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SCIENTIFIC INVESTIGATIONS

Sleep apnea in women veterans: results of a national survey of VA health care users

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Study Objectives: The goals of this study were to estimate rates of undiagnosed, diagnosed, and treated sleep apnea in women veterans and to identify factors associated with diagnosis and treatment of sleep apnea in this population.

Methods: A large nationwide postal survey was sent to a random sample of 4,000 women veterans who had received health care at a Veterans Health Administration (VA) facility in the previous 6 months. A total of 1,498 surveys were completed. Survey items used for the current analyses included: demographics; sleep apnea risk, diagnostic status, and treatment; symptoms of other sleep disorders (eg, insomnia); mental health symptoms; and comorbidities.

Results: Among responders, 13% of women reported a prior sleep apnea diagnosis. Among women who reported a diagnosis of sleep apnea, 65% reported using positive airway pressure therapy. A sleep apnea diagnosis was associated with older age, higher BMI, non-Hispanic African American/Black racial/ethnic identity, being unemployed, other sleep disorder symptoms (eg, insomnia), depression and post-traumatic stress disorder symptoms, and multimorbidity. Among women without a sleep apnea diagnosis, 43% scored as "high risk" on the STOP (snoring, tiredness, observed apneas, blood pressure) questionnaire. High risk scores were associated with older age, higher BMI, African American/Black identity, other sleep disorder symptoms (eg, insomnia), mental health symptoms, and multimorbidity. Only BMI differed between women using vs not using positive airway pressure therapy.

Conclusions: Women veterans with diagnosed sleep apnea were commonly treated with positive airway pressure therapy, which is standard first-line treatment; however, many undiagnosed women were at high risk. Efforts to increase screening, diagnosis, and treatment of sleep apnea in women with comorbid mental and physical health conditions are needed.

Keywords: sleep apnea, sleep disordered breathing, women, veterans, positive airway pressure therapy.

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BRIEF SUMMARY

Current Knowledge/Study Rationale: Sleep apnea is a common sleep disorder and a known risk factor for cardiovascular disease; however, it is not well studied in women. Veterans are at high risk for sleep apnea; however, studies to date have included a large proportion of male veterans, and there are no studies specifically of women who are veterans.

Study Impact: This study demonstrates that a large number of women veterans are at high risk for sleep apnea, but most are undiagnosed. Variables associated with high sleep apnea risk were identified to guide diagnosis and treatment of sleep apnea in women who receive VA health care. Only BMI was related to use of positive airway pressure treatment among those diagnosed, suggesting differences with studies in the veteran population of mostly male participants.

INTRODUCTION

The proportion of veterans who are women is increasing steadily due to changes in the composition of the active duty military. Understanding the health care needs of this growing segment of the patients served by the Veterans Health Administration (VA) is of utmost importance, as their health care needs are different from those of their male counterparts.[1] Sleep disorders, including sleep apnea, are common among veterans overall,[2,3] and there is growing evidence that sleep disorders contribute to poor outcomes in veteran patients in terms of quality of life,[4] cardiovascular and metabolic health,[5,6] and mortality.[7] The VA and Department of Defense recently developed clinical practice guidelines related to the diagnosis and treatment of sleep disorders, including sleep apnea.[8] The guidelines recommend screening for sleep apnea in symptomatic patients, diagnostic

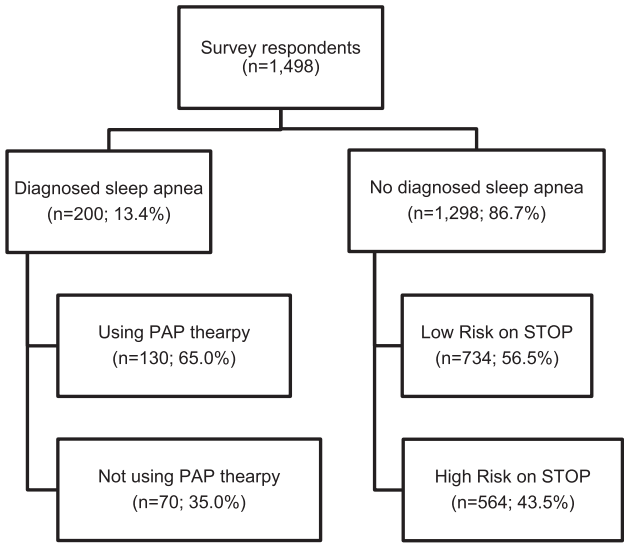
testing for those who are high risk, and treatment with positive airway pressure (PAP) therapy as a first-line approach; however, the guidelines do not address sex-specific differences in screening, diagnosis, or treatment.

Sleep apnea is the most commonly diagnosed sleep disorder among veterans who receive VA health care,[2] and rates of diagnosed sleep apnea have been steadily increasing for active duty and veteran men and women alike.[2,9] This increase is likely attributable to increasing awareness, in combination with rising rates of obesity nationwide,[10] and among VA users, obesity prevalence in women is 44%, which is greater than in men.[11] Despite this increasing awareness, there is less information on sleep apnea among women compared to men, perhaps owing to lower prevalence in women in the population at large. For example, the Wisconsin Sleep Cohort Study found that 34% of men and 17% of women studied between 2007 and 2010 met the minimum criteria for sleep apnea (apnea-hypopnea index $\geq$ 5 events/h).[5] While the underlying disease is similar in men and women, there are known sex differences in the underlying pathophysiologic factors underpinning disordered breathing during sleep overall. Specifically, 2 key features distinguish breathing during sleep in men vs women: higher pharyngeal compliance and increased propensity to hypocapnic central apnea in men relative to women.[12,13] The former increases the risk of pharyngeal collapse and the latter increases not only the risk of pharyngeal collapse but also breathing instability and recurrent apnea.

While research on differences in the presentation of sleep apnea between men and women is limited, there is some evidence that men and women with sleep apnea describe different symptoms related to their disease.[14,15] The classic symptoms of sleep apnea are largely derived from studies that included mostly men, and few studies have included a sufficiently large number of women to explore risk factors and associated symptoms specifically among women, especially women veterans.[16] This absence of data may reduce clinical suspicion for sleep apnea and create barriers to diagnostic testing in women, increasing the likelihood that women with sleep apnea remain undiagnosed and hence untreated.[7–9] Another factor that may contribute to underdiagnosis is the overall low rate of sleep apnea in premenopausal women, which may lead to lower suspicion that sleep-related symptoms are due to sleep apnea, but rather, that they are due to insomnia, which is more common among women compared to men.[17]

In the current study, we used data that focused on sleep-related symptoms from a nationwide survey of women veterans who use VA health care.[18,19] Our first objective was to identify rates of diagnosed sleep apnea among women veterans who use VA health care, and the proportion of diagnosed women who used PAP therapy. Our second objective was to identify women at high risk for sleep apnea who were not previously diagnosed and to explore differences between women with and without reported diagnosed sleep apnea in terms of demographic factors, symptoms of other sleep disorders, mental health symptoms, and comorbid conditions. Our third objective was to explore differences between women who reportedly used PAP therapy to those who did not in terms of the same patient characteristics.

Figure 1—Flow diagram showing number of women diagnosed with and treated for sleep apnea, and risk (based on the STOP screening questionnaire) among those who are undiagnosed.



PAP = positive airway pressure.

METHODS

Study survey sample

The national study sample was identified using simple random sampling of all women veterans (n > 300,000) who had received health care services at a VA facility (1 or more VA visits) in the 6-month period from May to November, 2012. A dataset was obtained from the VA Health Eligibility Center, which included contact information (name, address, telephone number) and other data elements available through administrative records (eg, age, sex, period of military service). The 6-month time frame was chosen based on our prior experience conducting a postal survey in one VA Healthcare System[20]: Women who had interacted with the VA Healthcare System within the past 6 months were more likely to have valid addresses and phone numbers compared to women who had not been seen in the prior 6 months. Additional details related to survey methodology and insomnia-related findings have been published previously.[18,19]

A random sample of 4,000 women was selected from the cohort of approximately 300,000 women veterans described above. Using standard postal survey methodology, including steps to reduce risk of nonresponse bias,[21] surveys were sent by mail in batches of 1,000 surveys per mailing between February and October, 2013. If no response was received within 3 weeks, a second survey was sent. After the final set of surveys were mailed, all nonresponders from the first 1,000-person cohort were contacted by phone and offered the opportunity to complete the survey verbally as an additional strategy for reducing response bias.[21] For the purpose of this analysis, a "responder" was defined as an individual who returned a survey and provided answers to the sleep apnea–related items [ie, responded about diagnosis and treatment of sleep apnea, plus the 4

items necessary for computing the STOP (snoring, tiredness, observed apneas, blood pressure) questionnaire].[22] Out of the 1,562 surveys returned by mail or completed by phone, 1,498 surveys were complete and available for the current analysis (total response rate = 37%). Using available administrative data from VA Health Eligibility Center, we found minimal differences between responders and nonresponders, (eg, the unweighted percentage who reported a diagnosis of sleep apnea was 13.4% while the weighted percentage was 12.0%, a difference of only 1.3%), thus weighting for nonresponse was not employed as weighting had minimal impact on the key variable of interest.

This study was approved by the Institutional Review Board of the VA Greater Los Angeles Healthcare System. A waiver of documentation of consent was obtained for the survey.

Survey

The original survey study was conducted for the purpose of estimating the prevalence of insomnia and other sleep disorders and identifying insomnia treatment preferences among women veterans.[19] The survey included cover material describing the survey as research and 4 pages of questionnaire items. The specific items used in the current analyses are described below. Variable selection was based on a demonstrated or theoretical relationship with sleep disorders. The survey elements reported here included demographics, sleep apnea-related items, insomnia severity, mental health symptoms, and physical health–related factors. Core survey items were developed and tested in a previous study.[20]

Demographics

Demographic characteristics evaluated in the survey included self-identified race/ethnicity, marital status, employment status, and military service history. Age (computed as date of survey completion minus date of birth, in years) was obtained from administrative databases. Self-reported height and weight were also collected and used to calculate body mass index [BMI; height (meters) divided by weight (in kilograms) squared]

Sleep apnea

The survey included the 4 items used to evaluate sleep apnea risk from the STOP questionnaire.[22] This scale includes 4 dichotomous yes/no items: snoring, tiredness, observed apneas, and high blood pressure, with 1 point given per "yes" response. Scores of 2 or higher suggest high risk for sleep apnea. Items were developed and formatted for use in the postal survey to cover each of these domains. "Yes" responses to the following questions were scored as "1" on the STOP questionnaire for a total possible score of 0–4.

- Do you snore loudly? (yes/no)
- During the past month, did you feel tired, fatigued, or sleepy during the day? (yes/no)
- Has anyone told you that you stop breathing during your sleep? (yes/no)
- Do you have or have you ever been treated for: high blood pressure? (yes/no, asked as part of a comorbidity checklist)

In addition, the survey asked women if they had been diagnosed with sleep apnea or had previously received treatment (new items developed for this survey). Each question was asked in a yes/no format.

- Have you ever been diagnosed with sleep apnea? (yes/no)
- Do you use a CPAP, BPAP, or APAP machine to treat sleep apnea? (yes/no)

Symptoms related to other sleep disorders

The 7-item Insomnia Severity Index was used to evaluate the severity of insomnia symptoms.[23] Restless legs syndrome symptoms and nightmares were assessed via the following questions (developed for this survey):

- When you try to relax in the evening or sleep at night, do you have unpleasant, restless feelings in your legs that can be relieved by walking or movement? (yes/no)
- During the past month, how often did you have disturbing dreams and/or nightmares? (4-item scale assessing frequency that was dichotomized to "not during the past month" = 0 and any response indicating nightmares in the past month = 1)

Mental health measures

We evaluated 3 domains of mental health using brief screening measures. The Patient Health Questionnaire (PHQ-4)[24] was used to assess symptoms of depression (2 items) and anxiety (2 items) over the past 2 weeks, and a total score was computed for depression (0–6) and anxiety (0–6). The primary care–post-traumatic stress disorder (PC-PTSD)-4 item[25] was also included to evaluate risk for PTSD.

Self-reported comorbidities

A list of self-reported medical and psychiatric conditions was developed for the survey using 3 sources: (1) the most common *International Classification of Diseases, Ninth Revision*[26] diagnostic codes for women veterans who use VA health care, (2) the Comorbidity Index,[27] and (3) history of medical conditions assessed in the Study of Women's Health Across the Nation (SWAN).[28] A total of 15 comorbid conditions were included in the survey, including 9 medical and 6 psychiatric conditions/symptoms. Respondents were asked "Do you have, or have you ever been treated for … (yes/no):

- High blood pressure (included in the STOP questionnaire, above)
- Heart disease
- High cholesterol
- Diabetes
- Gastroesophageal reflux disease (GERD)
- Chronic pain (including back pain or headaches)
- Breathing problems (such as asthma, emphysema, or COPD)
- Thyroid disorders
- Traumatic brain injury (TBI)
- Depression
- Anxiety or panic disorder
- Post-traumatic stress disorder (PTSD)
- Problem drinking or alcoholism
- Drug use (other than alcohol)
- Bipolar disorder or manic-depressive disorder

Data analysis

We first estimated rates of diagnosed sleep apnea by computing the percent of respondents who answered "yes" to having received a diagnosis. Among those women, we then computed the percent of respondents who reported using a continuous positive airway pressure (CPAP), bilevel positive airway pressure (BPAP), or automatic or autotitrating positive airway pressure machine to treat sleep apnea. Of the respondents who did not report a diagnosis of sleep apnea, none reported using PAP therapy.

Among the women who answered "no" to having diagnosed sleep apnea, we computed their risk score on the STOP questionnaire, and categorized them as "high risk" (ie, STOP score ≥ 2) vs "low risk" (ie, STOP score of 0 or 1). Among women who were not diagnosed with sleep apnea, we compared those who were at high vs low risk according to their score on the STOP using *t* tests (continuous variables) and chi-square tests (categorical variables). Again, we compared the 2 groups in terms of demographic factors, evidence of other sleep disorders (ie, insomnia, restless legs syndrome, nightmares), mental health symptoms, and comorbid conditions.

Among women with diagnosed sleep apnea, we compared women who were using PAP therapy to those who were not via *t* tests (continuous variables) and chi square tests (categorical variables). We compared the 2 groups in terms of demographic factors, evidence of other sleep disorders, mental health symptoms, and comorbid conditions.

For all statistical tests, $P < .05$ was used to establish statistical significance. Since there is limited data on sleep in women veterans, we considered multiple factors in balancing the risk of type I and type II errors in this study. Rather than employ a stringent type I error correction (eg, Bonferroni correction), we elected to use $P < .05$ for each individual statistical test, and to interpret the totality of the results, with the understanding that a small number of findings may not be replicated in future research. This means that up to 5% of tests conducted may, in fact, represent type I errors. Based on the number of tests carried out within this study, we expected 4–5 tests to be significant by chance alone. This decision was made based on a desire to avoid increasing risk of type II errors in a relatively under-studied area, as this could limit future investigation of potentially important findings in this early cross-sectional study. Data were analyzed using STATA 15.1. (StataCorp LLC, College Station, TX).[29]

RESULTS

Survey sample characteristics

Characteristics of respondents (n = 1,498) with sufficient data for inclusion in this analysis are shown in **Table 1**. The average age was 52 years, ranging from 18 to > 100 years. Forty-one percent identified racial/ethnic minority group status. As expected in VA patient populations, most women reported medical and psychiatric comorbidities. The most commonly reported medical comorbidity was chronic pain, which was reported by 65% of respondents. The most common mental health condition reported was depression (54%). Less than half (41%) were currently employed for wages.

Sleep apnea diagnosis

Two hundred respondents [13.4%; 95% confidence interval (CI) 11.7% to 15.1%] reported being diagnosed with sleep apnea (**Figure 1**). Women who reported a diagnosis of sleep apnea were significantly older, were less likely to be employed, and had higher BMI. Women who identified as non-Hispanic African American/Black were more likely to report a diagnosis of sleep apnea. There were no differences between groups regarding marital status. In terms of other sleep-related symptoms, women with diagnosed sleep apnea had higher Insomnia Severity Index scores and were more likely to have restless legs syndrome symptoms and nightmares. Women with diagnosed sleep apnea also had more symptoms of depression and PTSD but not anxiety/panic, and had higher rates of diagnosed medical and mental health comorbidities (see **Table 2**).

Risk of sleep apnea among undiagnosed women veterans

Among those who did not report a diagnosis of sleep apnea (n = 1,298), 43.4% (95% CI 40.1% to 46.2%) scored as high risk on the STOP screening questionnaire (**Figure 1**). Differences between undiagnosed women at high and low risk of sleep apnea are shown in **Table 3**. Undiagnosed women who were high risk for sleep apnea were significantly older, were more likely to identify as non-Hispanic White, and had higher BMI but did not differ in terms of employment or marital status. Women who identified as non-Hispanic White were less likely to be high risk and women who identified as non-Hispanic African American/Black were more likely to be high risk. Undiagnosed women who were high risk also had more symptoms of other sleep disorders, more mental health symptoms (depression, anxiety/panic, and PTSD), and more comorbid conditions.

Treatment of sleep apnea with PAP therapy

Among those reporting a diagnosis of sleep apnea (n = 200), 130 women (65%) reported using PAP therapy (**Figure 1**). Women using PAP therapy had significantly higher BMI than women not using PAP therapy. There were no other significant differences on survey variables between women who used or did not use PAP therapy (see **Table 4**).

DISCUSSION

This study is among the first to report on rates of sleep apnea among a large sample of women. Within this sample of women veterans who use VA health care, we found that 13.4% reported a prior diagnosis of sleep apnea, which is higher than the reported rates among women in the Wisconsin Sleep Cohort Study (3% among women 30–49, and 9% among women age 50–70).[30] This difference may be related to the inclusion of women over age 70, high rates of obesity, and the high comorbidity burden of women who use VA health care. Veterans have more diagnosed health conditions than their non-veteran counterparts, and women using VA health care have greater medical and mental health comorbidity than women veterans who do not receive VA care.[31] Women veterans also experience high rates of military sexual trauma,[32–35] which is associated with increased risk of a

Table 1—Demographics and descriptive characteristics for survey respondents (n = 1,498).

	Mean (SD) or Frequency (%)	95% CI
Sociodemographic characteristics		
Age	51.6 (14.6)	50.9, 52.4
Race/ethnicity		
Non-Hispanic White	921 (61.5%)	59.0%, 63.9%
Hispanic	362 (24.2%)	22.1%, 26.4%
Non-Hispanic African American/Black	69 (4.6%)	3.7%, 5.8%
All other groups (including > 1 race/ethnicity)	146 (9.7%)	8.3%, 11.3%
Employed for wages	614 (41.1%)	38.6%, 43.6%
Married/living as married	662 (41.7%)	39.3%, 44.3%
BMI (m/kg^2)	28.8 (6.4)	28.5%, 29.2%
Sleep apnea		
Diagnosed with sleep apnea	200 (13.4%)	11.7%, 15.2%
Treatment with CPAP (yes)	130 (65%)	58.1%, 71.3%
Not diagnosed with sleep apnea	1298 (86.7%)	84.8%, 88.3%
High risk for sleep apnea (STOP ≥ 2)	564 (43.5%)	40.1%, 46.2%
Symptoms of other sleep disorders		
ISI total score (0–28)	12.8 (7.1)	12.5%, 13.2%
RLS symptoms (yes)	590 (39.5%)	37.0%, 42.0%
Nightmares (past month, yes)	472 (31.6%)	29.3%, 34.0%
Mental health symptoms		
PHQ-4 Depression (0–8)	1.9 (2.0)	2.0%, 2.3%
PHQ-4 Anxiety (0–8)	2.2 (2.0)	1.8%, 2.0%
PC-PTSD (0–4)	1.5 (1.6)	1.4%, 1.5%
Medical comorbidities (yes/no)		
High blood pressure	585 (39.1%)	36.7%, 41.6%
Heart disease	161 (10.8%)	9.3%, 12.5%
High cholesterol	608 (40.8%)	38.3%, 43.3%
Diabetes	232 (15.6%)	13.8%, 17.5%
GERD	491 (33.0%)	30.6%, 35.4%
Chronic pain (including back pain or headaches)	965 (64.5%)	62.1%, 66.9%
Breathing problems (such as asthma, emphysema or COPD)	351 (23.5%)	21.4%, 25.7%
Thyroid disorders	312 (20.9%)	18.9%, 23.0%
TBI	77 (5.2%)	4.2%, 6.4%
Mental health comorbidities (yes/no)		
Depression	808 (54.2%)	51.7%, 56.7%
Anxiety or panic disorder	626 (42.0%)	39.5%, 44.5%
PTSD	453 (30.5%)	28.2%, 32.9%
Problem drinking or alcoholism	103 (6.9%)	5.7%, 8.3%
Drug use (other than alcohol)	46 (3.1%)	2.3%, 4.1%
Bipolar/manic-depressive disorder	153 (10.3%)	8.8%, 11.9%

BMI = body mass index, COPD = chronic obstructive pulmonary disease, CPAP = continuous positive airway pressure, GERD = gastroesophageal reflux disease, ISI = Insomnia Severity Index, PC-PTSD = primary care–post-traumatic stress disorder, PHQ = patient health questionnaire, PTSD = post-traumatic stress disorder, RLS = restless legs syndrome, SD = standard deviation, TBI = traumatic brain injury.

variety of negative physical and mental health consequences.[36] In our study we do not have information on trauma specifically, but over 30% of respondents reported PTSD, which is a known risk factor for low PAP adherence in male veterans.[37]

This study also provides information about potential predictors of sleep apnea diagnosis among women veterans. Similar to non-veteran women, sleep apnea diagnosis was more common in older women, women with higher BMI, non-

Table 2—Differences between women who reported a diagnosis of sleep apnea vs women who did not report a previous diagnosis of sleep apnea (total n = 1,498).

	Have you been diagnosed with sleep apnea?		*P*-Value
	Yes	No	
Number of women	200 (13.4%)	1,298 (86.7%)	—
Sociodemographic characteristics			
Age	55.3 (11.9)	51.1 (14.9)	< .001
Race/ethnicity			
Non-Hispanic White	114 (57%)	807 (62.2%)	0.162
Hispanic	60 (30%)	302 (23.3%)	0.039
Non-Hispanic African American/Black	12 (6.0%)	57 (4.4%)	0.314
All other groups (including > 1 race/ethnicity)	14 (7.0%)	132 (10.2%)	0.162
Employed for wages	66 (33.0%)	548 (42.3%)	0.013
Married/living as married	77 (38.5%)	545 (42.3%)	0.318
BMI (m/kg^2)	32.6 (7.6)	28.3 (6.0)	< .001
Symptoms of other sleep disorders			
ISI total score (0–28)	15.0 (6.9)	12.5 (7.1)	< .001
RLS symptoms (yes/no)	103 (51.8%)	487 (37.6%)	< .001
Nightmares (past month, yes/no)	77 (38.5%)	395 (30.5%)	0.024
Mental health symptoms			
PHQ-4 Depression (0–8)	2.6 (2.0)	1.8 (2.0)	< .001
PHQ-4 Anxiety (0–8)	2.4 (2.0)	2.1 (2.0)	0.059
PC-PTSD (0–4)	1.9 (1.7)	1.4 (1.6)	< .001
Medical comorbidities (yes/no)			
High blood pressure	115 (57.5%)	470 (36.2%)	< .001
Heart disease	40 (20.1%)	121 (9.4%)	< .001
High cholesterol	113 (57.1%)	495 (38.3%)	< .001
Diabetes	69 (34.9%)	163 (12.6%)	< .001
GERD	103 (51.5%)	388 (30.1%)	< .001
Chronic pain (including back pain or headaches)	158 (79.8%)	807 (62.2%)	< .001
Breathing problems (such as asthma, emphysema or COPD)	83 (41.7%)	268 (20.71%)	< .001
Thyroid disorders	61 (30.7%)	251 (19.4%)	< .001
TBI	17 (8.6%)	60 (4.7%)	0.019
Mental health comorbidities (yes/no)			
Depression	140 (70.7%)	668 (51.7%)	< .001
Anxiety or panic disorder	108 (54.3%)	518 (40.1%)	< .001
PTSD	90 (45.5%)	363 (28.2%)	< .001
Problem drinking or alcoholism	13 (6.6%)	90 (7.0%)	0.836
Drug use (other than alcohol)	3 (1.5%)	43 (3.3%)	0.178
Bipolar/manic-depressive disorder	30 (15.0%)	123 (9.5%)	0.019

BMI = body mass index, COPD = chronic obstructive pulmonary disease, GERD = gastroesophageal reflux disease, ISI = Insomnia Severity Index, PC-PTSD = primary care–post-traumatic stress disorder, PHQ = patient health questionnaire, PTSD = post-traumatic stress disorder, RLS = restless legs syndrome, TBI = traumatic brain injury.

Hispanic African American/Black women, and unemployed women. This is consistent with previous studies indicating that older patients and non-Hispanic African American/Black patients are at an increased risk for developing sleep apnea.[14,38,39] Additionally, a number of sleep disorder symptoms (insomnia, restless legs syndrome, and nightmares) and mental health symptoms (PTSD and depression) were more commonly reported by women with a sleep apnea diagnosis in the current study. Results revealed that all medical comorbidities analyzed (high blood pressure, heart disease, high cholesterol, diabetes, gastroesophageal reflux disease, chronic pain, breathing problems, thyroid disorders, and traumatic brain injury) were more common in women with diagnosed sleep apnea compared to undiagnosed women, and most mental health comorbidities

Table 3—Differences between undiagnosed women at high risk vs low risk for sleep apnea on the STOP screening questionnaire (total n = 1,298).

	Risk for Sleep Apnea on STOP		*P*-Value
	Low Risk (STOP < 2)	High Risk (STOP ≥ 2)	
Number of women	734 (56.5%)	564 (43.5%)	
Sociodemographic characteristics			
Age	49.5 (15.8)	53.1 (13.3)	< .001
Race/ethnicity			
Non-Hispanic White	486 (66.2%)	321 (56.9%)	0.001
Hispanic	33 (4.5%)	24 (4.3%)	0.834
Non-Hispanic African American/Black	136 (18.5%)	166 (29.4%)	< .001
All other groups (including > 1 race/ethnicity)	79 (10.8%)	53 (9.4%)	0.420
Employed for wages	318 (43.4%)	230 (40.9%)	0.364
Married/living as married	322 (44.1%)	223 (6.4%)	0.122
BMI (m/kg^2)	26.8 (5.)	30.2 (6.6)	< .001
Symptoms of other sleep disorders			
ISI total score (0–28)	11.1 (7.2)	14.4 (6.4)	< .001
RLS symptoms (yes/no)	236 (32.3%)	251 (44.5%)	< .001
Had nightmare (yes/no)	195 (26.6%)	200 (35.5%)	0.001
Mental health symptoms			
PHQ-4 Depression (0–8)	1.6 (1.9)	2.2 (2.0)	< .001
PHQ-4 Anxiety (0–8)	1.9 (1.9)	2.4 (2.1)	< .001
PC-PTSD (0–4)	1.2 (1.6)	1.6 (1.7)	< .001
Medical comorbidities (yes/no)			
Heart disease	44 (6.0%)	77 (13.8%)	< .001
High cholesterol	211 (28.8%)	284 (50.5%)	< .001
Diabetes	46 (6.3%)	117 (20.9%)	< .001
GERD	188 (25.6%)	200 (36.0%)	< .001
Chronic pain (including back pain or headaches)	411 (56.0%)	396 (70.3%)	< .001
Breathing problems (such as asthma, emphysema, or COPD)	118 (16.1%)	150 (26.6%)	< .001
Thyroid disorders	131 (17.9%)	120 (21.3%)	0.126
TBI	35 (4.8%)	25 (4.5%)	0.784
Mental health comorbidities (yes/no)			
Depression	344 (47.1%)	324 (57.5%)	< .001
Anxiety or panic disorder	272 (37.2%)	246 (43.8%)	0.017
PTSD	190 (26.1%)	173 (30.9%)	0.054
Problem drinking or alcoholism	50 (6.8%)	40 (7.1%)	0.839
Drug use (other than alcohol)	20 (2.7%)	23 (4.1%)	0.180
Bipolar/manic-depressive disorder	63 (8.6%)	60 (10.7%)	0.207

BMI = body mass index, COPD = chronic obstructive pulmonary disease, GERD = gastroesophageal reflux disease, ISI = Insomnia Severity Index, PC-PTSD = primary care–post-traumatic stress disorder, PHQ = patient health questionnaire, PTSD = post-traumatic stress disorder, RLS = restless legs syndrome, TBI = traumatic brain injury.

(all except problematic drinking and drug use) were more common in women diagnosed with sleep apnea compared to those without a diagnosis. These findings are not surprising as comorbidities among sleep disorders are well documented,[40,41] and there is a growing body of literature demonstrating the relationship between psychiatric disorders and sleep apnea as well.[42,43] Greater health care use by women with multiple comorbidities may also increase likelihood of detection of disorders such as sleep apnea and lead to referrals for diagnostic testing. Due to the cross-sectional nature of the current study, we cannot comment on the directional nature of these relationships; however, it appears that women veterans with a sleep apnea diagnosis are likely to present with multiple symptoms. It is important that providers evaluate potential sleep apnea

Table 4—Differences between women who used positive airway pressure (PAP) therapy to treat sleep apnea vs those who did not use PAP therapy (total N = 200).

	Treatment with PAP Therapy		*P*-Value
	Using PAP	Not Using PAP	
Number of women	130 (65%)	70 (35%)	
Sociodemographic characteristics			
Age	55.5 (11.4)	55.0 (12.9)	0.753
Race/ethnicity			
Non-Hispanic White	76 (58.5%)	38 (54.3%)	0.570
Hispanic	7 (5.4%)	5 (7.1%)	0.619
Non-Hispanic African American/Black	41 (31.5%)	19 (27.1%)	0.518
All other groups (including > 1 race/ethnicity)	6 (4.6%)	8 (11.4%)	0.072
Employed for wages	45 (34.6%)	21 (30.0%)	0.508
Married/living as married	44 (33.8%)	33 (47.1%)	0.066
BMI (m/kg^2)	34.4 (8.0)	29.3 (5.7)	< .001
Other sleep disorders			
ISI total score (0–28)	14.6 (6.7)	15.7 (7.2)	0.271
RLS symptoms (yes/no)	68 (52.7%)	35 (50.0%)	0.715
Had nightmare (yes/no)	47 (36.2%)	30 (42.9%)	0.353
Mental health symptoms			
PHQ-4 Depression (0–8)	2.5 (2.0)	2.8 (2.1)	0.348
PHQ-4 Anxiety (0–8)	2.3 (2.0)	2.6 (2.1)	0.385
PC-PTSD (0–4)	1.7 (1.6)	2.1 (1.7)	0.094
Medical comorbidities (yes/no)			
High blood pressure	76 (58.5%)	39 (55.7%)	0.708
Heart disease	27 (20.8%)	13 (18.8%)	0.747
High cholesterol	75 (58.1%)	38 (55.1%)	0.678
Diabetes	46 (35.9%)	23 (32.9%)	0.664
GERD	69 (53.1%)	34 (48.6%)	0.543
Chronic pain (incl. back pain, headaches)	102 (79.1%)	56 (81.2%)	0.727
Breathing problems (such as asthma, emphysema, or COPD)	57 (44.2%)	26 (37.1%)	0.337
Thyroid disorders	38 (29.5%)	23 (32.9%)	0.620
TBI	9 (7.0%)	8 (11.6%)	0.281
Mental health comorbidities (yes/no)			
Depression	94 (72.3%)	46 (67.6%)	0.494
Anxiety or panic disorder	69 (53.5%)	39 (55.7%)	0.763
PTSD	57 (44.5%)	33 (47.1%)	0.724
Problem drinking or alcoholism	8 (6.3%)	5 (7.1%)	0.809
Drug use (other than alcohol)	2 (1.6%)	1 (1.4%)	0.946
Bipolar/manic-depressive disorder	21 (16.2%)	9 (12.9%)	0.534

BMI = body mass index, COPD = chronic obstructive pulmonary disease, GERD = gastroesophageal reflux disease, ISI = Insomnia Severity Index, PC-PTSD = primary care–post-traumatic stress disorder, PHQ = patient health questionnaire, PTSD = post-traumatic stress disorder, RLS = restlesss legs syndrome, TBI = traumatic brain injury.

symptoms and not simply attribute symptoms to other sleep, medical, or psychiatric disorders.

Another important finding from the current study was that, among women without a prior sleep apnea diagnosis, 43% were at high risk for sleep apnea based on the symptoms they endorsed. Not surprisingly, many of the same variables associated with sleep apnea diagnosis were also associated with elevated sleep apnea risk in undiagnosed women, including: older age, higher BMI, non-Hispanic African American/Black racial/ethnic identity, sleep disorder symptoms, mental health symptoms, and medical and mental health comorbidities. These findings are largely consistent with prior research; however, it is notable that factors associated with diagnosis of sleep apnea are similar to factors associated with being high risk but not yet diagnosed. This suggests a need for

assessing risk of sleep apnea in all patients with sleep complaints. In fact, the recent VA/DOD Clinical Practice Guidelines suggest use of the STOP questionnaire to identify patients with sleep complaints who may need further evaluation.[8]

Our study also shows that, among women veterans who have been diagnosed with sleep apnea, only two-thirds reportedly used PAP therapy, which is considered first-line treatment. It is not clear from the information collected within the survey why one-third of women were not using this treatment, whether alternative approaches (eg, oral appliance therapy) were used, or whether no treatment was being used. Women who were treated with PAP and women who were diagnosed with sleep apnea but did not use PAP differed only in terms of BMI. Women using PAP treatment did not differ in terms of other demographic variables, sleep-related symptoms, mental health symptoms/comorbidities, or medical comorbidities. It is not clear why women using PAP treatment had higher BMI; however, one possible explanation is that they had more severe sleep apnea and clinicians more actively encourage women with obesity to use PAP. Also, women with higher BMI may experience greater benefit from PAP and therefore were more likely to report use of this treatment at the time of the survey. There is 1 study showing PTSD and nightmares are associated with lower PAP use (using objective monitoring data) among veterans; however, that study did not include any women.[44] A more recent study of veterans who received treatment in a VA sleep disorders center found that Black race was associated with less PAP use (compared to White race) over the first 30 days of treatment, but again, the study sample was 95% male veterans.[45] We did not find differences in PAP use among women veterans based on racial/ethnic identity. Another study found worse PAP adherence in younger women (ages 18–30) compared to women in other age ranges and compared to men in a national sample,[46] but age was not different in users and nonusers of PAP in our study.

This study had multiple strengths and some limitations. Importantly, this was the first study to examine rates of sleep apnea diagnosis, presence of high-risk symptoms, and PAP use in a nationwide sample of women veterans. This study also involved widely cited and empirically validated self-reported measures plus new items developed through systematic survey development methods; however, a key limitation is the absence of objective data on diagnosis of sleep apnea or use of PAP therapy. Another potential limitation is the possibility of survey response bias because participants self-selected to return the postal survey. It is possible that individuals who completed the survey may differ from those who did not in terms of their sleep apnea symptoms or other important characteristics. Additionally, women veterans are a unique population and results from the current study may not generalize to women more broadly. For example, the fact that there were no differences between women with sleep apnea who do or do not use PAP is in contrast with recent research and should be replicated. Given the exploratory nature of the current study, we selected a limited number of variables to examine based on the larger sleep apnea literature, and unmeasured variables may play an important role. Lastly, we acknowledge that there is a risk of type I error in a study with multiple comparisons. In this study, there may have been 4–5 significant differences due to type I errors; however, there were 41 statistically significant findings, and the pattern of findings is highly consistent. We have focused on the overall patterns of differences observed rather than emphasizing 1 specific statistical test finding. Nevertheless, we caution the reader about drawing conclusions regarding any particular significant result, as any particular test may be a type I error. Instead, attention should focus on the overall pattern of results, which demonstrates that a sleep apnea diagnosis and high-risk symptoms are associated with poorer physical and mental health in women veterans, but use of PAP therapy in those who were already diagnosed was not.

This study provides novel information regarding sleep apnea prevalence as well as its treatment among women veterans. Sleep apnea is understudied in women compared to men. Research should continue to explore risk factors for sleep apnea and treatment barriers to PAP that may be unique to women. Future studies should also identify potential sex differences in terms of both sleep apnea presentation and PAP treatment response. This study shows that many women veterans with high risk symptoms are not diagnosed with sleep apnea and demonstrates the importance of assessing for sleep apnea in women, particularly in the context of multiple medical and mental health comorbidities. Finally, this study should inform work to implement the new VA/DOD Clinical Practice Guidelines,[8] with particular attention to the needs of women veterans at high risk for sleep apnea.

ABBREVIATIONS

PTSD, post-traumatic stress disorder
STOP, snoring, tiredness, observed apneas, blood pressure
VA, Veterans Health Administration

REFERENCES

1. Washington DL, Bean-Mayberry B, Hamilton AB, Cordasco KM, Yano EM. Women veterans' healthcare delivery preferences and use by military service era: findings from the National Survey of Women Veterans. *J Gen Intern Med*. 2013;28(Suppl. 2):S571–S576.
2. Alexander M, Ray MA, Hébert JR, et al. The national veteran sleep disorder study: descriptive epidemiology and secular trends, 2000-2010. *Sleep*. 2016;39(7):1399–1410.
3. Ryden AM, Martin JL, Matsuwaka S, et al. Insomnia disorder among older veterans: results of a postal survey. *J Clin Sleep Med*. 2019;15(4):543–551.
4. Bjornsdottir E, Keenan BT, Eysteinsdottir B, et al. Quality of life among untreated sleep apnea patients compared with the general population and changes after treatment with positive airway pressure. *J Sleep Res*. 2015;24(3):328–338.
5. Punjabi NM, Caffo BS, Goodwin JL, et al. Sleep-disordered breathing and mortality: a prospective cohort study. *PLoS Med*. 2009;6(8):e1000132.
6. Solomon SD, Davidson JR. Trauma: prevalence, impairment, service use, and cost. *J Clin Psychiatry*. 1997;58(Suppl 9):5–11.
7. Molnar MZ, Mucsi I, Novak M, et al. Association of incident obstructive sleep apnoea with outcomes in a large cohort of US veterans. *Thorax*. 2015;70(9):888–895.
8. Mysliwiec V, Martin JL, Ulmer CS, et al. The management of chronic insomnia disorder and obstructive sleep apnea: synopsis of the 2019 U.S. Department of Veterans Affairs and U.S. Department of Defense Clinical Practice Guidelines. *Ann Intern Med*. 2020;172(5):325–336.
9. Caldwell JA, Knapik JJ, Lieberman HR. Trends and factors associated with insomnia and sleep apnea in all United States military service members from 2005 to 2014. *J Sleep Res*. 2017;26(5):665–670.

10. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity among Adults and Youth: United States, 2015–2016.*NCHS Data Brief*, no 288. Hyattsville, MD: National Center for Health Statistics; 2017; accessed November 9, 2020.
11. Breland JY, Phibbs CS, Hoggatt KJ, et al. The obesity epidemic in the Veterans Health Administration: prevalence among key populations of women and men veterans. *J Gen Intern Med*. 201732, S1, Suppl 1:11–17.
12. Rowley JA, Sanders CS, Zahn BR, Badr MS. Gender differences in upper airway compliance during NREM sleep: role of neck circumference. *J Appl Phys*. 2002;92(6):2535–2541.
13. Rowley JA, Zhou XS, Diamond MP, Badr MS. The determinants of the apnea threshold during NREM sleep in normal subjects. *Sleep*. 2006;29(1):95–103.
14. Gabbay IE, Lavie P. Age- and gender-related characteristics of obstructive sleep apnea. *Sleep Breath*. 2012;16(2):453–460.
15. Chervin RD. Sleepiness, fatigue, tiredness, and lack of energy in obstructive sleep apnea. *Chest*. 2000;118(2):372–379.
16. Zhang Y, Weed JG, Ren R, Tang X, Zhang W. Prevalence of obstructive sleep apnea in patients with posttraumatic stress disorder and its impact on adherence to continuous positive airway pressure therapy: a meta-analysis. *Sleep Med*. 2017;36:125–132.
17. Zhang B, Wing Y-K. Sex differences in insomnia: a meta-analysis. *Sleep*. 2006; 29(1):85–93.
18. Schweizer CA, Hoggatt KJ, Washington DL, et al. Use of alcohol as a sleep aid, unhealthy drinking behaviors, and sleeping pill use among women veterans. *Sleep Health*. 2019;5(5):495–500.
19. Culver NC, Song Y, Kate McGowan S, et al. Acceptability of medication and non-medication treatment for insomnia among women veterans: effects of age, insomnia severity, and psychiatric symptoms. *Clin Ther*. 2016;38(11): P2373–2385.
20. Martin JL, Schweizer CA, Hughes JM, et al. Estimated prevalence of insomnia among women veterans: results of a postal survey. *Women's Health Issues*. 2017;27(3):366–373.
21. Halbesleben JRB, Whitman MV. Evaluating survey quality in health services research: a decision framework for assessing nonresponse bias. *Health Serv Res*. 2012;48(3):913–930.
22. Chung F, Yegneswaran B, Liao P, et al. STOP questionnaire: a tool to screen patients for obstructive sleep apnea. *Anesthesiology*. 2008;108(5):812–821.
23. Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med*. 2001;2(4):297–307.
24. Kroenke K, Spitzer RL, Williams JB, Löwe B. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics*. 2009;50(6):613–621.
25. Ouimette P, Wade M, Prins A, Schohn M. Identifying PTSD in primary care: comparison of the Primary Care-PTSD screen (PC-PTSD) and the General Health Questionnaire-12 (GHQ). *J Anxiety Disord*. 2008;22(2):337–343.
26. World Health Organization. *International Classification of Diseases, Ninth Revision*. Geneva, Switzerland: World Health Organization; 1979.
27. Selim AJ, Fincke G, Ren XS, et al. Comorbidity assessments based on patient report: results from the Veterans Health Study. *J Ambul Care Manage*. 2004;27(3): 281–295.
28. Sowers M, Crawford SL, Sternfeld B, et al. SWAN:A multicenter, multi–ethnic, community–based cohort study of women and the menopausal transition. In: Lobo RA, Kelsey J, and Marcus R, eds. *Menopause: Biology and Pathobiology*. San Diego, CA: Academic Press; 2000.
29. STATA release 15. College Station, TX: StataCorp LLC; 2015. Available from: https://www.stata.com/stata15/. Accessed November 9, 2020.
30. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med*. 1993; 328(17):1230–1235.
31. Washington DL, Farmer MM, Mor SS, Canning M, Yano EM. Assessment of the healthcare needs and barriers to VA use experienced by women veterans: findings from the national survey of women Veterans. *Med Care*. 201553, 4, Suppl 1: S23–S31.
32. Eibner C, Krull H, Brown KM, et al. Current and projected characteristics and unique health care needs of the patient population served by the Department of Veterans Affairs. *Rand Health Q*. 2016;5(4):13. https://www.rand.org/pubs/research_reports/RR1165z1.html
33. Zundel CG, Krengel MH, Heeren T, et al. Rates of chronic medical conditions in 1991 Gulf War veterans compared to the general population. *Int J Environ Res Public Health*. 2019;16(6):949.
34. Wilson LC. The prevalence of military sexual trauma: A meta-analysis. *Trauma Violence Abuse*. 2018;19(5):584–597.
35. Kelly UA, Skelton K, Patel M, Bradley B. More than military sexual trauma: interpersonal violence, PTSD, and mental health in women veterans. *Res Nurs Health*. 2011;34(6):457–467.
36. Suris A, Lind L. Military sexual trauma: a review of prevalence and associated health consequences in veterans. *Trauma Violence Abuse*. 2008;9(4):250–269.
37. Collen JF, Lettieri CJ, Hoffman M. The impact of posttraumatic stress disorder on CPAP adherence in patients with obstructive sleep apnea. *J Clin Sleep Med*. 2012;8(6):667–672.
38. Friedman M, Bliznikas D, Klein M, Duggal P, Somenek M, Joseph NJ. Comparison of the incidences of obstructive sleep apnea-hypopnea syndrome in African-Americans versus Caucasian-Americans. *Otolaryngol Head Neck Surg*. 2006;134(4):545–550.
39. Buxbaum SG, Elston RC, Tishler PV, Redline S. Genetics of the apnea hypopnea index in Caucasians and African Americans: I. Segregation analysis. *Genet Epidemiol*. 2002;22(3):243–253.
40. Benetó A, Gomez-Siurana E, Rubio-Sanchez P. Comorbidity between sleep apnea and insomnia. *Sleep Med Rev*. 2009;13(4):287–293.
41. Barthlen GM. Sleep disorders. Obstructive sleep apnea syndrome, restless legs syndrome, and insomnia in geriatric patients. *Geriatrics*. 2002;57(11):34–39, quiz 40.
42. Colvonen PJ, Masino T, Drummond SP, Myers US, Angkaw AC, Norman SB. Obstructive sleep apnea and posttraumatic stress disorder among OEF/OIF/OND veterans. *J Clin Sleep Med*. 2015;11(5):513–518.
43. BaHammam AS, Kendzerska T, Gupta R, et al. Comorbid depression in obstructive sleep apnea: an under-recognized association. *Sleep Breath*. 2016; 20(2):447–456.
44. El-Solh AA, Ayyar L, Akinnusi M, Relia S, Akinnusi O. Positive airway pressure adherence in veterans with posttraumatic stress disorder. *Sleep*. 2010;33(11): 1495–1500.
45. Hsu N, Zeidler MR, Ryden AM, Fung CH. Racial disparities in positive airway pressure therapy adherence among veterans with obstructive sleep apnea. *J Clin Sleep Med*. 2020;16(8):1249–1254.
46. Patel SR, Bakker JP, Stitt CJ, Aloia MS, Nouraie SM. Age and gender disparities in adherence to continuous positive airway pressure [published online ahead of print, 2020, July 17]. *Chest*.

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