Preoperative Screening for Obstructive Sleep Apnea using the DOISNORE Survey: A Quality Improvement Project in an Ambulatory Surgery Center

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Abstract

Preoperative nurses use obstructive sleep apnea screening tools to identify patients at risk for undiagnosed sleep apnea. The purpose of this quality improvement project was to initiate routine preoperative screening for sleep apnea according to current recommended practice guidelines. This project was implemented for a 3-month period at a rural ambulatory surgery center. Participants consisted of all outpatients ages 18 and older who had a surgical preadmission appointment. Inpatients and emergency patients were excluded from this project. The DOISNORE survey was used to screen for OSA in patients. We assessed pre- and post-intervention number of identified at-risk patients, sleep medicine referrals, and primary care provider notifications. The intervention resulted in a 17% increase in screening rates. The findings supported adherence to a routine screening protocol to increase the detection of at-risk patients. Only 6.25% of patients received a provider notification and 3.1% received a sleep referral. In conclusion, this project led to an overall positive practice change that will has become the new standard of care for surgical patients within the ASC.

Key Words: obstructive sleep apnea; preoperative screening; sleep apnea risk assessment

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Obstructive sleep apnea (OSA) is the most common sleep disorder worldwide.[1] OSA is characterized by either partial or complete obstruction of the upper airway during sleep, resulting in oxygen desaturations and sleep disturbances.[2] OSA has been linked with long-term health consequences including the development of cardiovascular and metabolic diseases, cognitive impairments, and a decreased quality of life.[2,3] The surgical population has a higher prevalence of undiagnosed OSA compared to the general population.[4] Undiagnosed OSA in the surgical patient has been linked with perioperative complications.[1,3,5] Identifying patients at risk for OSA allows anesthesiologists and surgeons to optimize surgical care plans, while reducing the risk of perioperative complications.[1]

Professional organizations support the need for routine OSA screening during the preoperative phase of care.[4,6-9] One screening option available is to order an overnight polysomnography. [10,11] This is the gold standard for diagnosing OSA, although rather expensive and time-consuming. [11] Validated OSA screening tools are another method used to assist in the identification of undiagnosed OSA.[6] The Stop-Bang Questionnaire (SBQ) is the most common tool used.[4] Screening tools for OSA offer a more economic and timely approach compared to an overnight polysomnography.[10] Identification of high-risk patients via screening tools is significantly less costly per patient than rescue interventions used during perioperative complications.[11]

Scope of Problem

Patients scheduled for elective, outpatient procedures at our ambulatory surgery center (ASC) receive preadmission appointments to review pertinent health information. Any identified concerns found during preadmission appointments are reported to either the patient's surgeon or an anesthesia provider for further evaluation prior to surgery. Preadmission registered nurses (RNs) at our ASC do not routinely use the facility approved DOISNORE survey to screen for OSA as part of preadmission appointments. A concern was raised at our ASC for failing to comply with current perioperative recommendations for routine OSA screening in surgical patients.

The Joint Commission has identified undiagnosed OSA in the surgical setting as a patient safety concern requiring intervention.[7] Literature strongly supports the association between undiagnosed OSA and negative perioperative outcomes.[1,2,12] The American Society of Anesthesiologists (ASA), Association of Perioperative Registered Nurses (AORN), and the American Society of Perianesthesia Nurses (ASPAN) all recommend screening patients for OSA using a validated OSA screening tool during the preoperative phase of care.[4,6,8,9] Based on current recommendations, a multi-disciplinary team was established to address the issue of non-compliance with routinely screening for OSA preoperatively at our facility.

Setting

This QI project took place within an ASC in the southeastern region of the United States. There are between 2,500 to 3,000 surgical procedures conducted annually, requiring either moderate sedation or general anesthesia. The following surgical specialties are practiced: general, orthopedic, dentistry, urology, gynecology, ophthalmology, and ear, nose, and throat. Preoperative personnel included 10 RNs trained on preoperative and postoperative care of a diverse surgical population.

Intended Outcomes

This QI project was designed to improve patient safety at the ASC by initiating routine preoperative screening for OSA during preadmission appointments based on current guideline recommendations. We measured the following outcomes,

- reporting and adopting of the evidence based OSA screening tool during preadmission visits,
- the number of identified at-risk for OSA patients,
- the number of sleep medicine referrals initiated, and
- the number of primary care provider referrals initiated.

Literature Review

A review of literature supports the connection between perioperative outcomes and obstructive sleep apnea (OSA).[2,3,5,12,13] OSA has serious long-term health consequences, which when combined with

anesthesia can lead to an increase in morbidity and mortality rates.[3] Respiratory compromise remains the leading perioperative complication associated with OSA.[2,3,5] Difficult airway management, preoperative desaturations, increased need for nonmechanical ventilation, and respiratory failure have all occurred in surgical patients with known OSA.[2,3,5] Cardiovascular complications have been documented in surgical patients with OSA.[3] Atrial fibrillation is the most reported cardiovascular complication.[3] Patients with OSA have a higher prevalence of gastroesophageal reflux disease, which increases the risk for aspiration during intubation and extubation.[3] OSA patients are two and a half times more likely to develop postoperative delirium compared to controls.[3,13] The occurrence of postoperative delirium in OSA patients increases morbidity and mortality during the recovery phase.[13] Other less common perioperative complications include postoperative myocardial infarctions, pulmonary embolisms, delayed wound healing, and an increased risk for postoperative infections.[3,13]

Episodes of perioperative complications result in an increase in length of stay for patients and intensive care unit admissions.[13] This increases the financial burden of caring for a patient who was originally scheduled for an outpatient elective same day surgery.[13] The number of medical malpractice cases filed for perioperative complications associated with OSA has been steadily growing over the past several years.[12] This creates financial and legal concerns for surgeons, anesthesiologists, and ASCs.[12] Prompt identification of undiagnosed OSA in surgical patients helps mitigate the risks associated with perioperative complications.[1]

Preoperative screening for OSA can be beneficial for patients.[3,5] Screening presents a unique opportunity for providers to identify patients who have or are suspected of having an OSA diagnosis, that would otherwise remain undiagnosed.[3,5] Early diagnosis and treatment of OSA results in improved patient outcomes, including a better quality of life with a decrease in cardiovascular morbidity and mortality rates.[3] Data on the use of OSA screening tools in the surgical setting is statistically significant for an increase in detection rates of undiagnosed OSA.[14-16] The American Society of Anesthesiologists (ASA), Association of Perioperative Registered Nurses (AORN), and the American Society of Perianesthesia

Nurses (ASPAN), and Society of Anesthesia and Sleep Medicine (SASM) all have developed recommendations for routine use of preoperative OSA screening.[4,6,8-9]

The ASA released new updated guidelines in 2014 detailing the need for enhanced assessment for OSA in the surgical patient.[8] Patients at risk for OSA must be properly identified.[8] Early risk identification allows for adequate time to develop a risk reduction plan for perioperative complications, while improving clinical outcomes.[8] To achieve this goal, the ASA guidelines support the use of a validated preoperative OSA screening tool.[8] The AORN and ASPAN have adopted similar recommendations regarding screening for OSA.[4,9] These organizations express a responsibility of the perioperative RN to assess surgical patients for the presence of undiagnosed OSA.[4,9] The preferred evaluation method for OSA is a preoperative OSA screening tool.[4,9] The SASM guidelines voice a concern between OSA and postoperative outcomes.[6] In response to this concern, the SASM recommends integrating OSA screening into the pre-surgical evaluation of patients.[6]

Methodology

This QI project was a pre- and post-intervention design. The pre-intervention period was defined as one year prior to the intervention and consisted of three consecutive months (November 2019 to February 2020). This was done to reduce the risk of seasonal variation in surgical patients and cases. The post-intervention included the three consecutive months following project implementation (November 2020 to February 2021).

Sample

A convenience sample of 10 registered nurses (RNs) was obtained for this QI intervention. To be included in the QI project, registered nurses needed to be trained on preoperative assessment of patients and work in the outpatient surgery preadmission department. Nurses who only worked in the intraoperative or postoperative phase of case were excluded from this project.

Protection of Participants

The Lenoir Rhyne University Investigational Review Board (IRB) granted this project approval after an expediated review. The medical institution affiliated with the ASC approved this project through

its IRB via an expediated review process. Additionally, the chief nursing officer and practice administrator of the ASC approved the project. We maintained anonymity of patient information by avoiding the collection of patient health identifiers.

Measurement Tool

We adapted our preadmission OSA screening tool, the DOISNORE survey, from the SBQ.[6] The purpose of the adapted screening tool was to help increase the identification of undiagnosed OSA patients presenting for preadmission surgical evaluation at the ASC.[14-16] The tool consisted of a list of nine items: eight directly from the SBQ, and one additional item (See Appendix A). Scores range from zero to nine on the survey. A score greater than three was considered at-risk for OSA. A score greater than five was considered high-risk for OSA.

Studies have been conducted to assess the reliability and validity of the SBQ.[6, 14-17] The SBQ is validated for use in the surgical setting.[4,15,17,18] The SBQ has a high level of sensitivity ranging from 75.8% to 89.7%, with a moderate level of specificity ranging from 42.3% to 69.6% for identifying high risk OSA patients.[6] A review of our adapted screening tool was done by a team of anesthesiologists, certified registered nurse anesthetists, perioperative RNs, and the nurse manager. All members were in agreeance this adapted screening tool would provide similar results as the original SBQ.

Data Collection

Data collection through patient chart reviews took place during the three-month implementation phase. A retrospective chart review was conducted to collect data from patients record from the previous year during the same months of implementation. The following data was obtained:

- patient demographics (age, sex, body mass index (BMI), race),
- surgical specialty,
- current diagnosis of OSA,
- whether the patient uses continuous positive airway pressure (CPAP),
- the DOISNORE survey score and corresponding risk level,

- whether a PCP letter was sent, and
- whether a sleep medicine referral was initiated.

Data was stored on an encrypted database system. Nominal patient demographic variables were coded using a numeric system (eg, 0 = yes, 1 = no). Age was recorded in number of years. BMI was recorded as a numeric response to the hundredth digit (eg, 25.32, 35.48). Surgical specialties were assigned the following numerical values: general = 0, urology = 1, orthopedics = 2, gastroenterology = 3, gynecology = 4, ear, nose, and throat = 5, ophthalmology = 6, and dentistry = 7. The OSA diagnosis and CPAP usage were recorded nominally. The DOISNORE survey score was recorded numerically. OSA risk classification was coded ordinally. Sleep medicine referrals and PCP referrals were coded nominally.

Data Analysis

Simple descriptive statistics were used to evaluate adherence rates to OSA screening using the DOISNORE survey pre- and post-implementation of the QI initiative. Data collected from both groups was used to calculate the frequency of completed OSA screenings taking place during preadmission appointments. A completed OSA screen was defined as having all components of the DOISNORE survey answered and a reportable score calculated. Partial screenings were considered when any attempt to screen a patient using the DOISNORE survey was present with at least one documented response to a question. Descriptive statistics were used to analyze the number of sleep medicine referrals and primary care provider notification letters sent. Demographic data obtained through chart reviews was analyzed using descriptive statistics to provide an understanding of the average surgical patient seen at this ASC, while identifying the most prevalent surgical specialties. A Mann Whitney U test was performed to determine if a relationship was present between OSA screening scores and gender. An ordinal logistic regression was used to determine whether OSA risk levels were influenced by age, BMI, or gender. The information obtained from these statistical analyzes was used to determine whether this QI intervention had an overall positive effect.

Implementation

Perioperative RNs, involved in preadmission appointments, participated in an educational training session on identifying OSA risk factors, perioperative complications of OSA, and how to use the DOISNORE screening tool. Information on placing sleep medicine referrals and sending primary care provider notification letters was provided. The educational intervention lasted for twenty minutes and took place within the ASC's post-anesthesia care unit. A PowerPoint presentation was used to convey information, and a copy of the presentation was emailed to each participant. Following completion of the training session, RNs started routinely screening for OSA using the DOISNORE survey at all preadmission appointments. The DOISNORE survey was incorporated into the preadmission electronic charting system to increase the ease of screening. RNs were responsible for offering patients scoring in the at-risk or higher category a sleep medicine referral and sending a notification letter to the patient's PCP.

Facilitators

Strengths were present within the ASC work environment that assisted with facilitating change in practice. An established safety culture and excellent team player atmosphere facilitated open communication between staff. RNs were not afraid to voice concerns or offer additional suggestions for practice change regarding OSA screening. Information brought forth by RNs was used to further enhance the QI project. For example, one RN expressed a need for additional time to place sleep medicine referrals while completing preadmission assessments. After a review of the situation, additional time was granted by allowing preoperative RNs to place referrals anytime between a patient's preadmission appointment and the end of the patient's surgical day.

Barriers

Securing adequate time for an educational intervention was challenging due to busy surgical schedules. All staff were present on days with high numbers of cases. Times were available on low census days; however, not all staff were present on these days. A time slot was able to be secured during a week when a high case volume surgeon was on vacation.

A serious perioperative complication linked with undiagnosed OSA has never occurred at this ASC. The absence of a serious complication instilled feelings of unimportance regarding OSA screening among a couple preoperative RNs who have worked at this ASC for greater than 10 years. These RNs had worked within this department for such an extended period that they had developed habitual routines of practice. Initially, these RNs were resistant to change; however, after additional education and support of other team members, these RNs became more open to the idea of routinely screening for OSA.

Results

A total of 1,709 records were reviewed during this project: 916 before and 793 after the QI intervention. The average surgical patient presenting for preadmission evaluation was a Caucasian female over the age of 65 with a BMI greater than 25 who was being evaluated for an upcoming scheduled gastroenterology procedure. A further breakdown of patient demographics pre-intervention can be viewed in Table 1 (Appendix B) and post-intervention can be viewed in Table 2 (Appendix C). It was noted that patients scheduled for gastroenterology procedures had a higher incidence of being at risk (38.05%) or high risk (56.67%) for OSA. A closer examination of patient demographics revealed that having a BMI greater than 30 resulted in a higher prevalence of being at risk (67.26%) or high risk (80%) for OSA. An overview of DOISNORE survey calculated OSA risk compared to patient demographics is presented in Table 3 (Appendix D). An ordinal logistic regression test was statistically significant for age ($B = 0.02$, $x^2 = 7.47$, $p = 0.006$), BMI ($B = 0.12$, $x^2 = 50.75$, $p < 0.001$), and gender ($B = 1.62$, $x^2 = 48.99$, $p < 0.001$) increasing the chances of certain OSA risk levels. Increasing age raised the risk of higher OSA risk level by 2.26%. A one unit increase in BMI was statistically significant for 12.37% increase in OSA risk level. Male gender was statistically significant for increasing the chance of being at a higher OSA risk level. A Mann-Whitney U test was statistically significant (alpha = 0.05, $U = 12{,}081$, $z = -6.92$, $p < 0.001$) for females having lower OSA scores than men.

Before implementation only 12 of the reviewed charts had documentation of a completed DOISNORE survey. Following implementation, a total of 502 charts reviewed contained documentation of OSA screening with the DOISNORE survey. However, of those 502 charts, 85 revealed incomplete or

partial screenings, leaving only 417 completed screenings. Incorporation of the DOISNORE survey into the routine preadmission process resulted in a drastic increase in OSA screening rates from 1.31% (pre-intervention) to 52.6% (post-intervention). The incidence of a score greater than 3 on the screening tool was less than 1% before implementation of routine OSA screening and was 18% after implementation. This resulted in a 17% increase in the identification of at risk for OSA surgical patients at our ASC.

Prior to the intervention, the retrospective chart review found only 2 records that had an established OSA diagnosis on current CPAP treatment. After the intervention, 134 records contained an established OSA diagnosis and 32 of them were on current CPAP treatment. This QI project produced a noteworthy increase in the identification of an established OSA diagnosis and current CPAP treatment from 0.22% to 16.9% and 0.22% to 4% respectively.

Lastly, preadmission RNs had little documented success with getting patients to accept sleep medicine referrals. During the 3-month implementation phase, only 2 out of 96 recommended referrals were placed for sleep medicine. This is concerning after discovering that only 25% of identified high risk individuals at our ASC had an established OSA diagnosis. Nurses struggled to send out PCP notification letters for at risk patients. A total of 6 out of 96 identified at risk patients had notification letters sent to PCPs during this QI project.

Discussion

Screening for OSA during the preoperative phase of care is crucial to increasing the identification of established OSA diagnoses and patients at risk for having OSA.[16] Proper identification of these surgical patients allows for ample time to prepare and implement risk reduction strategies.[16] By reducing the risk of OSA-related perioperative complications, patient safety and quality of care will greatly improve over time. [2,3,5,12,13] The findings of this QI project suggest that routine OSA screening during preadmission evaluation increases the detection of at-risk patients and patients with an established OSA diagnosis. With the aid of an educational intervention and promotion of routine OSA screening, this QI project was able to increase OSA screening rates by 17%. The prevalence of OSA following implementation of routine screening (16.9%) is closely aligned with the estimated prevalence that 20% of

the surgical population has an established diagnosis of OSA.[16] The identified population of at-risk patients after implementation of routine screening (18%) is slightly lower than the projected 28% of surgical patients being at risk for OSA.[16] This is an expected finding for our ASC since we lack several high-risk surgical specialties known to have an increased incidence of at-risk patients, like bariatric surgery.[6]

Limitations

The primary limitation of this project was the impact of the corona virus pandemic on preadmission appointment scheduling. Due to the pandemic, preadmission appointments were conducted via telephone encounters instead of in-person visits. Preoperative RNs had to rely on patient reported height, weight, and neck circumference. There was the possibility for falsely reported patient measurements leading to inaccurate DOISNORE survey scores. Another limitation of this project was poor generalizability. This was a quality improvement project; therefore, the project results are specific to our organization.

Implications for Future Practice

This project identified a new area of concern related to poor rates of sleep medicine referrals and distribution of PCP notification letters. We recommend further investigation into the rationale behind such low rates of compliance in hopes of identifying the causative agent and remedy. One possibility to consider is to provide more in-depth patient education regarding the hazards of undiagnosed OSA and need for prompt evaluation and treatment. Another recommendation is to develop an electronic notification system that will automatically send PCP notification letters if a patient is at risk for OSA and whether the patient has agreed to a sleep medicine referral. The focus of this recommendation would be to promote continuity of care within a patient's interdisciplinary team of providers through prompt and timely communication of new findings warranting a need for further evaluation.

Conclusion

We found that by implementing a routine OSA screening protocol, including a brief educational intervention and promotion of routine OSA screening, improved compliance rates with current recommended perioperative OSA screening guidelines. Overall, this QI project led to a positive practice

change based on the improvement in OSA screening rates from 1.21% pre-intervention to 52.6% post-intervention. An increase in the identification of patients with established OSA diagnoses also took place within this project. However, further investigations are needed to determine the necessary interventions to improve sleep medicine referral rates and the number of PCP notification letters sent.

This screening protocol has been adapted as the new standard of care for all surgical patients presenting for preadmission evaluation at our ASC. For this practice change to be sustainable, preoperative RNs will continue receiving periodic updates on current screening rates and ways to continue to improve current practice. Routine OSA screening offers surgical centers a simple, cost-effective way to increase the detection of OSA in the surgical patient.[10,11] Based on this and the results of this QI project, we support the recommended published perioperative guidelines regarding the push for routine OSA screening in the preoperative environment.

References

1. Fassbender, P., Herbstreit, F., Eikermann, M., Teschler, H., & Peters, J. (2016). Obstructive sleep apnea – A perioperative risk factor. *Deutsches Arzteblatt International, 113*, 463-469. doi: 10.3238/arztebl.2016.0463

2. Nagappa, M., Wong, D., Cozowicz, C., Ramachandran, S., Memtsoudis, S., & Chung, F. (2018). Is obstructive sleep apnea associated with difficult airway? Evidence from a systematic review and meta-analysis of prospective and retrospective cohort studies. *PLoS ONE, 13*(10), 1-15. https://doi.org/10.1371/journal.pone.0204904

3. Auckley, D. (2016). Perioperative complications in obstructive sleep apnea patients. *Current Sleep Medicine Reports, 2*, 87-98. doi: 10.1007/s40675-016-0040-5

4. Harrelson, B., & Fencl, J. (2016). Care of the surgical patient with obstructive sleep apnea. *Association of Perioperative Registered Nurses Journal, 103*(4), 433-437. doi: 10.1016/j.aorn.2016.02.004

5. Verbraecken, J., Hedner, J., & Penzel, T. (2017). Pre-operative screening for obstructive sleep apnea. *The European Respiratory Review, 26*, 1-7. https://doi.org/10.1183/16000617.0012-2016

6. Chung, F., Memtsoudis, S., Ramachandran, S., Nagappa, M., Opperer, M., Cozowicz, C., Patrawala, S., Lam, D., Kumar, A., Joshi, G., Fleetham, J., Ayas, N., Collop, N., Doufas, A., Eikermann, M., Englesakis, M., Gali, B., Gay, P., Hernandez, A. … Auckley, D. (2016). Society of anesthesia and sleep medicine guidelines on preoperative screening and assessment of adult patients with obstructive sleep apnea. *Anesthesia & Analgesia, 123*(2), 452-461. doi: 10.1231/ANE.0000000000001416

7. Quick safety 14: At risk: Obstructive sleep apnea. (2020). *The Joint Commission*. Retrieved from https://www.jointcommission.org/en/resources/news-and-multimedia/newsletters/newsletters/quick-safety/quick-safety--issue-14-at-risk-obstructive-sleep-apnea-patients/at-risk-obstructive-sleep-apnea-patients/

8. Practice guidelines for the perioperative management of patients with obstructive sleep apnea: An updated report by the American society of anesthesiologists task force on perioperative

management of patients with obstructive sleep apnea. (2014). *Anesthesiology, 120*, 268-286. https://doi.org/10.1097/ALN.0000000000000053

9. Hauk, L. (2018). Undiagnosed obstructive sleep apnea in the perioperative patient. *Association of Perioperative Registered Nurses Journal, 108*(4), P7-P9. doi: 10.1002/aorn.12408

10. Gaddam, S., Gunukula, S., & Mador, M. (2016). Post-gastrointestinal endoscopy complications in patients with obstructive sleep apnea or at high risk for sleep apnea: A systematic review and meta-analysis. *Sleep and Breathing, 20*(1), 155-166. doi: 10.1007/s11325-015-1199-6

11. Ayas, N., Laratta, C., Coleman, J., Doufas, A., Eikermann, M., Gay, P., Gottlieb, D., Gurubhagavatula, I., Hillman, D., Kaw, R., Malhotra, A., Mokhlesi, B., Morgenthaler, T., Parthasarathy, S., Ramachandran, S., Strohl, K., Strollo, P., Twery, M., Zee, P., & Chung, F. (2018). Knowledge gaps in perioperative management of adults with obstructive sleep apnea and obesity hypoventilation syndrome: An official American Thoracic Society workshop report. *Annals of the American Thoracic Society, 15*(2), 117-126. doi: 10.1513/AnnalsATS.201711-888WS

12. Fouladpour, N., Jesudoss, R., Bolden, N., Shaman, Z., & Auckley, D. (2016). PEroperative complications in obstructive sleep apnea patients undergoing surgery: A review of legal literature. *Anesthesia & Analgesia, 122*(1), 145-151. doi: 10.1213/ANE.00000000000841

13. Zaremba, S., Mojica, J., & Eikermann, M. (2016). Perioperative sleep apnea: A real problem or did we invent a new disease. *F1000Research, 5*, 1-16. doi: 10.12688/f1000research.7218.1

14. Dixon, S., Haas, S., Klopp, A., & Carlson, J. (2016). A quality improvement project: Using the STOP-BANG tool in a military population to improve equity in preoperative screening. *Journal of PeriAnesthesia Nursing, 31*(5), 371-380. http://dx.doi.org/10.1016/j.jopan.2014.12.002

15. Spence, D., Han, T., Morrison, T., & Couture, D. (2018). High rate of undiagnosed obstructive sleep apnea in patients undergoing total joint arthroplasty. *American Association of Nurse Anesthetists Journal, 86*(4), 282-288.

16. Williams, R., Williams, M., Stanton, M., & Spence, D. (2017). Implementation of an obstructive sleep apnea screening program at an overseas military hospital. *American Association of Nurse Anesthetists Journal, 85*(1), 42-47.

17. Abdullah, B., Idris, A., Mohammad, Z., & Mohamad, H. (2018). Validation of Bahasa Malaysia STOP-BANG questionnaire for identification of obstructive sleep apnea. *Sleep and Breathing, 22*(4), 1235-1239. https://doi.org/10.1007/s11325-018-1663-1

18. Duarte, R., Magalhaes-da-Silveira, F., Oliveira-e-Sa, T., Silva, J., Mello, F., & Gozal, D. (2020). Obstructive sleep apnea screening with a 4-item instrument, named GOAL questionnaire: Development, validation and comparative study with No-Apnea, STOP-Bang, and NoSAS. *Nature and Science of Sleep, 12*(1), 57-67. doi: 10.2147/NSS.S238255

Appendix A

DOISNORE Survey

1. Have you been diagnosed with a-fib, stroke, or hypertension? Yes or No
2. Has anyone observed you stop breathing or choking/gasping during your sleep? Yes or No
3. Do you wake up multiple times during the night? Yes or No
4. Do you snore? Yes or No
5. For males – Is your neck circumference greater than 17 inches? For females- Is your neck circumference greater than 16 inches? Yes or No
6. Is your BMI greater than 32? Yes or No
7. Are you male? Yes or No
8. Do you have excessive daytime sleepiness, or do you feel tired during the day? Yes or No
9. Are you age 50 or older? Yes or No

Total Score: _____

*Score 4-5: At-risk for obstructive sleep apnea
*Score 6-9: High-risk for obstructive sleep apnea

Appendix B

Table 1. Patient Demographics (Pre-Intervention)		
	# of Patients	% of Patients
Sex		
Male	421	46%
Female	495	54%
Total	916	100%
Race		
Caucasian	868	94.76%
African American	27	2.95%
Hispanic	15	1.64%
Asian	2	0.22%
American Indian	1	0.11%
Other	3	0.33%
Total	916	100%
Age (in years)		
18 – 44	125	13.65%
45 – 64	326	35.59%
> 65	465	50.76%
Total	916	100%
BMI (in kg/m^2)		
< 18.5	12	1.31%
18.5 – 24.9	175	19.10%
25.0 – 29.9	287	31.33%
> 30.0	442	48.25%
Total	916	100%
Surgery Type		
Orthopedics	232	25.33%
Ophthalmology	153	16.70%
Ear, Nose, & Throat	29	3.17%
General	116	12.66%
Urology	63	6.88%
Gastroenterology	300	32.75%
Gynecology	23	2.51%
Total	916	100%

Appendix C

Table 2. Patient Demographics (Post-Intervention)

	# of Patients	% of Patients
Sex		
Male	357	45%
Female	436	55%
Total	793	100%
Race		
Caucasian	742	93.57%
African American	32	4.04%
Hispanic	15	1.89%
Asian	3	0.38%
Other	1	0.13%
Total	793	100%
Age (in years)		
18 – 44	101	12.74%
45 – 64	319	40.23%
> 65	373	47.07%
Total	793	100%
BMI (in kg/m^2)		
< 18.5	16	2.02%
18.5 – 24.9	156	19.67%
25.0 – 29.9	245	30.90%
> 30.0	376	47.41%
Total	793	100%
Surgery Type		
Orthopedics	166	20.93%
Ophthalmology	203	25.60%
Ear, Nose, & Throat	24	3.03%
General	113	14.25%
Urology	14	1.77%
Gastroenterology	252	31.78%
Dentistry	1	0.13%
Gynecology	20	2.52%
Total	793	100%

Appendix D

Table 3. Prevalence of OSA Risk Related to Patient Demographics

	At-Risk	High-Risk
Sex		
Male	50.44%	76.67%
Female	49.56%	23.33%
Race		
Caucasian	92.04%	93.33%
African American	6.19%	3.33%
Hispanic	1.77%	3.33%
Asian	0%	0%
Age (in years)		
18 – 44	12.39%	3.33%
45 – 64	44.25%	90%
> 65	43.36%	6.67%
BMI (in kg/m^2)		
< 18.5	0.88%	0%
18.5 – 24.9	12.39%	0%
25.0 – 29.9	19.47%	20%
> 30.0	67.26%	80%
Current OSA Diagnosis	44.12%	25%
Surgery Type		
Orthopedics	26.55%	13.33%
Ophthalmology	15.04%	3.33%
Ear, Nose, & Throat	5.31%	13.33%
General	11.5%	13.33%
Urology	0%	0%
Gastroenterology	38.05%	56.67%
Dentistry	0.88%	0%
Gynecology	2.65%	0%