OXFORD

Health Service Research

The challenge of identifying family medicine patients with obstructive sleep apnea: addressing the question of gender inequality

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Abstract

Purpose. The purpose of this study was to examine the sleep characteristics, metabolic syndrome disease and likelihood of obstructive sleep apnea in a sample of older, family medicine patients previously unsuspected for sleep apnea.

Methods. A total of 295 participants, minimum age 45, 58.7% women, were recruited from two family medicine clinics. None previously had been referred for sleep apnea testing. All participants completed a sleep symptom questionnaire and were offered an overnight polysomnography study, regardless of questionnaire results. 171 followed through with the sleep laboratory component of the study. Health data regarding metabolic syndrome disease (hypertension, hyperlipidemia, diabetes and obesity) were gathered by chart review.

Results. Overall, more women than men enrolled in the study and pursued laboratory testing. Of those who underwent polysomnography testing, 75% of the women and 85% of the men were diagnosed with sleep apnea based on an apnea/hypopnea index of 10 or greater. Women and men had similar polysomnography indices, the majority being in the moderate to severe ranges. In those with OSA diagnosis, gender differences in sleep symptom severity were not significant.

Conclusions. We conclude that greater gender equality in sleep apnea rates can be achieved in family practice if sleep apnea assessments are widely offered to older patients.

Key words: Case finding, gender, family medicine, prevalence, sleep apnea.

Introduction

In the past two decades, there have been tremendous advances in the understanding of the intricate physiological mechanisms of obstructive sleep apnea (OSA) and their impacts on long term health and mortality. Less well advanced, but making progress, is the development of effective treatments with adequate patient acceptance and adherence. Least well advanced is our ability to recognize people who have sleep apnea so they can be assessed and treated for a medical condition that can cause significant harm. This is especially true among women.

Obstructive sleep apnea is a very significant disorder of the upper respiratory system that acts in two problematic ways: intermittent hypoxia during sleep, linked to a wide range of problems stemming from oxidative stress and inflammation; and intermittent arousals from sleep occurring to resume breathing, causing fragmented sleep architecture and reduced slow wave sleep. Unsurprisingly,

OSA is associated with a host of metabolic and cardiovascular illnesses which increase with age. Additionally, the inter-relationships among disordered breathing, sleep fragmentation, hypoxia and the metabolic syndrome (1), including obesity, hyperlipidemia (2), hypertension (3) and diabetes (4,5) may well be bi-directional (6). Intermittent hypoxia was found to be associated with all-cause mortality and coronary-artery related mortality, in particular (7).

Recognizing OSA is a particular challenge as the signs and symptoms may arise from almost any biological system. The majority of suspected OSA cases are referred to specialized sleep clinics by family physicians, who must be sensitized to the problem and prepared to look beyond the classic stereotype (i.e., male, obese, snores, size 17 neck circumference). Based on numbers expected from community-based epidemiological studies, there remains a troubling under-recognition and under-referral of patients with OSA from primary care to specialized sleep centres. The few surveys conducted in primary care settings found that individuals with sleep disorders are common in primary care clinics, but under-recognized, particularly in women (8–10).

Prevalence: community versus clinical samples

Prevalence estimates of OSA in the adult general population vary dramatically and appear to range from 2% to 4% (women and men) (11) to as many as 50% of the Swedish population (12). Much depends on recruitment methodology, testing methods and criteria, age, and obesity as well as other co-morbidities. It appears that prevalence may have been a moving target over the past 25 or so years as population age and obesity have increased, and may account for some of the discrepancy from earlier to more recent estimates (13).

Sub-groups of the population, such as those with cardiovascular disease or the metabolic syndrome (e.g., hypertension, diabetes) have been reported to have much higher rates of OSA (7,14,15). For example, Heffner et al. (2012) reviewed the literature on the expected prevalence of diagnosed OSA among diabetic patients, estimated to be around 85%. When such high risk samples were evaluated in a primary care setting, it was shown that among diabetics, 75% had at least mild and 50%, severe OSA.

Gender representation in community and sleep clinic samples

Population studies generally report that OSA is twice as prevalent in men as in women, though this depends on age, and whether or not hormone replacement (HRT) is undertaken after menopause. It has been noted that the gender discrepancy decreases after age 65 in women who do not use HRT (16).

Many studies have compared the prevalence and severity of OSA in men and women who have already been referred to a specialized sleep clinic (i.e., having been identified as greater risk). Such samples typically have a high rate of OSA diagnosis, about 70–78% (17–19). Women are usually found to have less likelihood of being diagnosed than men, with 44% and 55% diagnosis rates, respectively (18).

There is a consistently noted discrepancy in gender ratio between sleep disorder centre and community estimates: one women versus five to eight men; one woman versus two to three men, respectively (18–22), suggesting that data from sleep disorder centres underestimate the prevalence OSA in women as compared with men.

Recruitment from family practice: the present study

In Canada, most referrals to sleep medicine clinics with suspected OSA come from primary care settings, particularly family medicine.

However, there have been no comprehensive studies to date on the prevalence of OSA among middle aged and older family medicine patients. The present study describes a sample recruited from two hospital-based family medicine clinics. We invited consecutive middle-aged and older patients (age 45 and older) to complete questionnaires and undergo an overnight polysomnography test. Here we describe the symptom profiles, sleep characteristics (including OSA) and health status of these individuals who may be typical of family medicine patients. We pay particular attention to gender disparities in symptom presentation, OSA presence and severity in individuals who have not previously been screened or suspected of OSA.

Methods

Participants

Participants were recruited as part of a large prospective study on identifying symptoms and medical conditions that can be indicative of OSA risk. Inclusion criteria were: age over 45, no prior testing for or diagnosis of OSA, and not currently experiencing severe medical or psychiatric crisis preventing participation. It was emphasised that we were seeking to study both those with possible OSA and those in good general health with a low likelihood of OSA. A total of 295 individuals (172 women and 123 men) were initially recruited from two hospital-based family medicine clinics in Montreal. Mean age was 57.5 years (SD = 11.5).

In the context of the Canadian publically funded health care system, the participants had an assigned family doctor whom they saw for routine/annual checkups, follow-up appointments, and to consult for non-emergency health concerns. Recruitment was conducted between March 2011 and June 2013.

Procedure

Family medicine patients were referred to the study by their family physician during a clinic visit if they met the inclusion criteria. In each case, the recruiter explained the study to the patient (in person or by phone), showed or mailed them the consent form, and reviewed questions about the protocol and consent form before gaining signed consent. Each participant completed the Sleep Symptom Checklist (SSC) as well as measures needed for the larger investigation at home, prior to their OSA testing. All were referred to a board certified sleep laboratory for a meeting with a medical sleep specialist followed by an overnight polysomnography study. Health status was determined by chart review, including diagnosis of hypertension, hyperlipidemia, diabetes and obesity. For those completing the polysomnography study, the body mass index (BMI) was calculated based on measurements taken at the sleep laboratory.

After completing their polysomnography sleep study and questionnaires, participants met with the medical sleep specialist to obtain the results of the assessment. Where participants were found to have a sleep disorder diagnosis, they were recommended treatment options and followed according to usual medical practice.

Measures

Polysomnography

Nocturnal polysomnography (PSG) was used to obtain sleep parameter scores (i.e., frequency of nocturnal arousals, total sleep time, sleep onset latency, wake after sleep onset, and sleep efficiency) as well as OSA related factors (i.e., nocturnal profile of oxygen saturation (O_2%), apnea hypopnea index (AHI) and respiratory events

related to arousal from sleep). Participants were monitored in a supervised sleep laboratory from 10:00 PM to 7:00 AM. Monitoring included: electro-oculogram (EOG), electroencephalogram (EEG), bilateral anterior tibialis and chin electromyogram (EMG), electrocardiogram (ECG), pulse oximetry, nasal and oral airflow with thermistor and nasal pressure cannulae, microphone for snoring, end-tidal CO_2 monitoring, and respitrace bands for measurement of respiratory effort. Apnea events and associated arousals were scored manually according to scoring rules established by the American Academy of Sleep Medicine 2012 ([23],[24]). An apnea event was defined as cessation of breathing lasting 10 seconds or more. Hypopneas were scored when there was a 30% or more decrease in airflow with 3% or more oxygen desaturation or a subsequent cortical arousal. Scoring sleep began at lights out and stopped when the participant arose in the morning.

Sleep Symptom Checklist

The SSC is a 21-item survey of a broad range of symptoms that are both directly and indirectly related to sleep disorders ([25]). It is easily completed by older patients. The respondent rates each symptom for its severity from 0 (not at all) to 3 (very severe) based on the previous month. Temporal stability of the severity ratings was found to be acceptable (total score $r = 0.79$, $P < 0.01$). Cronbach's alpha was 0.74. Factor analysis yielded four distinct subscales: Insomnia, Daytime Distress, Sleep Disorder, and Psychological Maladjustment, accounting for 52% of the variance in the data set. Temporal stability of the subscales according to test–retest correlations on the sums of the severity ratings of a convenience sample ranged from 0.77 (Daytime Distress) to 0.85 (Sleep Disorder).

Data treatment

For continuous data, t-tests and univariate and multivariate analyses of variance were employed as appropriate. These data include age, BMI, symptom severity scores on the SSC, polysomnography indices. A critical comparison among these variables is the difference between OSA severity as measured by the AHI between women and men. Based on our prior research with similar samples, we assumed a standard deviation of 20. We also assumed that a clinically meaningful difference in AHI is 10, which is the difference in range among mild, moderate and severe OSA categories. Given these parameters, a minimum sample size of 126 (63 per gender group) would be sufficient to detect a moderate effect size with alpha = 0.05 and beta = 0.2. For the SSC subscale comparisons, significant differences with strong effect sizes were demonstrated with relatively small sample sizes (between 15 and 57) in a previous study ([26]). Categorical data, such as the presence or absence of OSA diagnosis were analysed using chi-square tests where appropriate. Assuming a population incidence of 40% for OSA in this age cohort, a minimum of 132 participants would be required to demonstrate 12% difference, with alpha = 0.05 and beta = 0.2. Missing data were excluded from the multivariate F and univariate post hoc analyses. These analyses included only participants with complete data. In particular, ten Completer participants lacked data for the Psychological Distress subscale of the SSC.

Results

Sample characteristics

In the present sample, 295 participants completed questionnaires (172 women, Mean age = 57.8, SD = 10.8; 123 men, Mean age = 57.1, SD = 12.5). Of these, 171 completed the overnight,

in-laboratory polysomnography study (Completers), giving a 58% study completion rate. Of the 124 participants who did not do the polysomnography study (Non-completers), reasons given were: they were no longer interested or did not think the test was relevant to them (40%), they did not wish to sleep away from home or had family or time constraints (18%). A further 22% declined to specify a reason and 20% could not be reached for booking after repeated attempts. Figure 1 presents a flow chart for the study participants.

Means and standard deviations for age, four sleep symptom subscales (SSC), and metabolic syndrome co-morbidity for the overall sample, Completers and Non-completers, are presented in Table 1. There was no significant difference between Completers and Non-completer participants in age. A multivariate analysis of variance (MANOVA) carried out comparing Completers and Non-completers on the four SSC subscales showed no significant main effect for completer status, Wilks' $\lambda = 0.978$, $F(4,285) = 1.68$, $P = 0.16$, partial $\eta^2 = 0.02$. Univariate analyses of variance for each subscale revealed that Completers reported more severe symptoms Daytime Distress than Non-completers, though this finding should be interpreted with caution, given the non-significant MANOVA and small effect size. No differences between Completers and Non-completers on the other SSC subscales were significant with univariate comparisons.

Included in Table 1 are percentages for four metabolic syndrome comorbidities, gathered by chart review, for the two completer status groups. Note that the chart review was not done for 55 Non-completers once it was evident that they would not complete the laboratory part of the study. The reported Non-completer percentages are for 39 women and 30 men. A series of 2 (Completer status) × 2 (Metabolic syndrome status) chi-square tests of association, carried out for each metabolic syndrome category as well as for participants with no comorbidities, were not significant.

Using an AHI criterion of 10 or greater, 135 participants (79% of the total completers) were diagnosed with OSA: 75% of the women and 85% of the men. Compared to an expected prevalence of 40%, the observed percentages for men and women were both statistically significant, chi-square (d.f. = 1) = 53.46, $P < 0.0001$, Cramer's $V = 0.041$, chi-square (d.f. = 1) = 52.87, $P < 0.0001$, Cramer's $V = 0.015$, respectively. For the Completer group men and women who received a diagnosis of OSA, polysomnography results as well as
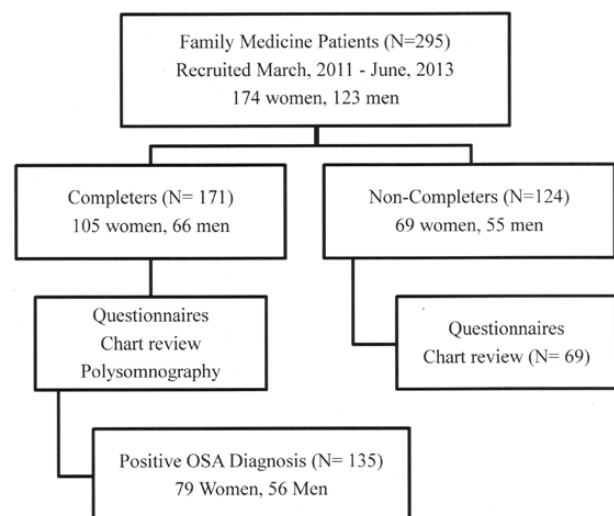

Figure 1. Study flow chart illustrating participant progression through recruitment from family medicine clinics and evaluation by questionnaires and polysomnography.

age and body-mass index (BMI) are presented in Table 2. Univariate *F*-tests between men and women were carried out separately for age and BMI, showing no significant gender differences. A one-way MANOVA was carried out to compare men and women with OSA on the four SSC subscales. This was not significant, Wilks' λ = 0.950, $F(4,122)$ = 1.6, P = 0.177, partial η^2 = 0.05. Univariate F tests for the four subscales suggest that women reported worse daytime symptoms than men, though given the non-significant MANOVA and modest effect size, this finding is regarded with caution.

Finally, a series of 2 (Gender) × 2 (Metabolic syndrome status) chi-square tests of association, carried out for each metabolic syndrome category as well as for participants with no comorbidities, showed no significant differences between men and women regarding presence of metabolic syndrome disease. These test results are presented in Table 2.

Discussion

Presence of OSA, metabolic syndrome in men and women

When middle aged and older patients from family medicine clinics were offered sleep assessment and agreed to spend a night in a sleep laboratory, similar numbers of men (85%) and women (75%)

Table 1. Age, sleep symptom and metabolic syndrome comorbidity characteristics for participants recruited from family medicine clinics who completed the polysomnography study (Completers) and those who did not (Non-completers) (recruited March 2011 to June 2013).

	Completers	Non-completers	F, χ^2(d.f.)	Sig	Effect size[d]	95% CI for difference
N	171	124				
Age (M,SD)	56.6(10.5)	58.7(12.5)	2.49(1,293)	0.115	0.01	−4.77, 0.52
Sleep Symptom Checklist[a]						
Insomnia	9.81(4.7)	9.29(5.1)	18.95(1,283)	0.372	0.00	−0.62, 1.66
Daytime distress	7.78(3.9)	6.69(3.9)	83.84(1,283)	0.021[c]	0.02	0.17, 2.02
Sleep disorder	7.36(4.3)	7.00(4.8)	8.85(1,283)	0.511	0.00	−0.71, 1.42
Psychological distress	2.60(2.5)	2.19(2.2)	12.00(1,283)	0.143	0.01	−0.14, 0.97
MSC comorbidity (%)[b]						
Hypertension	30.4	40.5	0.11(1)	0.097	0.004	−0.10, 0.15
Hyperlipidemia	16.4	10.1	0.07(1)	0.269	0.004	−0.11, 0.14
Diabetes	17.5	17.4	0.01(1)	0.930	0.004	−0.12, 0.13
Obesity	20.0	17.4	0.04(1)	0.532	0.004	−0.11, 0.14
No MSC comorbidity (%)	53.2	42.0	3.29(1)	0.070	0.004	−0.01, 0.24

MSC, metabolic syndrome component.

[a]Higher scores indicate worse symptom severity.

[b]Comorbidity for four metabolic syndrome components (MSC) may overlap within participants. Comorbidity data are incomplete for Non-completers and based on 69 participants.

[c]A multivariate ANOVA comparing Completers and Non-completers on four subscales was not significant.

[d]Effect size for F statistic is eta^2; Effect size for χ^2 is Cramer's *V* (MSC comorbidity frequency data).

Table 2. Age, BMI, Polysomnography indices, BMI, sleep symptom and metabolic syndrome comorbidity for women and men recruited from family medicine clinics with diagnosed OSA (recruited March 2011 to June 2013).

	Women	Men	F, χ^2(d.f.)	Sig	Effect size[d]	95% CI for difference
N	79	56				
Age (M,SD)	57.5(9.9)	58.4(12.1)	0.21(1,133)	0.646	0.002	−4.62, 2.87
BMI	30.6(7.9)	29.4(5.4)	0.99(1,133)	0.322	0.007	−1.20, 3.63
Polysomnography indices						
AHI (M,SD)	36.4(28.8)	38.6(25.9)	0.20(1,133)	0.653	0.002	−11.59, 7.29
Mean SpO$_2$	95.2(2.1)	95.2(2.1)	0.00(1,133)	0.943	0.000	−0.76, 0.71
Min SpO$_2$	83.8(7.0)	83.4(9.1)	0.11(1,133)	0.743	0.001	−2.28, 3.20
Sleep Symptom Checklist[a]						
Insomnia	10.3(4.7)	8.8(4.7)	3.11(1,125)	0.080	0.02	−0.18, 3.14
Daytime distress	8.7(4.2)	7.1(3.9)	4.76(1,125)	0.031[c]	0.04	0.15, 3.08
Sleep disorder	8.5(4.8)	7.1(3.9)	3.43(1,125)	0.066	0.03	−0.10, 3.02
Psychological distress	3.1(2.8)	2.3(2.2)	3.36(1,125)	0.069	0.03	−0.07, 1.74
MSC comorbidity (%)[b]						
Hypertension	35.3	31.2	0.04(1)	0.650	0.01	−0.15, 0.18
Hyperlipidemia	16.2	16.7	0.01(1)	0.944	0.01	−0.16, 0.18
Diabetes	22.1	12.5	0.12(1)	0.188	0.01	−0.14, 0.20
Obesity	23.5	18.8	0.06(1)	0.538	0.01	−0.15, 0.19
No MSC comorbidity (%)	24.4	34.6	0.95(1)	0.329	0.01	−0.08, 0.25

AHI, apnea/hypopnea index; SpO$_2$ arterial oxygen saturation; BMI, body mass index; MSC, metabolic syndrome component.

[a]Higher scores indicate worse symptom severity.

[b]Comorbidity for 4 metabolic syndrome components (MSC) may overlap within participants.

[c]A multivariate ANOVA comparing Men and Women on 4 subscales was not significant.

[d]Effect size for F statistic is eta^2; Effect size for χ^2 is Cramer's *V* (MSC comorbidity frequency data).

had diagnosed OSA, with similar severity. This finding contrasts with most population prevalence estimates, possibly due to our focus on an older, family medicine population using a recruitment approach that was open to anyone willing to participate. In addition, given that women are thought to be under-represented among sleep clinic patients, this approach appears to offer older women an uncommon opportunity for OSA testing, resulting in near parity with men in case finding. None of the primary care participants in the present study had been suspected of having OSA and none had ever been referred to a sleep clinic. At the same time, we recognize that unless all potential participants agree to laboratory screening, there is no way of knowing how many with OSA were missed or how representative of family medicine patients in general was the present sample.

Approximately 45% of the overall sample were found to have at least one aspect of metabolic syndrome disease. Given the possible bi-directional causality between OSA and metabolic syndrome, identification of a hidden sleep breathing disorder can improve clinical management and reduce overall morbidity.

Identifying OSA is a particular challenge

While OSA rates obtained in the present sample seem unusually high, it is worth noting that good population estimates are very difficult to obtain. An important problem for epidemiological studies, and research studies in OSA in general, is that the disease is largely 'hidden' and its diagnosis relies on expensive and intensive tests. These characteristics limit the sample sizes that are feasible for population-wide studies due to cost and due to the willingness of participants to undergo fairly burdensome testing procedures.

To overcome the prohibitive costs of testing very large samples with expensive gold standard evaluation (i.e., overnight polysomnography), population studies have included focused, a priori risk groups in which the condition is more likely to occur—a technique called oversampling- permitting smaller general sample sizes. At the same time, OSA presents with a wide ranging list of both reportable and unreportable symptoms as well as a multitude of associated diseases. There has been little consistency among studies as to which risk groups have been targeted for oversampling, and these have changed over the years as the associated disease profile of OSA has become more fully understood. Self-reported heavy snoring, daytime sleepiness, diabetes, hypertension, otitis media, obesity, myocardial infarction (as examples), have been used singly or in different combinations for oversampling strategies (27). Moreover, oversampling strategies may favour the stereotypical male OSA presentation. Studies have suggested that men with OSA report more sleepiness and snoring than women, while women report more fatigue and depression (22,28). Gender differences in symptom presentation and associated diseases tend to diminish with older age and with severity of OSA (20,29,30). In the present study, there was little substantial evidence of differences in sleep and sleep disorder symptoms reported by men and women with OSA in this older sample.

Study burden and refusal rates

In many population-based studies, the rate of acceptance of in-lab polysomnography testing varies around 50% or less. The burden of the test is the most cited reasons for declining participation (11). There could be numerous additional reasons for refusal (both in research and in clinical practice) including the reluctance to discover an illness, unwillingness to undergo treatment (CPAP) in case of a diagnosis, concerns about loss of health insurance or driving privileges, lack of symptoms, or lack of understanding about OSA. The motivations for pursuing (or not) a comprehensive sleep investigation were not examined in the present study.

It is notable that, in a Brazilian epidemiological study by Tufik et al. (31) in which there was very high participant retention, that included older participants (>70) and did not use oversampling, much higher rates of OSA across age strata were obtained than typically reported (40 and 26% for men and women, respectively). In participants aged over 60, sleep apnea rates were over 60%, and over 80% in those over age 70, for both men and women.

In the present study, 58% of those who initially enrolled in the study and completed questionnaires underwent overnight polysomnography. The Non-completer group did not differ in age, symptom severity (except possibly less severe daytime symptoms) or co-morbid conditions associated with OSA, so it might be assumed that there would be a substantial percentage of this group with OSA. Although there appear to be some differences in metabolic syndrome co-morbidity between Completers and Non-completers, or between women and men, these differences did not reach statistical significance. Future research should examine what motivates participants to accept an intensive investigation of their sleep, including PSG, and what are reasons why they decline. It would also be important to evaluate the effect of providing educational material describing sleep apnea and its potential health consequences on participant retention.

Previous findings

In previous studies using a similar recruitment approach, we have found that participants who accepted the overnight polysomnography test also had a high rate of OSA diagnosis (8,25,32). More women than men accepted enrolment and completed the polysomnography study, leading to high diagnosis rates for both men and women. Among older community-dwelling adults, there was an abundance of symptoms of insomnia, daytime problems and OSA that were not discussed with their family doctor (32), suggesting that the opportunity for a physician referral for screening is often missed. On the other hand, routinely offering OSA testing can help identify many more patients with complex disease risk, with an efficient use of sleep laboratory resources.

Conclusions

Compared with OSA prevalence studies reported in the literature and reviewed above, the findings of the present study are most consistent with those reporting higher risk in clinical and/or older samples rather than general community samples. In spite of the methodological limitations of the present study, we are confident in our conclusion that many more patients with moderate to severe OSA will be identified if screening is offered routinely to older patients in family medicine. This approach is particularly effective for women. The ability to identify older individuals with OSA would improve overall health care and help in management of associated diseases and conditions.

Declaration

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