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ORIGINAL ARTICLE

Using the No-Apnea score to screen for obstructive sleep apnea in adults referred to a sleep laboratory: comparative study of the performance of the instrument by gender

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ABSTRACT

Objective: To evaluate the performance of the No-Apnea score, a simplified screening instrument for obstructive sleep apnea (OSA), by gender. **Methods:** This was a cross-sectional study including adults undergoing full polysomnography. The No-Apnea model comprises two items (neck circumference and age) with a total score of 0 to 9. The severity of OSA was categorized, on the basis of the apnea-hypopnea index, as any (≥ 5 events/h), moderate-to-severe (≥ 15 events/h), or severe (≥ 30 events/h). The performance of the No-Apnea instrument was assessed by determining the area under the (ROC) curve (AUC) and by constructing contingency tables. **Results:** We evaluated a total of 6,606 adults (53.8% men). For categorizing the level of OSA severity, the No-Apnea score had a sensitivity of 83.9-93.0% and a specificity of 57.3-35.2%. At all OSA severity levels, the No-Apnea score exhibited higher sensitivity and lower specificity in men than in women. The No-Apnea score proved to be an appropriate screening model for patients in general or when separated by gender or severity of OSA (AUC > 0.7 for all). The discriminatory power of the No-Apnea score to predict any, moderate-to-severe, and severe OSA was similar between genders (p = 0.109, p = 0.698, and p = 0.094, respectively). **Conclusions:** In a sample of adults referred to the sleep laboratory, there was no significant difference between men and women in terms of the discriminatory power of the No-Apnea instrument in for screening for OSA severity.

Keywords: Sleep apnea, obstructive/diagnosis; Polysomnography; Sex; Surveys and questionnaires.

INTRODUCTION

Obstructive sleep apnea (OSA) is a sleep disorder characterized by recurrent episodes of upper airway obstruction, resulting in intermittent hypoxemia, disruptions in sleep, and cardiovascular problems.[1-3] The prevalence of OSA has increased considerably in recent years,[4-6] possibly because of the aging population and the global obesity epidemic. One recent study reported that the overall prevalence of OSA was 32.8% in the city of São Paulo, Brazil.[6]

It is common for sleep laboratories around the world to have a long list of individuals with suspected OSA waiting to get tested. To date, the gold standard test for diagnosing OSA is full polysomnography (PSG). However, it is an expensive test that is not widely available, especially in regions with limited economic resources. Therefore, a screening instrument offering a simplified or home-based diagnostic method can be useful for stratifying patients.

The No-Apnea score is an instrument that comprises only two objective parameters—neck circumference (NC) and age—with a final score ranging from 0 to 9 (a score ≥ 3 indicates a high risk for OSA).[7]) In the No-Apnea derivation cohort, the area under the ROC curve (AUC) was 0.784, 0.758, and 0.754 for screening for any, moderate-to-severe, and severe OSA, respectively. In fact, despite the simplicity of the No-Apnea score, when compared with two other previously validated models, its discriminatory power showed no statistically significant difference.[7]

As for the clinical history, men with OSA usually display typical symptoms, such as snoring and observed apnea, whereas women often report atypical symptoms, such as insomnia, morning headache, and fatigue.[8-12] In comparison with male patients, female patients typically are older, are more obese, and have more comorbidities—such as hypertension and diabetes mellitus.[10-13] However, NC tends to be greater in men than in women.[14] Based on the polysomnographic findings, women have a lower prevalence of OSA and show evidence of lower quality of sleep than do men.[8-12] As we can see, significant differences can be found between men and women with OSA, not only in the prevalence of the disease but also in the clinical phenotypes associated with it.

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However, despite the several gender-related differences consistently reported in the clinical presentation and polysomnographic findings of the condition,[8-14] analyses of the performance of OSA screening instruments by gender are surprisingly rare. In view of the above, the main objective of the present study was to evaluate the predictive performance and discriminatory power of the No-Apnea score, a simplified model for screening for OSA, by gender.

METHODS

This was a prospective study, carried out between January of 2017 and March of 2019, with recruitment of individuals who were referred for sleep assessments by their attending physicians. The inclusion criteria were being ≥ 18 years of age and having a suspected sleep disorder. Patients who had previously been diagnosed with OSA were excluded, as were those who were diagnosed through the use of a portable or home monitoring device, those for whom the clinical data were incomplete, and those in whom the PSG was technically inadequate. The study protocol was in accordance with the Declaration of Helsinki and was approved by the Research Ethics Committee of the Federal University of Rio de Janeiro (Reference no. 1.764.165). All participants gave written informed consent. If the same patient was submitted to more than one PSG, the test with the longest total sleep time was selected for analysis.

The clinical characteristics included gender, age, body mass index (BMI), NC, self-reported comorbidities (smoking, hypertension, and diabetes mellitus), and sleep-related complaints (snoring, observed apnea, nocturnal choking, and morning headache). Patients also completed five instruments, all of which have been validated in the literature: the No-Apnea score[7]; the **S**noring, **T**iredness, **O**bserved apnea, and high blood **P**ressure (STOP) and **S**noring, **T**iredness, **O**bserved apnea, high blood **P**ressure, **B**ody mass index, **A**ge, **N**eck circumference, and **G**ender (STOP-Bang) questionnaires[15]; the **N**eck circumference, **o**besity, **S**noring, **A**ge, and **S**ex (NoSAS) score[16]; and the Epworth Sleepiness Scale (ESS).[17] All of those the instruments have also been validated for use with the Brazilian population.[7,16,18,19] The screening instruments were applied by the PSG technicians immediately prior to the sleep test. The BMI was calculated as the weight in kilograms divided by the height in meters squared (kg/m^2), and the NC (in cm) was systematically measured with a measuring tape, as follows[7]: patients were asked to remain erect; and the NC was measured with the upper edge of the measuring tape just below the laryngeal prominence.

Screening instruments

The No-Apnea model evaluates two objective parameters (NC and age), scored as follows: NC of 37.0-39.9 cm = 1; NC of 40.0-42.9 cm = 3; NC of ≥ 43.0 cm = 6; age of 35-44 years = 1; age of 45-54 years = 2; and age of ≥ 55 years = 3. The scores given to each variable are summed, generating a final score ranging from 0 to 9 (a score ≥ 3 indicates a high risk for OSA).[7]

The STOP and STOP-Bang questionnaires[15,18] consist of four and eight yes/no questions, respectively. Each affirmative answer gets a score of 1. The STOP questionnaire contains questions about loud snoring, tiredness, observed apnea, and hypertension (the total score ranging from 0 to 4), whereas the STOP-Bang questionnaire uses those same parameters plus BMI > 35 kg/m^2, age > 50 years, NC > 40 cm, and male gender (the total score ranging from 0 to 8). The STOP and STOP-Bang questionnaires use a score of ≥ 2 and ≥ 3, respectively, to identify individuals at risk for OSA.

The NoSAS instrument is scored as follows: an NC > 40 cm gets a score of 4; BMIs of 25-29 kg/m^2 and ≥ 30 kg/m^2 get scores of 3 and 5, respectively; snoring gets a score of 2; age > 55 years gets a score of 4; and being a male gets a score of 2. The score ranges from 0 to 17 and is considered positive when a patient gets a score ≥ 8.[16]

The ESS is an eight-item instrument that assesses the likelihood of a patient falling asleep in various contexts. Each question is answered on a scale from 0 (never dozes off) to 3 (high chance of dozing off), with a final score ranging from 0 to 24 (a score ≥ 11 indicates excessive daytime sleepiness).[17]

Sleep studies

All polysomnographic evaluations were performed on the same type of device (EMBLA S7000; Embla Systems Inc., Broomfield, CO, USA), at the same sleep center in the city of Rio de Janeiro, Brazil. The recordings consisted of continuous monitoring by electroencephalography, electro-oculography, chin/leg electromyography, and electrocardiography, as well as of airflow, respiratory effort (with chest and abdominal belts), SpO_2 (by pulse oximetry), snoring (with a tracheal microphone), and body position (with position sensors). Two pulmonologists performed the manual reading of the exams, as recommended by the American Academy of Sleep Medicine.[20] Both were blinded to the results obtained with the screening instruments. Apnea was defined as a ≥ 90% drop in the baseline airflow value for at least ten seconds was classified as apnea, whereas hypopnea was defined as a ≥ 30% drop for at least 10 seconds accompanied by a ≥ 3% drop in oxygen saturation or a microarousal.[20] The level of OSA severity was classified, on the basis of the apnea-hypopnea index (AHI), as any (AHI ≥ 5 events/h), moderate-to-severe (AHI ≥ 15 events/h), or severe (AHI ≥ 30 events/h).

Statistical analysis

The data were analyzed with the IBM SPSS Statistics software package, version 21.0 (IBM Corporation, Armonk, NY, USA) and are expressed as means ± standard deviation (for numerical variables) or as absolute and relative frequencies (for categorical

variables). We used the chi-square test to compare dichotomous variables, whereas we used the Student's t-test and ANOVA to compare numerical variables. The predictive value of the No-Apnea score was assessed on the basis of its discriminatory power and by contingency tables. The discriminatory power was estimated on the basis of the AUC, which can vary from 0.5 (no discrimination) to 1.0 (perfect discrimination).[21] An AUC > 0.7 was considered clinically significant.[22] The discriminatory power was compared by using a methodology previously described.[23] Sensitivity, specificity, positive predictive value, and negative predictive value were calculated from the contingency tables, and all values are expressed with their respective 95% CIs. A two-tailed p value < 0.05 was considered statistically significant.

RESULTS

Of a total of 6,820 consecutive individuals who were referred for OSA workup, 214 (3.1%) were excluded on the basis of the study criteria. Therefore, 6,606 patients were enrolled for further analysis: 3,054 (46.2%) were female and 3,552 (53.8%) were male. In comparison with the male patients, the female patients were older, had a higher BMI, and had a lower NC ($p < 0.001$ for all), as shown in Table 1. Diabetes mellitus was more prevalent in women than in men ($p < 0.001$). All sleep parameters evaluated were statistically different between genders, except for rapid eye movement sleep ($p = 0.334$). The mean AHI was higher in men than in women (37.2 ± 29.6 events/h vs. 18.9 ± 22.3 events/h; $p < 0.001$), whereas the SpO_2 nadir was lower in men than in women (80.0 ± 9.8% vs. 83.5 ± 8.8%; $p < 0.001$), suggesting that OSA was more severe in men than in women. The prevalence of any, moderate-to-severe, and severe OSA was statistically higher in men than in women—88.5% vs. 67.9%, 71.1% vs. 41.9%, and 51.2% vs. 20.9%, respectively ($p < 0.001$ for all). In addition, the likelihood of having any, moderate-to-severe, and severe OSA was statistically higher in men than in women—OR = 3.626 (95% CI: 3.190-4.121), OR = 3.403 (95% CI: 3.073-3.769), and OR = 3.966 (95% CI: 3.555-4.424), respectively.

The mean No-Apnea score was significantly lower in women than in men (3.2 ± 2.2 vs. 5.5 ± 2.3; $p < 0.001$). Overall, 75.3% of the patients were classified as being at high risk for OSA (No-Apnea score ≥ 3), the proportion of high-risk individuals being higher among the men than among the women (88.0% vs. 60.4%; $p < 0.001$). The proportional distribution of women and men by No-Apnea score is shown in Figure 1.

For both genders, an increase in the No-Apnea score from 0 to 9 led to an increase in the prevalence of OSA—that of any OSA increased from 27.6% to 94.4% in women and from 53.5% to 96.6% in men; that of moderate-to-severe OSA increased from 10.8% to 76.7% in women and from 25.4% to 85.2% in men; and that of severe OSA went from 2.0% to 63.3% in women and from 12.7% to 68.3% in men. Similarly, with the progressive increase in the No-Apnea score,

Table 1. Characteristics of our study sample.[a]

Parameters	Total (N = 6,606)	Women (n = 3,054)	Men (n = 3,552)	p
Clinical data				
Age, years	44.6 ± 13.8	45.9 ± 14.2	43.6 ± 13.4	< 0.001
BMI, kg/m^2	33.5 ± 7.9	34.1 ± 8.4	33.0 ± 7.4	< 0.001
NC, cm	40.7 ± 4.9	37.8 ± 4.0	43.2 ± 4.3	< 0.001
ESS score	10.0 ± 5.0	9.5 ± 5.0	10.4 ± 5.0	< 0.001
Smoking history	610 (9.2)	261 (8.5)	349 (9.8)	0.074
Hypertension	2,571 (38.9)	1,199 (39.3)	1,372 (38.6)	0.613
Diabetes mellitus	792 (12.0)	435 (14.2)	357 (10.1)	< 0.001
Loud snoring	4,322 (65.4)	1,727 (56.5)	2,595 (73.1)	< 0.001
Observed apnea	3,387 (51.3)	1,228 (40.2)	2,159 (60.8)	< 0.001
Choking/suffocation	2,731 (41.3)	1,274 (41.7)	1,457 (41.0)	0.581
Morning headache	3,396 (51.4)	2,045 (67.0)	1,351 (38.0)	< 0.001
Polysomnographic data				
Total sleep time, min	342.2 ± 69.4	340.1 ± 69.6	344.1 ± 69.2	0.031
REM sleep, %	16.1 ± 7.7	16.2 ± 7.8	16.0 ± 7.7	0.334
NREM sleep, %	83.4 ± 7.7	83.2 ± 7.8	83.6 ± 7.7	0.021
Arousals/h	30.8 ± 25.8	22.2 ± 20.5	38.2 ± 27.6	< 0.001
AHI, events/h	28.7 ± 28.0	18.9 ± 22.3	37.2 ± 29.6	< 0.001
AI, events/h	15.6 ± 24.2	7.5 ± 16.1	22.6 ± 27.7	< 0.001
HI, events/h	13.1 ± 12.8	11.3 ± 12.4	14.6 ± 12.9	< 0.001
Mean SpO_2, %	93.4 ± 3.4	93.9 ± 3.3	93.0 ± 3.5	< 0.001
Minimum SpO_2,%	81.6 ± 9.5	83.5 ± 8.8	80.0 ± 9.8	< 0.001

BMI: body mass index; NC: neck circumference; ESS: Epworth Sleepiness Scale; REM: rapid eye movement; NREM: non-REM; AHI: apnea-hypopnea index; AI: apnea index; and HI: hypopnea index. [a]Values expressed as mean ± SD or n (%).

there was a trend toward a linear increase in the mean AHI (Figure 2): from 5.1 ± 8.6 events/h to 42.8 ± 28.8 events/h in women ($p < 0.001$); and from 12.1 ± 16.1 events/h to 46.8 ± 27.1 events/h in men ($p < 0.001$).

Table 2 shows the performance of the No-Apnea score by gender. Overall, for screening different levels of OSA severity, the sensitivity of the No-Apnea model ranged from 83.9% to 93.0%, whereas its specificity ranged from 57.3% to 35.2%. Regardless of the level of severity, the No-Apnea model had higher sensitivity and lower specificity in men than in women.

Table 3 shows the discriminatory power calculated for each of the five screening instruments: the No-Apnea score, the STOP questionnaire, the STOP-Bang questionnaire, the NoSAS score, and the ESS. The No-Apnea proved to be a useful screening tool for all patients included in the study and for patients dichotomized by gender (AUC > 0.7 for all OSA severity levels). In women, the AUC obtained ranged from 0.719 (95% CI: 0.701-0.737) to 0.741 (95% CI: 0.721-0.760), whereas in men, it ranged from 0.702 (95% CI: 0.685-0.720) to 0.763 (95% CI: 0.738-0.788). The discriminatory power of the No-Apnea score for any, moderate-to-severe, and severe OSA was comparable between the genders ($p = 0.109$, $p = 0.698$, and $p = 0.094$, respectively). The other models also had similar performances for both genders, except for the ESS, which performed better in men than in women for any, moderate-to-severe, and severe OSA ($p = 0.007$, $p = 0.009$, and $p = 0.015$, respectively).

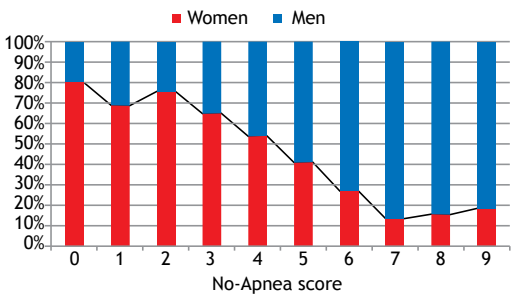

Figure 1. Proportion of women and men per No-Apnea score (from 0 to 9): women predominated at scores of 0-4, whereas men predominated at scores of 5-9.

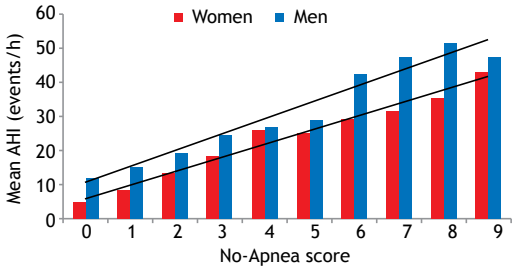

Figure 2. Mean apnea-hypopnea index (AHI) detected by overnight polysomnography per No-Apnea score (from 0 to 9) in women (n = 3,054) and in men (n = 3,552). As the No-Apnea score increases, there is a trend toward a linear increase in the AHI in men and women ($p < 0.001$ for both).

DISCUSSION

The main finding of our study was that, in adult individuals who were referred to a sleep laboratory, the No-Apnea score can be a useful screening tool for OSA. The instrument showed appropriate predictive performance and discriminatory power for the purpose of screening for OSA at all levels of severity and in both genders.

An advantage of using OSA screening instruments like the No-Apnea score is the possibility of appropriately referring high-risk patients for evaluation with portable diagnostic methods, thereby reducing the long waiting lists at sleep laboratories.[24,25] In addition, because the No-Apnea score comprises only objective variables, it can be used in individuals who sleep alone and whose subjective sleep information is not always easily available.

In the present study, we found several clinical and polysomnographic differences between genders that have already been extensively reported in the literature.[8-14] We found a predominance of OSA in men, which is in keeping with the findings of population-based studies[6] and studies conducted in sleep laboratories,[18] albeit different that what has been reported in studies of patients in the preoperative period of bariatric surgery[26] or of patients with insomnia.[27] One previous study showed that the prevalence of OSA was lower in women than in men, despite the fact that the women in the sample had higher BMIs and were older.[28] The following factors have been implicated in the gender-related difference in OSA[29-31]: hormonal influences and menopause (in women); craniofacial structure; and upper airway length.

There are several OSA screening instruments available, and their performance may vary depending on the tests used to diagnose OSA, the type of population evaluated, and the AHI cutoff used.[32] It is possibly more important that screening tests for diseases like OSA have high sensitivity than that they have high specificity, especially in a population with a high pretest probability.[32,33] Preeminent among the several OSA screening models described in the literature are the Berlin questionnaire,[34] the STOP-Bang questionnaire,[15] and the NoSAS score.[16] Although the gender-related differences in the symptoms and prevalence of OSA are well established, few studies have effectively evaluated whether there are also gender-specific differences in the performance of the screening instruments.

A study assessing the applicability of the fractional exhaled nitric oxide test as a screening method for OSA found that the No-Apnea score was a useful screening tool for any, moderate-to-severe, and severe OSA, for which the AUC reported was 0.786, 0.713, and 0.717, respectively.[35] A subsequent study, involving a cohort of morbidly obese patients, found that the No-Apnea score had appropriate discriminatory power for screening for OSA.[36] The authors found no gender-specific differences in performance for the screening for any ($p = 0.973$) and moderate-to-severe OSA ($p = 0.817$),

Table 2. Predictive performance of the No-Apnea score in screening for obstructive sleep apnea.[a]

Variables	Total (N = 6,606)	Women (n = 3,054)	Men (n = 3,552)
AHI ≥ 5 events/h (any OSA)			
Sensitivity	83.9 (83.4-84.5)	72.5 (71.3-73.6)	91.5 (91.0-92.0)
Specificity	57.3 (55.2-59.5)	65.1 (62.6-67.5)	38.9 (34.8-43.0)
PPV	88.1 (87.5-88.7)	81.5 (80.2-82.8)	92.0 (91.5-92.5)
NPV	48.7 (46.9-50.5)	52.7 (50.7-54.7)	37.3 (33.4-41.3)
AHI ≥ 15 events/h (moderate-to-severe OSA)			
Sensitivity	89.5 (88.6-90.2)	80.5 (78.6-82.3)	94.0 (93.3-94.7)
Specificity	44.0 (42.9-45.1)	54.0 (52.6-55.3)	26.8 (24.9-28.5)
PPV	68.4 (67.8-69.0)	55.8 (54.5-57.0)	75.9 (75.3-76.5)
NPV	75.5 (73.5-77.3)	79.3 (77.3-81.2)	64.6 (60.1-68.8)
AHI ≥ 30 events/h (severe OSA)			
Sensitivity	93.0 (92.0-93.9)	85.6 (82.8-88.0)	95.6 (94.7-96.4)
Specificity	35.2 (34.6-35.8)	46.2 (45.5-46.8)	19.9 (19.0-20.8)
PPV	45.9 (45.4-46.4)	29.6 (28.6-30.4)	55.6 (55.0-56.0)
NPV	89.5 (88.0-90.8)	92.4 (90.9-93.7)	81.2 (77.3-84.6)

AHI: apnea-hypopnea index; OSA: obstructive sleep apnea; PPV: positive predictive value; and NPV: negative predictive value. [a]Values expressed as estimate (95% CI).

Table 3. Comparison between the five obstructive sleep apnea screening models in terms of their discriminatory power, by gender.[a]

Variables	Total (N = 6,606)	Women (n = 3,054)	Men (n = 3,552)	p
AHI ≥ 5 events/h (any OSA)				
No-Apnea score	0.784 (0.771-0.798)	0.741 (0.721-0.760)	0.763 (0.738-0.788)	0.109
STOP questionnaire	0.711 (0.695-0.726)	0.695 (0.675-0.714)	0.705 (0.678-0.732)	0.514
STOP-Bang questionnaire	0.796 (0.783-0.809)	0.755 (0.737-0.773)	0.767 (0.742-0.792)	0.374
NoSAS score	0.776 (0.762-0.790)	0.719 (0.699-0.738)	0.740 (0.713-0.768)	0.146
ESS	0.572 (0.555-0.589)	0.543 (0.521-0.564)	0.591 (0.562-0.621)	0.007
AHI ≥ 15 events/h (moderate-to-severe OSA)				
No-Apnea score	0.759 (0.747-0.771)	0.719 (0.701-0.737)	0.724 (0.705-0.743)	0.698
STOP questionnaire	0.687 (0.684-0.700)	0.675 (0.656-0.695)	0.680 (0.661-0.700)	0.713
STOP-Bang questionnaire	0.773 (0.762-0.784)	0.731 (0.713-0.748)	0.743 (0.725-0.761)	0.340
NoSAS score	0.752 (0.740-0.764)	0.699 (0.680-0.717)	0.704 (0.684-0.724)	0.705
ESS	0.576 (0.562-0.590)	0.548 (0.527-0.568)	0.586 (0.566-0.607)	0.009
AHI ≥ 30 events/h (severe OSA)				
No-Apnea score	0.758 (0.746-0.770)	0.727 (0.707-0.748)	0.702 (0.685-0.720)	0.094
STOP questionnaire	0.689 (0.676-0.702)	0.689 (0.666-0.711)	0.679 (0.662-0.697)	0.516
STOP-Bang questionnaire	0.780 (0.769-0.791)	0.745 (0.725-0.765)	0.739 (0.722-0.755)	0.679
NoSAS score	0.750 (0.738-0.762)	0.708 (0.686-0.729)	0.680 (0.663-0.698)	0.066
ESS	0.589 (0.575-0.603)	0.555 (0.529-0.580)	0.594 (0.577-0.614)	0.015

AHI: apnea-hypopnea index; OSA: obstructive sleep apnea; STOP: Snoring, Tiredness, Observed apnea, and high blood Pressure; STOP-Bang: Snoring, Tiredness, Observed apnea, high blood Pressure, Body mass index, Age, Neck circumference, and Gender; NoSAS: Neck circumference, obesity, Snoring, Age, and Sex; and ESS: Epworth Sleepiness Scale. [a]Values for area under the ROC curve (95% CI).

although they did find the score to perform better in screening for severe OSA in women than in men (p = 0.033).[36] The No-Apnea score has also been validated in a cohort of patients with insomnia, showing an appropriate predictive performance.[37] As previously reported,[7,36,37] its discriminatory power is similar to that of other instruments with positive evaluations in the literature, such as the STOP-Bang questionnaire[15] and the NoSAS score.[16]

In a study of 502 patients (465 men and 37 women) who underwent portable monitoring sleep studies, a STOP-Bang score ≥ 3 predicted an AHI ≥ 5 events/h with an AUC of 0.72.[38] Sensitivity and specificity rates were calculated separately for men and women but achieved similar results, the sensitivity being 98.8% and 100.0%, respectively, whereas the specificity was 4.0% and 0.0%, respectively. However, that study[38] had significant limitations that are worth mentioning:

few women were included; all participants were evaluated with unsupervised sleep studies; and no comparisons were made between the men and the women in terms of the AUC.

Another study, involving 1,426 individuals undergoing full PSG, found that observed apnea and snoring were reported more often in men, whereas the presence of tiredness and hypertension was similar between genders.[39] However, gender-specific AUCs have not been reported for the STOP-Bang questionnaire. A study involving 251 patients (76% women) undergoing preoperative evaluation for bariatric surgery applied four different instruments (the ESS, the Fatigue Severity Scale, the STOP-Bang questionnaire, and the NoSAS score) and found that, except for the ESS, all of the instruments performed better in women than in men.[40]

A study of 403 women and 532 men found that the performance of the STOP-Bang questionnaire in screening for OSA in women was influenced by the BMI, whereas NC seemed to be more relevant in the screening of men.[41] That study also showed that the STOP-Bang questionnaire had extremely low specificity in men: 11.9% for any OSA (AHI ≥ 5 events/h), 7.9% for moderate-to-severe OSA (AHI ≥ 15 events/h), and 7.0% for severe OSA (AHI ≥ 30 events/h). In our study, the No-Apnea score also showed low specificity in men: 38.9% for any OSA (AHI ≥ 5 events/h), 26.8% for moderate-to-severe OSA (AHI ≥ 15 events/h), and 19.9% for severe OSA (AHI ≥ 30 events/h). However, our values were higher than those found for the STOP-Bang questionnaire.[41]

The present study has some limitations. The sample was composed of patients referred to a single sleep laboratory (i.e., preselected individuals with a high pretest probability), which could limit the generalizability of our findings. In addition, it did not include many individuals of other ethnicities, who could have different anthropometric characteristics.

In conclusion, the present study, involving adult individuals who were referred to a sleep laboratory, identified several clinical and polysomnographic differences between genders. Nevertheless, the No-Apnea score showed appropriate performance in screening for suspected OSA across all severity levels. Because the prevalence of OSA increases in parallel with increases in the No-Apnea score, this model can be used to aid in classifying risk in individuals referred to sleep laboratories, regardless of gender.

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