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IDENTIFYING GAPS IN CLINICAL EVALUATION AND TREATMENT OF SLEEP DISORDERED BREATHING IN WOMEN VETERANS

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee of the VA Greater Los Angeles Healthcare System and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Verbal informed consent was obtained from all individual participants included in the study.

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Abstract

Purpose: Sleep disordered breathing (SDB) is a common sleep disorder in veterans; however, limited research exists in women veterans. We sought to estimate patterns of care in terms of evaluation, diagnosis, and treatment among women veterans with factors associated with elevated SDB risk.

Methods: Within one VA healthcare system, 319 women, identified through electronic health record data as having one or more factors (e.g., age>50 years, hypertension) associated with SDB, completed telephone screening in preparation for an SDB treatment study and answered questions about prior care related to SDB diagnosis and treatment.

Results: Overall, 111 (34.8%) participants reported having completed a diagnostic sleep study in the past, of whom 48 (43.2%) were diagnosed with SDB. Women who completed a diagnostic study were more likely to have hypertension or obesity. Those who were diagnosed with SDB based on that study were more likely to have hypertension, diabetes, or be ≥ 50 years old. Of the 40 women who received treatment, 37 (92.5%) received positive airway pressure therapy. Only 9 (24.3%) had used positive airway pressure therapy in the prior week. Few women received other treatments such as oral appliances or surgery.

Conclusions: Findings support the need for increased attention to identification and management of SDB in women veterans, especially those with conditions associated with elevated SDB risk.

Keywords

sleep; sleep apnea; women; veterans; positive airway pressure therapy

INTRODUCTION:

Sleep disordered breathing (SDB) is the most commonly diagnosed sleep disorder in US veterans,¹ yet it remains understudied in women veterans even though SDB is linked to adverse health consequences in women.² In a national survey of women veterans, 43% of those not previously diagnosed with SDB were high risk for SDB.³ Among those diagnosed with SDB, 65% reported using positive airway pressure (PAP) therapy when surveyed^{4,5} Symptomatology in women versus men with SDB may differ, with women reporting more fatigue and less sleepiness than men.⁶ Given that most of SDB research is done in males, providers may base clinical decisions on data that are potentially inaccurate for women.

We analyzed retrospective, subjective telephone screening data from a trial examining SDB treatment for women veterans with selected SDB risk markers⁴ documented in electronic health record data. Our objectives were to 1) identify patterns of diagnostic testing for SDB in women aged ≥ 50 years and/or with cardiometabolic conditions (i.e., hypertension, diabetes, obesity) associated with SDB risk; 2) test differences in SDB risk markers between

women with and without a past diagnosis of SDB; and 3) describe use of SDB treatments among women veterans.

METHODS:

Design.

Women veterans screened as part of the SDB treatment adherence intervention study (NCT03377452) included women residing within approximately 50 miles of two major clinical sites in an urban VA Healthcare system. The study protocol was approved by the VA Greater Los Angeles Healthcare System Institutional Review Board. Participants provided verbal consent prior to collection of research data (the IRB approved a waiver of written consent for the telephone screening; only verbal consent was obtained).

Participants.

Between June 2018 and March 2022, women veterans were identified via random sampling of all women who had a VA visit in the prior year and at least one SDB risk marker in their medical record (i.e., ICD-9/ICD-10 codes for cardiometabolic conditions including hypertension, diabetes, obesity, or age \geq 50 years; see Supplementary Table S1). Recruitment letters were mailed to 2,880 women. A total of 154 women opted-out of future contact and 1,898 women could not be reached (e.g., letter undeliverable, left voicemail, wrong number, deceased). Of 828 women contacted, a total of 319 women veterans completed the telephone screening questionnaire to assess parent trial eligibility and were included in these analyses.

Measures.

The parent trial targeted women not currently using PAP therapy. VA administrative data obtained for all potential participants included demographics and diagnostic codes for cardiometabolic conditions linked to SDB (i.e., hypertension, diabetes, and obesity; see Supplemental Table S1). Five screening items included in the current analysis focused on prior SDB diagnosis and treatment:

Q1: Previous diagnostic testing for SDB: “Have you been seen by a sleep specialist and completed an overnight sleep evaluation?” (yes/no)

Q2: Diagnosed with SDB: If yes, “were you told you have sleep apnea?” (yes/no)

Q3: PAP treatment for SDB: “Have you ever been prescribed or given a CPAP, APAP or BPAP machine for sleep apnea?” (yes/no)

Q4: Other treatment for SDB: “Have you received any other treatment for your sleep apnea, and if so, what treatment [e.g., oral appliance, surgery]?” (yes/no)

Q5: Current use of PAP or other treatment for SDB: “When was the last time you used your [PAP or other treatment; categorized as within past week vs. not currently using]” or “When did you have your surgery?” For the current study, PAP use within the past week was defined as any self-reported usage of PAP versus no usage at all in the past week.

Data Analysis.

Descriptive statistics, cross tabulations, and Pearson Chi-square tests were computed using Stata/SE (StataCorp. 2021. *Stata Statistical Software: Release 17*. College Station, TX: StataCorp LLC). Two-tailed tests with $\alpha=0.05$ were used for all comparisons.

RESULTS:

Patient characteristics.

Participant characteristics are shown in Table 1.

Patterns of undiagnosed SDB.

Overall, 34.8% of women veterans with 1 SDB risk factor reported prior diagnostic testing. Among women veterans who were previously tested, 43.2% were diagnosed with SDB (see Figure 1).

Differences in factors associated with SDB between women who were and were not evaluated for or diagnosed with SDB.

Women who reported prior diagnostic testing for SDB (Q1) were more likely to have a diagnosis of hypertension (28.8% versus 18.8%, $p=0.039$), but not a diagnosis of diabetes (18.9% versus 12.5%, $p=0.123$), or obesity (78.4% versus 71.6%, $p=0.191$) compared to women who did not report prior testing. Women who reported prior diagnostic testing for SDB were not more likely to be aged 50 years (44.1% versus 47.1%, $p=0.612$) compared to women who did not report prior testing. Among women 50 years of age ($N=147$), 20.4% did not have a diagnosis of hypertension, diabetes, or obesity.

Women who reported a prior diagnosis of SDB (Q2) were more likely to have diagnosed hypertension (41.7% versus 18.8%, $p<0.001$), diabetes (25.0% versus 12.9%, $p=0.029$) and age 50 years (62.5% versus 43.2%, $p=0.0013$). However, diagnosed obesity (72.9% versus 74.2%, $p=0.855$) was not significantly different between women who did versus did not report a prior diagnosis of SDB. There were no significant differences between women who identified as non-Hispanic white versus other racial or ethnic identities in terms of previous testing for (35.6% versus 34.1%, $p=0.820$) or diagnosis of (9.6% versus 16.7%, $p=0.138$) SDB.

Treatment use.

We found that 92.5% of women veterans treated for SDB were prescribed PAP therapy, but 75.7% of those prescribed PAP reported no use over the past week at the time of the screening assessment (see Figure 1). One woman was offered PAP and then oral appliance. Two women were prescribed oral appliance therapy and one indicated prior surgery.

DISCUSSION:

We found that only one third of women veterans with diagnoses and characteristics associated with SDB risk had completed diagnostic testing, and although PAP therapy was typically recommended, less than one quarter of diagnosed women ($n=48$) used treatment

in the past week (n=9). Women who were tested were more likely to have a history of hypertension; however, older age did not increase the likelihood of testing despite prior studies suggesting that SDB rates triple in women after menopause.⁷ This is concerning because, among women who were previously tested, those aged 50 years in our study were more likely to be diagnosed with SDB. Efforts to increase testing for SDB in older women veterans are needed to increase diagnosis and treatment.

Currently, diabetes is not considered a trigger for SDB screening in VA/DoD clinical practice guidelines;⁴ however, we found women with diabetes were more likely to report a diagnosis of SDB. Higher rates of SDB diagnosis among those with diabetes may be due to clinician awareness of the link between SDB and cardiometabolic diseases or to frequent contacts with providers for women with diabetes. We found no association between SDB diagnosis and obesity, which is consistent with previous research showing normal body mass index in active-duty women servicemembers with SDB.⁸

Most women diagnosed with SDB were prescribed PAP therapy; however, less than one-quarter of women veterans prescribed PAP therapy reported usage in the prior week. This suggests a need for additional support to facilitate adherence to PAP. This finding differs from a prior national survey of women veterans in which two-thirds reported current PAP use.⁵ This discrepancy may represent local variations or other factors (patient-related or systemic) influencing PAP use. The two women who reported treatment with oral appliance therapy, an alternative to PAP therapy,⁴ reported no usage in the past week, and it remains unclear if women who do not use PAP would be more likely to use oral appliance therapy. Further research is needed to identify reasons for non-adherence and to inform interventions that address identified barriers to SDB treatment in this population.

This study adds to foundational clinical knowledge about this understudied population and identified potential discrepancies between evaluation and diagnosis due to age 50 or a history of diabetes. Limitations of the study include a larger number of women who could not be reached for screening potentially introducing selection bias, the use of a brief telephone assessment that did not include questions related to barriers to diagnostic testing or treatment, menopausal status, time since SDB diagnosis, and report SDB symptoms. We also do not have objective PAP use data, diagnostic measures for other sleep disorders or comorbid mental health conditions. Findings also may not apply to men or women veterans receiving care outside of VA.

CONCLUSION:

Two-thirds of women veterans with SDB risk markers had not received diagnostic testing, suggesting an opportunity for increased clinical attention to SDB in women veterans. Those diagnosed with SDB were often prescribed PAP therapy but only a minority of patients were using PAP at the time of screening. Diabetes was associated with SDB diagnosis despite it not being a condition that triggers SDB evaluation in current clinical practice guidelines. Since there is evidence that educational and supportive interventions improve PAP adherence in general, providing education that is specific to women veterans may

increase use. Studies are needed to identify patient, provider and system-level barriers to timely diagnosis and effective treatment of SDB in women veterans.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data Availability Statement:

Datasets generated during the study may be available through execution of a data use agreement between the requesting institution and the VA Greater Los Angeles Healthcare System, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Inquiries can be made to the corresponding author.

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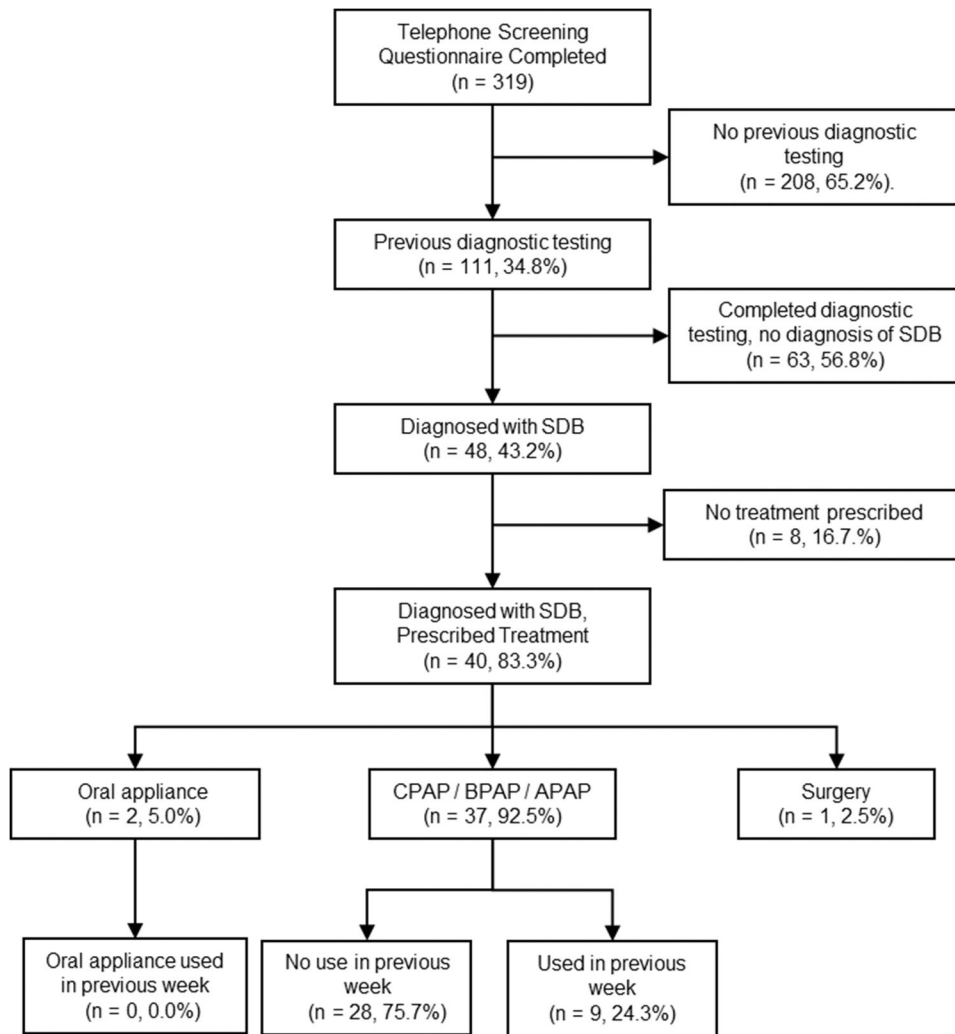


Figure 1: Rates of SDB evaluation, diagnosis, and treatment in women veterans

This figure shows rates of SDB diagnostic testing (Q1), SDB diagnosis (Q2), and current treatments (Q3–5) among participants (N=319). CPAP = continuous positive airway pressure, BPAP = bilevel positive airway pressure, APAP = auto-titrating positive airway pressure. Surgery: patient reported prior tonsillectomy to treat SDB. Note that one individual tried PAP and oral appliance therapy.

Table 1:

Characteristics of women veterans (N=319) with one or more SDB risk markers.

Variable	Mean (SD) / n (%)
Age in years, (SD)	48.1 (13.9)
Age ≥ 50 years, n (%)	147 (46.1%)
Race	
American Indian/Alaska Native, n (%)	7 (2.2%)
Asian, n (%)	14 (4.4%)
Black/African American, n (%)	98 (30.7%)
Multiracial, n (%)	6 (1.9%)
Pacific Islander, n (%)	7 (2.2%)
White, n (%)	170 (53.3%)
Unknown, n (%)	17 (5.3%)
Ethnicity	
Hispanic/Latina, n (%)	73 (22.9%)
Not Hispanic/Latina, n (%)	240 (75.2%)
Unknown	6 (1.9%)
History of Cardiometabolic Conditions	
History of hypertension, n (%)	71 (22.3%)
History of obesity, n (%)	236 (74.0%)
History of diabetes, n (%)	47 (14.7%)

Note: Percentages may not sum to 100.0% due to rounding. SDB risk markers were: Age ≥ 50 years, history of either: hypertension, obesity, or diabetes