference increasing with age.[5] Regarding obstructive sleep apnea (OSA), data from civilian sleep centers, assessing middle-aged adults, show higher rates of OSA in men compared with women with ratios of 8:1 to 10:1.[6–9] Overall, the incidence of OSA in women referred for polysomnography (PSG) is 16%-34.2% compared with 65.8%-83% in men.[8,10] Women diagnosed with OSA are typically older and have less severe disease than their male counterparts.[11] Most studies comparing gender-related differences in sleep disorders were performed in older populations. Research

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comparing sleep disorders in young men and women is limited, but one large population study showed that in adults aged 20-39 years, women were 64% more likely to have insomnia and 59% less likely to have OSA than men.[12]

Military personnel are a relatively young, healthy population at baseline who are subjected to multiple stressors, which can result in disturbed sleep and predispose them to sleep disorders. These stressors include deployments, frequent moves, shift work, family separation, and work hours that typically begin prior to 6:00 AM.[13,14] Additionally, insufficient sleep is highly prevalent in the military, with only 24% reporting sleeping 7-8 hours.[15] Although there is a relationship between deployments and sleep disorders, including insufficient sleep, insomnia, nightmares, and parasomnias, how this differentially affects men and women in the military is unknown.[16]

Data on the role of sex and sleep disturbance in the general military population are limited. The Millennium Cohort study analyzed almost 3000 female military personnel and found that women who are pregnant or have young children have the shortest sleep duration, ranging from 5.45 to 5.84 hours.[17] In another non-clinical sample, Taylor et al[18] surveyed a large sample of US Army soldiers, including more than 300 women, and found no gender-related differences in rates of insomnia. Although there are a number of clinical studies assessing sleep disorders, they are limited because they are focused on male military personnel and do not establish the prevalence of specific disorders. In one of the largest clinical samples to date, Mysliwiec et al[19] studied 725 military service members who were referred to a sleep center. Although only 7% of their cohort was female, they reported that female military personnel were more likely to have insomnia and less likely to be diagnosed with moderate to severe OSA.

Based on the limited data, there appears to be gender-related differences in sleep disorders between female and male military personnel. The primary objective of this study was to characterize differences in sleep disorders between men and women serving on active duty in the US military. An exploratory objective was to determine if there were gender-related differences in comorbid behavioral health disorders and chronic pain between male and female military personnel who were referred for sleep disturbances.

Methods

Study sample

This is a retrospective cross-sectional cohort study of 209 military personnel who were referred for evaluation to an academic military sleep disorders center between March 2014 and January 2016. Military personnel with sleep disturbances are referred for evaluation to the sleep center from within the military network, with consults coming primarily from primary care, behavioral health, and otolaryngology. We evaluated the records of 107 women (6 were excluded because of incomplete records) and 117 men (9 were excluded because of incomplete records). This resulted in a total cohort of 101 women and 108 men. Prior to their evaluation, the patients completed self-report questionnaires, which consisted of the Epworth Sleepiness Scale (ESS), Insomnia Severity Index (ISI), and other sleep behaviors. All participants underwent attended level 1 in-laboratory PSG. This study was approved by the Wilford Hall Ambulatory Surgical Center institutional review board.

Study variables

Demographic/biometric parameters, sleep center intake questionnaires, polysomnographic variables, and electronic medical records (EMRs) were reviewed. Demographic/biometric parameters included age, BMI, branch of service, and history of deployment (at least 1 deployment in participant's military career). The BMI values were used to classify participants as underweight (BMI < 18.5), normal weight ($18.5 \leq$ BMI < 25.0), overweight ($25.0 \leq$ BMI < 30), and obese (BMI ≥ 30.0). The ESS was used to assess patients' sleepiness. The total ESS score ranges from 0 (less sleepy) to 24 (more sleepy). A score >10 indicates excessive daytime sleepiness (EDS).[20] The ISI was used to assess insomnia symptoms and ranges from 0 to 28. A score ≥15 is consistent with clinical insomnia.[21]

Level 1 PSGs were performed in accordance with American Academy of Sleep Medicine (AASM) standards within an AASM-accredited laboratory (Embla Systems, Broomfield, CO; Sandman Version 9.3), with a subset of patients receiving split-night studies. Our laboratory policy was to perform a split-night study on any patient with an apnea hypopnea index (AHI) of greater than 20 per hour in the first 2 hours of sleep. Polysomnography was performed with 16 channels, including electrooculogram, electroencephalogram, electrocardiogram, electromyogram (submental and bilateral tibial), airflow measurements using both oronasal-thermal sensors and nasal air pressure transducers, transtracheal sounds via microphone, rib cage and abdominal movement by inductance plethysmography using thoracoabdominal belts, and continuous pulse oximetry. Studies were scored using the 2012 AASM scoring guidelines with hypopneas scored as a 30% drop in the nasal pressure from baseline for 10 seconds and associated with either an arousal or drop in oxygen saturation by 3%.[22] Polysomnographic variables, to include sleep onset latency (SOL), rapid eye movement (REM) onset latency, total sleep time, sleep efficiency (SE), sleep stages (stage N1, stage N2, stage N3, stage R), wake after sleep onset (WASO), arousal index, AHI, and maximal desaturation, were analyzed.

Diagnosis of sleep disorders and associated illnesses

The *International Classification of Sleep Disorders, Third Edition* was used to adjudicate sleep disorders in our patients integrating PSG data, EMR review, ESS, ISI, and our sleep laboratory questionnaire.[23] All diagnoses were reviewed and adjudicated by 2 board-certified sleep medicine physicians. The diagnosis of insomnia was rendered in patients with self-reported symptoms of insomnia who had an SOL >30 minutes and a reduced SE (<85%) on the sleep laboratory questionnaire, as well as an ISI score consistent with insomnia (≥15). Patients with subthreshold ISI of 11-14 were required to have the same self-reported insomnia symptoms along with at least 1 PSG variable consistent with insomnia, to include SOL >30 minutes, WASO of >30 minutes, and/or SE <85%. Patients with a PSG demonstrating apneas or hypopneas with an AHI >5/h were rendered a diagnosis of OSA. The diagnoses of insomnia and OSA were not mutually exclusive; a diagnosis of comorbid insomnia and OSA was adjudicated when the patient's sleep and wake complaints were not solely due to sleep disordered breathing or another disorder in accordance with the *International Classification of Sleep Disorders, Third Edition*. Associated illnesses including depression, anxiety, post-traumatic stress disorder (PTSD), and chronic pain were obtained from the EMR and self-report.

Statistical analysis

Statistical analysis was conducted with a statistical software package (JMP Pro 12; SAS Institute, Cary, NC). Individuals with previous PSGs, those referred for postsurgical evaluation, or those who did not complete our sleep center intake questionnaire were excluded from the analysis. Medical record review was performed using the EMR system. After collection, data were recorded in a deidentified database prior to statistical analysis.

Data normality was assessed with the Shapiro-Wilk test. Most of our data violated the assumption of normality (ie, age, all PSG

Table 1
Sample demographic characteristics

	Entire sample (N = 209)	Men (n = 108)	Women (n = 101)	Unadjusted *P* value[a]
Demographics				
Age (y), M ± SD (MD)	34.3 ± 8.52 (34.0)	34.7 ± 8.03 (35.0)	33.9 ± 9.03 (32.0)	.321
BMI, M ± SD (MD)	28.4 ± 3.97 (28.2)	29.4 ± 3.15 (29.2)	27.3 ± 4.46 (26.6)	<.001
Normal weight, % (n)	20.1% (42)	6.48% (7)	34.7% (35)	–
Overweight, % (n)	46.9% (98)	53.7% (58)	39.6% (40)	–
Obese, % (n)	33.0% (69)	39.8% (43)	25.7% (26)	–
Deployed in the past, % (n)	60.2% (124)	70.5% (74)	49.5% (50)	.003[b]
Self-reported measures				
ESS score, M ± SD (MD)	12.8 ± 4.88 (13.0)	12.7 ± 4.63 (13.0)	12.9 ± 5.16 (13.0)	.828
Elevated daytime sleepiness (ESS >10), % (n)	64.6% (135)	62.0% (67)	67.3% (68)	.470
ISI score, M ± SD (MD)	16.9 ± 5.33 (17.0)	16.3 ± 4.96 (17.0)	17.6 ± 5.66 (18.0)	.078
ISI score ≥15, % (n)	67.9% (142)	63.0% (68)	73.3% (74)	.138

[a] Comparison with the Wilcoxon rank-sum test.
[b] Comparison with Fisher exact test.

variables, ESS, ISI). Therefore, statistical analysis was based on nonparametric methods. An α level of .05 was used to determine statistical significance. Pairwise comparisons between groups were based on Wilcoxon rank-sum test, whereas Fisher exact test was used for pairwise comparisons between proportions. Accounting for family-wise error, post hoc statistical significance was assessed by the Benjamini-Hochberg false discovery rate (BH-FDR) controlling procedure with $q = 0.20$.[24] Data are presented as mean ± standard deviation (SD) (median [MD]) or percentage (number of occurrences). Patients that had a split-night PSG as part of their evaluation were not included in the PSG variables analysis; only the 134 patients who underwent a diagnostic PSG were included in this analysis.

Initially, all variables underwent descriptive analysis to describe our population in terms of demographic characteristics. Participants were then classified into 2 groups, "women" and "men," based on self-reported gender (on questionnaire) and the EMR. Multiple logistic regression models were used to assess differences in the prevalence of sleep and comorbid disorders by sex. Age and BMI were included in the models as confounding variables.

Results

Demographic characteristics of the sample are shown in Table 1. Patient ages ranged from 20 to 65 years (34.3 ± 8.52, MD = 34) with 51.7% being male. The average BMI was 28.4 ± 3.97 (MD = 28.2) kg/m^2, with a majority the participants being either overweight (46.9%) or obese (33.0%). Men were more overweight than women ($P = .003$). Participants were predominantly Air Force and Army. Approximately 60% of the military personnel evaluated had deployed at least once in their career, with men being more likely to have deployed than women ($P = .003$). More than half of the sample reported EDS (ESS >10). The average ISI score was 16.9 ± 5.33, with 67.9% of patients having an ISI ≥15.

In terms of PSG variables, women were characterized by longer SOL, less N1 sleep, and increased REM sleep compared with men. As expected, men had a higher AHI compared with women ($P < .001$) (Table 2).

We assessed differences in the prevalence of sleep disorders by sex (Table 3). Results showed that, after adjusting for age and BMI, women were more likely to be diagnosed with insomnia compared with men ($P < .001$). In contrast, men had a higher rate of OSA diagnoses compared with women ($P < .001$). Among patients diagnosed with only 1 sleep disorder, women showed an increased risk of being diagnosed with insomnia only, whereas men had an increased risk of OSA only.

Fourteen female patients were diagnosed with other sleep disorders: 4 with idiopathic hypersomnia, 4 with snoring, 2 with shift work disorder, 1 with nightmare disorder, 1 with restless legs syndrome, 1 with insufficient sleep, and 1 with sleepwalking. In contrast, only 4 male patients were diagnosed with other sleep disorders, all with primary snoring. These results are shown in Figure 1.

In addition, we compared the number of comorbid disorders a patient was diagnosed with (PTSD, anxiety, depression, pain) by sex. Anxiety, pain, and depression diagnoses were more frequent in women compared with men (Table 3). Women had on average 1.76 ± 1.36 comorbid disorders of interest compared with 1.08 ± 1.19 for men (Wilcoxon rank-sum test, $Z = 3.82$, $P < .001$). Furthermore, 33.7% of women had 3 or more comorbidities compared with

Table 2
Polysomnographic variables (based only on patients with diagnostic PSG only)

PSG variables, M ± SD	Entire sample (N = 134), M ± SD (MD)	Men (n = 50), M ± SD (MD)	Women (n = 84), M ± SD (MD)	Unadjusted *P* value[a]	Effect size *r*
SOL (min)	17.2 ± 21.6 (10.1)	10.6 ± 11.2 (5.95)	21.1 ± 25.2 (11.9)	<.001[b]	0.312
REM latency (min)	122 ± 61.0 (105)	124 ± 66.7 (102)	120 ± 57.5 (105)	.868	–
TST (min)	352 ± 61.4 (370)	365 ± 43.7 (372)	345 ± 69.1 (365)	.240	–
SE (%)	83.8 ± 12.3 (88.8)	86.4 ± 9.51 (89.3)	82.3 ± 13.6 (88.3)	.142	–
N1 (%)	8.93 ± 6.77 (7.49)	11.3 ± 7.80 (9.74)	7.55 ± 5.68 (5.97)	.002[b]	0.267
N2 (%)	54.3 ± 10.5 (54.8)	54.3 ± 10.3 (55.9)	54.3 ± 10.7 (54.1)	.749	–
N3 (%)	18.7 ± 10.5 (19.0)	17.7 ± 10.8 (17.1)	19.3 ± 10.4 (20.5)	.183	–
Stage REM (%)	18.0 ± 6.91 (18.5)	16.7 ± 6.45 (16.5)	18.4 ± 7.38 (18.9)	.048[b]	0.171
WASO (min)	47.9 ± 37.4 (33.8)	45.8 ± 31.0 (34.6)	49.1 ± 40.9 (33.5)	.788	–
Arousal index (events/h)	18.0 ± 12.6 (14.9)	16.8 ± 8.78 (15.4)	18.7 ± 14.4 (14.8)	.800	–
AHI (events/h)	6.41 ± 6.55 (5.15)	8.14 ± 5.34 (7.55)	5.37 ± 7.04 (4.25)	<.001[b]	0.317
Desaturation (%)	89.3 ± 6.26 (90.5)	89.0 ± 3.80 (89.5)	89.4 ± 7.36 (91.0)	.05[b]	0.170

[a] Statistical comparisons between women and men with Wilcoxon rank-sum test.
[b] Statistically significant according to post hoc analysis with the BH-FDR controlling procedure.

Table 3
Sleep disorders and associated illnesses by sex

Disorder group	Men (n = 108) % (n)	Women (n = 101) % (n)	*P* value[a]	Odds ratio of women compared with men (95% CI)
Overall				
Insomnia	38.0% (41)	71.3% (72)	<.001[b]	3.67 (2.02-6.66)
OSA	85.2% (92)	49.5% (50)	<.001[b]	0.20 (0.10-0.40)
Groups				
Insomnia only	11.1% (12)	36.3% (37)	<.001[b]	4.02 (1.90-8.49)
OSA only	58.3% (63)	14.9% (15)	<.001[b]	0.14 (0.07-0.28)
Comorbid insomnia and OSA	26.9% (29)	34.7% (35)	.239	–
Other	3.70% (4)	13.9% (14)	.028[b]	3.49 (1.06-11.50)
Associated illnesses				
PTSD	16.7% (18)	21.8% (22)	.173	–
Anxiety	24.1% (26)	48.5% (49)	<.001[b]	2.99 (1.63-5.51)
Pain	50.0% (54)	59.4% (60)	.044[b]	1.85 (1.02-3.36)
Depression	17.6% (19)	46.5% (47)	<.001[b]	4.49 (2.32-8.70)

[a] Statistical comparisons between women and men. *P* values adjusted for the effect of age and BMI.
[b] Statistically significant according to post hoc analysis with the BH-FDR controlling procedure.

13.9% of men (Fisher exact test, $P = .001$). These results are not shown in a table or figure.

Finally, we assessed gender-related differences regarding the occurrence of associated illnesses by sleep disorder. As shown in Table 4, women with insomnia were more likely to have anxiety than men. In addition, women with comorbid insomnia and OSA were more likely to be diagnosed with PTSD, anxiety, and depression compared with male patients. More than half of women diagnosed with both OSA and insomnia had anxiety, pain, or depression.

Discussion

To our knowledge, this is the first study to compare gender-related differences in the diagnostic rates of sleep disorders in a clinical population of military personnel. Although our results suggest that there are specific differences between male and female military personnel, which are somewhat similar to civilian cohorts, noting that women had higher rates of insomnia and men had higher rates of OSA, there are some important differences. Our cohort consisted of mostly young military personnel and reported on all sleep diagnoses. Previous studies reporting on gender-related differences focused on middle-aged and older adults, primarily with OSA.[9,25,26] Thus, our study, although conducted on a military population, has implications for younger patients with sleep disorders.

The women in our cohort differed from the men in 1 key variable, noting that they were significantly more likely to have a normal BMI. However, nearly 50% were diagnosed with OSA, which is higher than civilian reports.[9,10] Alternatively, the diagnostic rate of OSA in our male cohort of 85.2% is consistent with civilian literature and corresponds to their increased BMI.[27] As the women were relatively young (average age of 33.9 years) and only 25.7% were obese, what caused or contributed to their OSA diagnoses is not readily apparent. A potential reason is that the women, who were more likely to have anxiety and depression, had refractory sleep disturbances prompting them to seek evaluation. Young et al[28] estimated that more than 90% of women with OSA go undiagnosed because they present with symptoms that are different than men. Women with OSA are more likely to experience fatigue, whereas men have more sleepiness symptoms.[29] Because of their different symptomatology, women are often misdiagnosed with insomnia and/or depression.[30] Our findings further develop on this and suggest that a PSG should be performed in women with persistent sleep disturbances who may not necessarily fit the typical OSA profile.

Although the most common sleep disorder was insomnia in women and OSA in men, their rates of comorbid insomnia and OSA were similar, with approximately one-third of our cohort having both insomnia and OSA (26.9% men, 34.7% women; $P = .233$). Previous studies have reported variable findings in regard to comorbid insomnia and OSA, when this was specifically assessed, with rates of this diagnosis ranging from 39% to 84%.[31–34] In regard to sex-specific differences, Subramanian et al[32] reported that female sex was a significant risk factor for comorbid insomnia and OSA. In our cohort, the rate of comorbid OSA and insomnia was similar between men and women, which may represent a military unique finding. Bjornsdottir et al[35] hypothesized that the combination of insomnia and OSA causes increased sleep disruption and greater medical and psychiatric morbidity. A similar finding was reported by Lee et al,[36] who evaluated gender-related differences in 233 OSA patients with insomnia symptoms and found that women had higher depression scores. In our study, female military personnel with insomnia and OSA were significantly more likely to have PTSD, depression, and anxiety. However, because of the nature of our study, the directionality of this relationship is unknown, specifically, whether the sleep disorders contributed to and/or caused the behavioral medicine disorders or vice versa. Although we did not analyze medical comorbidities, prior research does show an increase in cardiovascular disease and diabetes in women veterans with comorbid insomnia and OSA.[37] Further prospective research evaluating medical comorbidities in military personnel with both OSA and insomnia is needed.

One-third of female military personnel had 3 or more comorbid disorders of interest compared with 13.9% of men. Specifically,

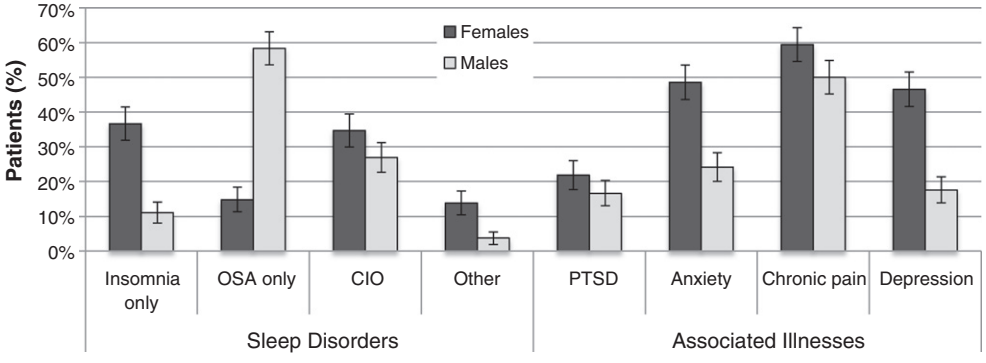

Fig. 1. Prevalence of sleep disorders and associated illnesses by sex. Vertical lines denote the standard error of the sample proportion. *CIO* indicates combined insomnia and OSA. Other: 4 men with snoring, 4 women with idiopathic hypersomnia, 1 with insufficient sleep, 1 with nightmares, 1 with parasomnia, 1 with restless leg syndrome, 4 with snoring, and 2 with shift work disorder.

Table 4
Associated illnesses by sleep disorder and sex

Sleep disorder group	Associated illnesses	Men, % (n)	Women, % (n)	*P* value[a]	Odds ratio of women compared with men (95% CI)
OSA (n = 78)	PTSD	19.1% (12)	13.3% (2)	.797	–
	Anxiety	30.2% (19)	26.7% (4)	.806	–
	Pain	50.8% (32)	53.3% (8)	.643	–
	Depression	22.2% (14)	26.7% (4)	.614	–
Insomnia (n = 49)	PTSD	16.7% (2)	13.5% (5)	.966	–
	Anxiety	16.7% (2)	51.4% (19)	.040[b]	6.02 (1.08-33.4)
	Pain	66.7% (8)	64.9% (24)	.928	–
	Depression	16.7% (2)	46.0% (17)	.086	–
Comorbid insomnia and OSA (n = 64)	PTSD	13.8% (4)	40.0% (14)	.021[b]	4.56 (1.26-16.5)
	Anxiety	17.2% (5)	57.1% (20)	.002[b]	7.38 (2.16-25.3)
	Pain	44.8% (13)	57.1% (20)	.190	–
	Depression	10.3% (3)	57.1% (20)	<.001[b]	14.2 (3.33-60.1)

[a] Statistical comparisons between women and men. *P* values adjusted for the effect of age and BMI.
[b] Statistically significant according to post hoc analysis with the BH-FDR controlling procedure.

women were more likely to have the diagnoses of anxiety and depression. Behavioral health disorders are commonly comorbid with sleep disturbances in military personnel[13]; however, this gender-related difference has not previously been reported. This finding is consistent with civilian studies, as women with OSA are more likely to have comorbid behavioral health disorders than men.[25,38–41] It remains unknown if young women with behavioral health disorders have higher rates of OSA or if they are more likely to be referred for sleep evaluation. Given the interactions between sleep and behavioral health disorders, there is potential for sleep-focused therapy to improve both sleep and behavioral health outcomes.

Interestingly, symptoms of sleep disorders by self-report did not substantially differ in our cohort. The majority had EDS, with more than 60% of both men and women having an ESS >10. This is notable for 2 reasons: women with OSA typically present with fatigue as opposed to EDS, and sleepiness, per se, is not a characteristic symptom of insomnia.[29,42] In civilian reports, gender-related differences for the ESS are reported inconsistently, with men scoring the same as or higher than their female counterparts.[43–45] A potential reason for our finding is that short sleep duration remains endemic in the military, with studies reporting average sleep duration of 6 hours.[13,17,46]

Limitations

Our study has limitations that merit discussion. We assessed the diagnostic rate of sleep disorders in a relatively small sample of military personnel referred for sleep disturbances. As the data were collected in a tertiary referral center, it is possible that patients with refractory sleep disturbances in the setting of comorbid illnesses were a large percentage of our study population. Furthermore, as this study is retrospective, associated illnesses were determined by their presence in the EMR and do not necessarily represent definitive diagnoses. Additionally, we focused on the comorbid illnesses (PTSD, anxiety, depression, pain), which are commonly found in military and veteran populations. As our cohort was relatively young, we did not evaluate cardiovascular illnesses such as hypertension and coronary artery disease, which are relevant to all patients with sleep disordered breathing. However, the strength of our study is it presents gender-related differences in PSG and clinical sleep disorders in a young military population, which has otherwise not been described.

Conclusions

In conclusion, we found specific differences between male and female military personnel with sleep disturbances which, in many ways, mirror those of older civilian cohorts. Yet, the rate of OSA diagnoses in young women in the military further suggests that this disorder is underdiagnosed in women in the general population. In addition, female military personnel, especially those with comorbid insomnia and OSA, were found to have greater behavioral health comorbidity, suggesting that they have greater overall disease severity. Clinically, an increased awareness of sleep disorders is required for military personnel and veterans, especially women with anxiety, depression, and PTSD. This finding also likely applies to civilians, where women with OSA have higher rates of behavioral health disorders. Given the multiple comorbidities in both male and female military personnel with sleep disorders, further research is required to determine if sleep disorders cause, contribute to, or develop as a consequence of the associated behavioral health disorders.

Disclosure

There is no financial support to disclose.

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