NEW RESEARCH

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SCIENTIFIC INVESTIGATIONS

Risk Assessment of Obstructive Sleep Apnea in a Population of Patients Undergoing Ambulatory Surgery

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Study Objectives: The aims of this study were to: (a) assess the prevalence of diagnosed OSA and symptoms of undiagnosed OSA in a cohort of ambulatory surgical patients, and (b) characterize the frequency of postoperative complications in outpatients with a diagnosis of or a propensity to OSA.

Methods: Patients presenting for ambulatory surgery completed a self-administered questionnaire. Using a previously validated prediction model, the probability for OSA was determined. Patients with ≥ 70% propensities were considered to be at high risk of having the disorder. Relevant perioperative data and complications were tracked and recorded, and differences in median estimated propensities for OSA were considered by these data.

Results: Three-thousand five hundred fifty-three patients completed the preoperative survey. A total of 2139 patients had perioperative data and estimated propensity scores. Ninety-four of the 2139 (4.4%) patients gave a self-reported prior diagnosis of OSA. One hundred three (4.8%) patients were found to be at high risk of OSA based on the survey and prediction model. Seventy-five percent of the patients with > 70% propensity for OSA had not yet been diagnosed. There was no association between OSA propensity scores and unplanned hospital admission, however there was an association of increased propensity with difficult intubation, intraoperative use of pressors, and postoperative oxygen saturation in the PACU.

Conclusion: The results of this study suggest that undiagnosed OSA may be relatively common in an ambulatory surgical population. There was no relationship between unplanned hospital admission and diagnosis of or increased risk of OSA. However, there was an association of increased perioperative events requiring additional anesthetic management in patients with a diagnosis of, or with a higher propensity to OSA.

Keywords: Outpatient, sleep apnea, anesthesia, outcome, complications

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Obstructive sleep apnea (OSA) has been recognized as a potential independent risk factor for adverse perioperative outcome.[1] Although the prevalence of OSA in the general population has been estimated to be between 2% to 4%, with a higher incidence in certain subpopulations such as males and obese subjects, many people with OSA have not been diagnosed.[2,3] The actual prevalence of OSA in the general population may be higher with as many as 80% to 90% of patients with the disease being undiagnosed.[2] While findings on physical examination such as cricomental space ≤ 1.5 cm, pharyngeal grade > II, and presence of overbite may be predictive of patients with OSA, otorhinolaryngological evaluation of anatomic parameters may not be sufficient to distinguish OSA patients from snoring non-OSA patients.[4,5] The gold standard for the diagnosis of OSA, polysomnography (PSG), is impractical as a routine preoperative assessment tool for OSA as the test is expensive and labor intensive.

Approximately 35 million patients undergo ambulatory surgical procedures annually in the United States (US).[6] Determining the prevalence of OSA in an ambulatory surgical population could be particularly important as these patients are scheduled to be discharged to an unmonitored setting (i.e., home) following the procedure. The physiologic perturbations resulting from anesthesia and postoperative analgesics are believed to place OSA patients undergoing outpatient surgery at risk for perioperative morbidity and mortality. Compared to non-OSA patients, OSA patients undergoing surgical procedures are vulnerable to postoperative airway obstruction, myocardial ischemia, congestive heart failure, stroke, and oxygen desaturation.[1,7] Although the American Society of Anesthesiologists (ASA) has created guidelines for perioperative care of OSA patients, the consultants were equivocal regarding whether even superficial procedures could be performed on an outpatient basis in patients who were either diagnosed with OSA or

BRIEF SUMMARY

Current Knowledge/Study Rationale: The prevalence of patients at risk for OSA presenting for ambulatory surgical procedures at an academic medical center has not been previously well defined. This study sought to identify these patients as well as assess potential associations of propensity for OSA with adverse outcomes.

Study Impact: This study suggests that patients with previously unrecognized risk for OSA frequently present to our center for a wide variety of ambulatory surgical procedures. While current guidelines are equivocal regarding the safety of discharge of these patients to a unmonitored setting, study subjects at risk for OSA were safely managed as outpatients at our center.

at risk for OSA.[8] Moreover, they concurred that the literature is insufficient to be able to support evidence based guidelines that delineate which surgical patients at risk for OSA can be safely managed on an outpatient basis. Because of the lack of data on the prevalence of OSA in patients undergoing ambulatory surgery, we designed a prospective observational study to define the prevalence of OSA symptoms in this population using a previously validated self-report instrument.[9] Additionally, outcome data was recorded in order to correlate the frequency of adverse events in patients at risk for OSA.

METHODS

This study was approved by the Johns Hopkins University Institutional Research Review board, and written informed consent was obtained from all patients enrolled. Patients undergoing outpatient surgery were enrolled from May 2004 to May 2006. The Johns Hopkins Outpatient Surgery Center is an integrated separate facility connected to the main inpatient hospital in downtown Baltimore, Maryland. The catchment area is the surrounding urban and suburban populations. Consecutive patients 18 years and older completed a self-administered questionnaire to assess demographics (age, gender, race, body mass index [BMI]) and sleep disturbance symptoms. History of angina, myocardial infarction, stroke, heart failure, and coronary artery revascularization was recorded based on self-report. Frequency of sleep related symptoms (e.g., snoring, witnessed apneas) was recorded on a 6-point Likert Scale (never, rarely, sometimes, often, usually, and always). Procedures included were otolaryngological, gynecological, orthopedic, plastic, general, neurological, and urological surgeries. Patients were excluded if they were pregnant, required supplemental home oxygen, or had a tracheostomy. Patients were considered at high risk for OSA if they had a ≥ 70% calculated probability based on demographic and questionnaire data.

Perioperative Management

Anesthetic care was provided by faculty anesthesiologists often supervising residents or nurse anesthetists. Each anesthesiologist conducted the usual preoperative assessment and physical exam, and was unaware of the study survey results. The anesthetic plan was determined by the attending anesthesiologist independent of the patient's participation in the investigation. Routine ASA monitoring was employed. The following intraoperative data was collected by a trained research assistant not involved in the patient's perioperative care using a predesigned data collection sheet: choice of anesthetic technique, changes in anesthetic plan (i.e., need to alter airway management from the original plan because of the inability to adequately ventilate the patient's lungs), difficulty of endotracheal intubation, including use of fiberoptic endoscopy, and vasoactive medications administered. Data recorded included the use of an oral airway or nasal trumpet during conscious sedation, as well as progression to unplanned placement of laryngeal mask airway or endotracheal intubation. Difficulty with tracheal intubation was assessed as multiple attempts at laryngoscopy, or inability to intubate secondary to poor visualization of anatomic structures.

Postoperatively, patients were transferred from the operating suite to the post-anesthesia care unit with supplemental oxygen delivered by face mask. Patients were weaned to room air immediately after transfer if oxygen saturation > 95% was maintained. Appropriateness of discharge was determined per usual criteria using a modified Aldrete Scoring System.[10] The following data were documented during the postoperative course: (1) supplemental oxygen requirement > 0.40 FiO2 to maintain oxygen saturation > 95%; (2) occurrence of cardiac arrhythmias including ≥ 3 consecutive premature ventricular contractions (PVC) or 6 PVCs per minute, bradycardia (heart rate < 50/min), or tachycardia (heart rate > 100 beats/min); (3) administration of naloxone; (4) need for assisted lung ventilation; (5) re-intubation of the trachea; and (6) unplanned hospital admission. Postoperative phone calls were made to each patient's home 24 hours postoperatively to ascertain: (7) re-admission within 24 hours of discharge; and (8) perioperative cardiac symptoms, stroke, or death within 24 hours.

Data analysis was performed using STATA version 9.0 (StataCorp. 2005. College Station, TX). Summary statistics were calculated for the demographic variables, and group differences were assessed using the Student *t*-test for continuous measures and the nonparametric Kruskal-Wallis for continuous measures that were non-normal, and the χ^2 goodness-of-fit test for categorical data. The probability of OSA was calculated from questions related to sleep disturbance using the multivariable logistic regression model validated by Maislin in patients who underwent polysomnography (**Appendix 1**). This index calculates the probability of a patient having OSA based on the patient's BMI, age, gender, and average index score of sleep disturbance.[9] Propensity for OSA was determined for each patient with complete BMI, age, gender, and sleep disturbance data.

RESULTS

Preoperative screens were completed in 3553 consecutive subjects; perioperative data and propensity data were available for 2139 of these patients. Subsequent analyses are based on the latter number. A summary of patient demographic characteristics and medical history are given in **Table 1** for the overall sample as well as by risk of OSA, as based on the propensity model. Patients ranged in age from 19 to 94 years. Ethnic breakdown was as follows: Caucasian (70.80%), African American (21.7%), Asian (4.1%), Hispanic (1.7%), American Indian (0.40%), and other (1.50%). Females (68.2%) who were enrolled were younger than males (mean of 46.8 y vs. 51.0 y, $p < 0.001$). From **Table 1**, we see that those with an OSA propensity ≥ 70% tended to be older ($p < 0.001$), have a higher BMI ($p < 0.001$), and were more likely to have had a CABG ($p < 0.001$). There was also a marginally significant association between race and risk of OSA ($p = 0.020$), with more African American (35.9% v. 20.9%) and fewer Caucasians (62.1% v. 71.2%) in the high OSA risk group. Ninety-four patients reported having been told that they have or had sleep apnea. Using the logistic regression model, 9.8% of men and 2.5 % of women were found to have > 70% probability of OSA. Among these at-risk patients, only 31.3% (21/67) of the males and 22.2% (8/36) of the females gave a previous self-reported diagnosis

Table 1—Demographic variables by OSA propensity and overall cohort

Demographic Variable	< 70% Propensity (N = 2036)	≥ 70% Propensity (N = 103)	Overall Cohort (N = 2139)
Age y [mean (SD)][1]	47.6 (15.5)	58.7 (14.5)*	48.1 (15.7)
BMI [mean (SD)][1]	26.8 (5.5)	39.8 (8.1)*	27.4 (6.3)
Race (% Caucasian)[2]	71.20%	62.10%*	70.80%
MI (% yes)[3]	1.5%	6.9%*	1.74%
Stroke (% yes)[3]	1.9%	4.00%*	2.00%
CHF (% yes)[3]	0.8%	2.00%*	0.90%
Angina (% yes)[3]	1.68%	4.00%	1.79%
CABG (% yes)[3]	0.99%	2.00%*	1.03%
PTCA (% yes)[3]	1.28%	4.00%	1.41%

*p < 0.05 when compared to < 70 % propensity; SD, standard deviation; BMI, body mass index; MI, myocardial infarction; CHF, congestive heart failure; CABG, coronary artery bypass graft; PTCA, percutaneous transluminal coronary angioplasty

of OSA. However, of the 4 patients with an OSA risk probability ≥ 0.90, all had a self-reported diagnosis of sleep apnea. In contrast, 729 patients had a deduced OSA probability ≤ 0.10. Of these low-risk patients, only 3 (0.4%) had a self-reported diagnosis of OSA.

There were no unplanned admissions for the patients who had a self-reported diagnosis of OSA. Furthermore, there was no association between OSA propensity scores obtained using the Maislin predictive model with the 11 patients who required unplanned hospital admission. Reasons for unplanned hospital admissions included need for continuous bladder irrigation (3), surgery more extensive than planned (1), observation of flap (2), pain management (1), dizziness (2), chest pain (1), and postoperative bleeding (1).

Table 2 shows the association of median propensities for OSA and variables related to airway assessment and management. Mallampati scores, decreased neck range of motion, numbers of attempts required for tracheal intubation and poor view of vocal cords with direct laryngoscopy were associated with increasing OSA propensity scores. **Figure 1** shows number of intubation attempts and grade view based on mean propensity scores. Fiberoptic intubation was also associated with higher median propensity scores, while there was no correlation between median propensity and intraoperative change in anesthetic management (See **Table 2**).

Table 3 illustrates median propensity scores associated with the administration of intraoperative medications. Higher propensity scores were associated with administration of intraoperative ephedrine ($p < 0.001$), labetalol ($p < 0.001$), metoprolol ($p = 0.003$), and succinylcholine ($p = 0.001$). **Figure 2** shows probability of medication use (ephedrine, metoprolol, and labetalol) as a function of propensity for OSA. Choice of regional anesthesia over GA was associated with increased propensity score ($p = 0.001$). **Table 4** demonstrates the association of propensity for OSA and postoperative variables. Prolonged supplemental oxygen and lower post operative oxygen saturations were associated with higher OSA propensity scores. The only additional

Table 2—Airway assessment and intraoperative airway management by median propensity to OSA

Variable	Median Propensity	p value	n[1]
Mallampati			
I	0.129	< 0.001	
II	0.213		
III	0.313		
IV	0.515		
Neck Extension			
Normal	0.167	< 0.001	
Moderately decreased	0.337		
Severely decreased	0.309		4
Neck Flexion			
Normal	0.170	0.015	
Moderately decreased	0.328		
Severely decreased	0.101		
Number of attempts at laryngoscopy			
1	0.154	0.001	
2	0.250		
3	0.344		
4	0.504		5
Laryngoscopic Grade View			
1	0.150	< 0.001	
2	0.224		
3	0.383		
4	0.400		
Fiberoptic Bronchoscopy			
No	0.160	0.010	
Yes	0.494		10
Stylette Needed			
No	0.163	0.100	
Yes	0.230		
Planned LMA			
No	0.170	0.601	
Yes	0.175		
Change in A.M.			
No	0.171	0.101	
Yes	0.307		8
Intubation due to change in A.M.			
No	0.171		
Yes	0.227	0.420	4

[1]Number of patients ≤ 10 for this variable result.
LMA, laryngeal mask airway; A.M., anesthetic management

variable associated with increased propensity was postoperative tachycardia. Two patients experienced supraventricular tachycardia; their median propensity score was 0.551; however, this was not found to be statistically significant. No correlation was found between increased propensity to OSA and administration of naloxone, need for postoperative ventilatory assistance, reintubation, or postoperative cardiac symptoms. When contacted by phone 24 hours postoperatively there were no patients or family caretakers who reported patient MI, CVA, or death.

Figure 1—Associations of mean number of attempts at endotracheal intubation, laryngoscopic grade view,and propensity for OSA

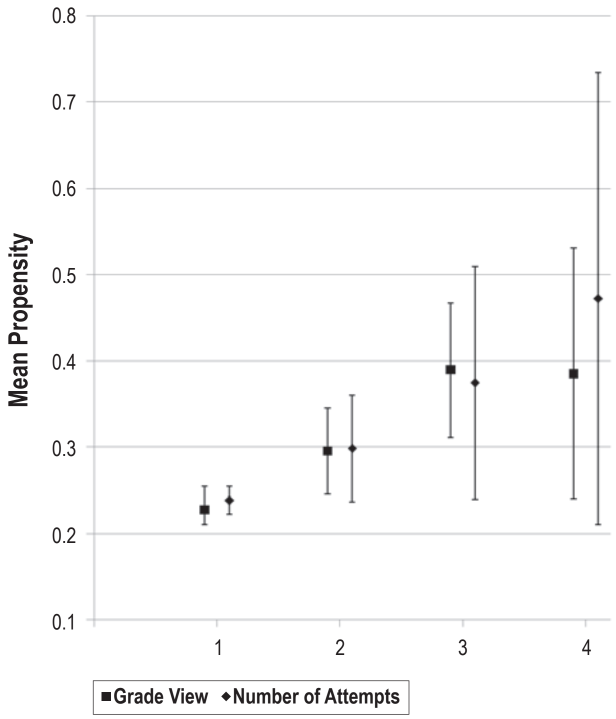
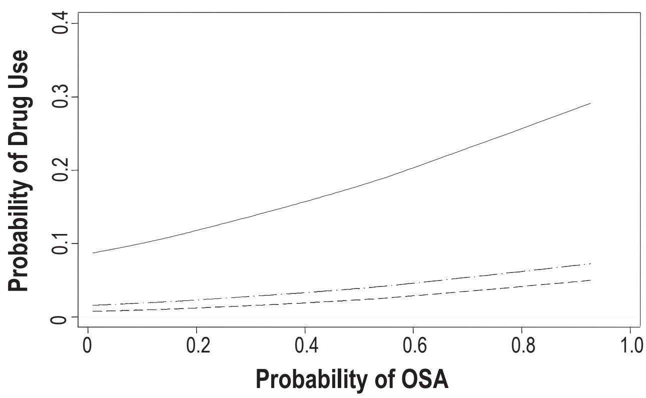


Figure 2—Association of administration of medications to correct hemodynamic abnormalities and propensity for OSA



Ephedrine (solid line), Labetolol (dash-dot line), and Metoprolol (dashed line)

Table 3—Choice of anesthesia and medications administered by median propensity for OSA

Variable	Median Propensity	p-value
Type of Anesthesia		
General	0.238	< 0.001
Regional	0.500	
MAC	0.268	
Propofol		
No	0.248	<0.001
Yes	0.169	
Midazolam		
No	0.217	<0.001
Yes	0.166	
Ephedrine		
No	0.162	<0.001
Yes	0.246	
Labetalol		
No	0.169	<0.001
Yes	0.311	
Succinylcholine		
No	0.167	0.001
Yes	0.201	
Metoprolol		
No	0.170	0.003
Yes	0.313	
Neostigmine		
No	0.175	0.014
Yes	0.145	
Vecuronium		
No	0.175	0.068
Yes	0.154	
Fentanyl		
No	0.170	0.69
Yes	0.172	

MAC, monitored anesthesia care

DISCUSSION

The results of our study suggest that the presence of OSA may be relatively common in an ambulatory surgical population and that a majority of these patients remain undiagnosed. Based on the previously validated prediction model, 4.8% of patients had a greater than 70% propensity for OSA. Although we did not find a relationship between unplanned admission, life-threatening events (e.g., re-intubation, cardiac arrhythmia), or death in patients with either a diagnosis of OSA or higher propensity for OSA, there was an increased risk of serious perioperative events (increased difficulty of intubation, increased need for supplemental oxygen, and use of medications to correct hemodynamic derangements) in patients with a high propensity for OSA.

Our findings are similar to other prior cohort studies that suggest that the majority of patients with OSA have not undergone polysomnography and therefore, carry no formal diagnosis. Furthermore, women with OSA are less likely to be evaluated and diagnosed.[11] This is important as the cohort in this study were predominately female. It is possible, based on current national surgical volume, that more than a million patients with undiagnosed obstructive sleep apnea undergo ambulatory surgery each year.

It is uncertain if patients with OSA can be managed safely as outpatients. Performing surgery in OSA patients on an ambulatory basis poses several dilemmas for clinicians as there are few prospective trials available to guide management decisions.[12] The ASA practice parameters for the anesthetic care of patients with OSA do not support discharge to home after most ambulatory procedures. In fact, the consultants agreed only that patients who had lithotripsy and minor peripheral procedures performed with local anesthetic or regional anesthesia could be safely discharged to an unmonitored setting. The length of postoperative observation and rules for discharge to home after outpatient surgery for OSA patients are unclear; however, recently published practice guidelines suggested a return to baseline room air oxygen saturation without evidence of clinical airway obstruction.[8] These guidelines also recommend that monitoring be continued for a median of 3 hours longer than non-OSA patients and 7 hours after the last episode of airway obstruction prior to discharge home.

Not surprisingly, in this investigation, OSA patients had a significantly greater likelihood of intraoperative issues. Patients with diagnosed OSA are presumed to be at increased risk for difficult airways. As noted by Siyam et al., OSA patients have a higher likelihood of airway-related problems with approximately 21.9% of OSA (vs. 2.6% in non-OSA) patients having a difficult intubation.[13] However, the authors are unaware of any large studies directly linking the two. In our cohort, higher Mallampati score, increased number of attempts of direct vision laryngoscopy, and poorer grade view were all associated with increased propensity to OSA (**Table 3**). Additionally, choice of fiberoptic intubation to secure the airway was similarly associated with increased propensity scores. Increased propensity to OSA was associated with presence of intraoperative tachycardia, and use of intravenous ephedrine, metoprolol, and labetalol, although none of these patients required postoperative admission. Again, these findings may not be unexpected, as OSA (vs. non-OSA) subjects have a higher frequency of baseline cardiac dysrhythmias, ST-segment depression, and increased sympathetic tone.[14-16] Of note, patients with an increased propensity to OSA were more likely to have been prescribed preoperative antihypertensive medications.

While there was a positive association of decreased oxygen saturation upon arrival to the PACU with increased OSA propensity in our study, there was not an association with need to assist ventilation or re-intubation. This is consistent with prior data by Sabers and Plevak.[17] Although OSA patients may be more likely to have postoperative and post-discharge complications, a retrospective analysis of 234 ambulatory surgical patients with polysomnography-confirmed OSA did not have a higher incidence of unanticipated hospital admission or other adverse events than non-OSA case controls. Prior studies reporting outcome in ambulatory surgical patients have studied subjects with either a prior diagnosis of OSA or with a known propensity for obstructive sleep apnea.

There are several limitations to our study. The questionnaires used in this investigation are not 100% predictive, and may fail to identify patients with OSA, particularly in those who are young, thin, or female. These limitations exist with all predictive questionnaires used to identify patients at risk for OSA.[19] Chung et al. examined outcome in an elective surgical population who were assessed for risk of OSA using the Berlin Questionnaire and the ASA checklist.[20] These tools were reported to be moderately sensitive, with lower specificity than diagnosis by polysomnography. In that study, the anesthesiologists were notified if the patient's AHI exceeded 30 episodes per hour and required that these patients be admitted to the ICU for overnight observation. While validated using PSG, the STOP-BANG predictive model also suffered from a significant self-selection bias of participants who agreed to overnight sleep study, and was found to be most useful in identifying patients with severe OSA. This is in part because of the difficulty in arranging formal polysomnography for patients who are dealing with the stress of having to undergo a surgical procedure, and is therefore potentially unavoidable. Additionally, the questionnaires used in our study were designed to determine the propensity of a patient to have OSA, but did not address severity. Although the anesthesia team was blinded to the survey results in our study, it appears that perhaps information obtained in the routine history and physical exam somehow influenced the anesthesiologist to choose regional anesthesia over general anesthesia in patients with increased propensity to OSA. Intraoperatively, choice of regional anesthesia over general anesthesia or monitored sedation was associated with increased propensity to OSA. Al-

Table 4—Postoperative results by median propensity of OSA

Variable	Median Propensity	p value	n[1]
Increased O_2 requirement			
No	0.091	0.016	
Yes	0.174		
PVCs > 6/min or 3 consecutive beats			
No	0.172	0.116	
Yes	0.344		
SVT			
No	0.178	0.084	
Yes	0.551		2
Bradycardia			
No	0.152	0.139	
Yes	0.198		
Tachycardia			
No	0.243	0.026	
Yes	0.134		
Naloxone			
No	0.172	0.285	
Yes	0.077		6
Need for Ventilatory Assistance			
No	0.171	0.848	
Yes	0.221		3
Reintubated			
No	0.172	0.524	
Yes	0.146		2
Unplanned Admission			
No	0.171	0.769	
Yes	0.244		
Discharged Home			
No	0.186	0.277	
Yes	0.170		

[1]Number of patients ≤ 10 for this variable result.
PVC, premature ventricular complex; SVT, supraventricular tachycardia

though our study is one of the largest cohorts to specifically examine the issue of perioperative morbidity and mortality in patients at risk for OSA undergoing outpatient surgery, the incidence of death after outpatient surgery even in patients with significant comorbidities such as OSA is relatively low, and a larger database may be better able to elucidate other factors that may predict morbidity and mortality in this population.[21]

In summary, our study suggests that there may be many patients with unrecognized OSA that present to an ambulatory surgical center. Although additional large scale studies are needed, our study supports the concept that patients with obstructive sleep apnea may be able to undergo ambulatory surgical procedures without increased risk of major adverse outcome. OSA patients who undergo outpatient surgical procedures may require additional perioperative interventions; however, they can be safely treated in an ambulatory care center with subsequent discharge to home.

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SUBMISSION & CORRESPONDENCE INFORMATION

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DISCLOSURE STATEMENT

This was not an industry supported study. The authors have indicated no financial conflicts of interest.

Appendix 1—Maislin Index Score

The index score used in the Maislin et al. (1995) formula is based on 3 questions concerning the frequency of snorting or gasping; loud snoring; and cessation of breathing, choking, or struggling for air. This frequency was recorded on a 5-point Likert scale that ranged from *never* to *5-7 times/week.* In this study, the highest 2 values in the 6-point Likert scale used here (*usually* and *always*) were combined prior to regression analyses to conform to the highest value of the 5-point Likert scale (5-7 *times/week*) used by Maislin et al. A missing response to a question used to calculate the average index score was imputed from the mean of the other 4 questions if only one question per patient was missing. Patients with ≥ 2 missing responses were excluded from the logistic regression analyses. Of the 3557 patients in the data, 36 were excluded from the logistic analyses due to lack of complete data. Missing responses for the 8-question ESS were imputed from the mean responses of the other questions if no more than 2 responses per patient were missing. Twenty-six patients had insufficient data to calculate an ESS. Similarly, 17 patients had missing data on the question of habitual snoring.

Probability = $e^x / (1 + e^x)$,
where: $x = -8.160 + 1.22*\text{Index 1} + 0.163*\text{BMI} – 0.028*\text{Index 1}*\text{BMI} + 0.032*\text{Age} + 1.278*\text{Male}$,
and Male = 1 if male and 0 if female.

Supplemental Material—Screening Sleep Survey

We are asking you to complete this survey today as a part of a research study on sleep apnea. Your decision on whether or not to complete this survey is voluntary, and will have no impact on your clinic visit today. There are no anticipated risks or benefits to you for completing the survey. If you would like us to contact you regarding further participation in this research study, please provide your name and telephone number at the end. Your survey responses will otherwise remain anonymous and confidential, and will not be a part of your medical record for this clinic visit.

Please keep these instructions in mind as you mark your answers on the survey.
Marking Instructions: Make heavy black marks that darken circle completely.
If you change your mind, please erase completely. Darken only ONE circle for each question.

Use #2 Pencil Only No. 2
FILL-IN EACH OVAL COMPLETELY
Wrong! Wrong! Right!!!

Gender: ○ Male
○ Female

Age: _________ years

Height : _____feet ______ inches

Weight: ________ pounds

Marital Status: ○ Single
○ Married
○ Separated
○ Divorced
○ Widowed

Race: ○ African American
○ American Indian/Native American
○ Asian or Pacific Islander
○ Caucasian/White
○ Hispanic
○ Other

Has a doctor ever told you that you have or had the following?	**Yes**	**No**	**Unsure**
Angina	○	○	○
Heart attack (myocardial infarct)	○	○	○
Stroke	○	○	○
Heart failure	○	○	○
Sleep apnea	○	○	○

Have you ever had any of the following procedures?	**Yes**	**No**	**Unsure**
Coronary bypass surgery (“CABBAGE”)	○	○	○
Coronary angioplasty (balloon angioplasty)	○	○	○

Please continue on the next page

How often do you (or your bed partner/roommate) find that you:	**Never**	**Rarely**	**Sometimes**	**Often**	**Usually**	**Always**
1. Snore so loudly that it bothers other near you	○	○	○	○	○	○
2. Sleep apart from your bed partner or roommate because of snoring	○	○	○	○	○	○
3. Have trouble breathing at night	○	○	○	○	○	○
4. Awaken choking or gasping	○	○	○	○	○	○
5. Have others say that you stop breathing in your sleep	○	○	○	○	○	○
6. Doze or nod off while watching a movie or TV show, a lecture or reading	○	○	○	○	○	○
7. Doze or nod off while at work	○	○	○	○	○	○
8. Doze or nod off while driving	○	○	○	○	○	○
9. Doze or nod off while on the phone or in embarrassing situations	○	○	○	○	○	○
10. Wake up and are alert in the morning before it's time to get up	○	○	○	○	○	○
11. Have trouble getting to sleep	○	○	○	○	○	○
12. Have trouble staying asleep after you have fallen asleep	○	○	○	○	○	○
13. Awaken early in the morning have have trouble getting back to sleep	○	○	○	○	○	○
14. Lie awake at night with thoughts racing through your mind	○	○	○	○	○	○
15. Lie awake at night worried or depressed	○	○	○	○	○	○
16. Are awakened easily by noise, light or other things	○	○	○	○	○	○
17. Are too full of energy or have many exciting/important things to do to sleep	○	○	○	○	○	○

How **likely** are you to **doze off or fall asleep** in the following situations? Even if you have not done some of these things recently, try to answer on how these activities may affect you. Use the following scale to choose the most appropriate response for each situation: (Choose only one response for each question)

	Would never doze	**Slight chance of dozing**	**Moderate chance of dozing**	**High chance of dozing**
1. Sitting and reading	○	○	○	○
2. Watching television	○	○	○	○
3. Sitting, inactive in a public place (e.g., a theatre or a meeting)	○	○	○	○
4. As a passenger in a car for an hour without a break	○	○	○	○
5. Lying down to rest in the afternoon when circumstances permit	○	○	○	○
6. Sitting and talking to someone	○	○	○	○
7. Sitting quietly after a lunchwithout alcohol	○	○	○	○
8. In a car, while stopped for a few minutes in traffic	○	○	○	○

If you are interested in participating in a research study, please leave your name and a phone number where we can reach you. If you are not interested in participating in a research study, do not give your name and phone number. Thank you.

Name: ____ Phone number: ______________________

Thank you for filling out this form. Please do not write or mark below this line.