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The Utilization of the STOP-Bang Questionnaire for Identification of Surgical Patients at Risk for Obstructive Sleep Apnea

Weatherall J. Borden
University of Pennsylvania

Leslie DiVincenzo
University of Pennsylvania, leslie119@me.com

Natalie R. Masi
University of Pennsylvania

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Abstract

Obstructive sleep apnea (OSA) is a breathing disorder that if left untreated during the perioperative period can lead to deleterious complications. Considering there remains a significant amount of Americans undiagnosed, it is of utmost importance that adult surgical patients undergoing elective procedures be appropriately screened to detect OSA risk in order to decrease adverse events through individualized interventions during the surgical phases. Polysomnography testing is the diagnostic standard, but its complexity in the perioperative setting renders it impractical. The STOP-Bang questionnaire is a validated screening tool that can be utilized as an alternative in this population to accurately identify at risk patients. At a local urban hospital in Pennsylvania, a data analytics team determined that a 1.6% annual compliance rate exists with this risk stratification tool amongst anesthesia providers. The aim of this quality improvement (QI) project is to increase overall compliance of the STOP-Bang questionnaire via incorporation into the preoperative nursing assessment and ultimately, increase detection of OSA risk in the undiagnosed surgical population at this healthcare institution. Post implementation data was analyzed and it was revealed that STOP-Bang compliance increased at an upwards of 62.2% over a 4–week period. It was also shown that 14.8% of the surgical population was identified as intermediate to high-risk for OSA development. The STOP-Bang questionnaire is well documented for its reliability, precision, and ability to aid in provider identification of surgical patients at risk for OSA. Considering the specialized, individualized, and careful management OSA patients require to prevent perioperative complications, screening with the STOP-Bang questionnaire is recommended.

Keywords

obstructive sleep apnea, perioperative, surgical, STOP-Bang, complications, anesthesia

Disciplines

Anesthesiology | Interprofessional Education | Nursing | Perioperative, Operating Room and Surgical Nursing | Respiratory System | Sleep Medicine

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Weatherall Josiah Borden, Leslie DiVincenzo, and Natalie Masi

University of Pennsylvania

Department of Nursing, University of Pennsylvania

Abstract

Obstructive sleep apnea (OSA) is a breathing disorder that if left untreated during the perioperative period can lead to deleterious complications. Considering there remains a significant amount of Americans undiagnosed, it is of utmost importance that adult surgical patients undergoing elective procedures be appropriately screened to detect OSA risk in order to decrease adverse events through individualized interventions during the surgical phases. Polysomnography testing is the diagnostic standard, but its complexity in the perioperative setting renders it impractical. The STOP-Bang questionnaire is a validated screening tool that can be utilized as an alternative in this population to accurately identify at risk patients. At a local urban hospital in Pennsylvania, a data analytics team determined that a 1.6% annual compliance rate exists with this risk stratification tool amongst anesthesia providers. The aim of this quality improvement (QI) project is to increase overall compliance of the STOP-Bang questionnaire via incorporation into the preoperative nursing assessment and ultimately, increase detection of OSA risk in the undiagnosed surgical population at this healthcare institution. Post implementation data was analyzed and it was revealed that STOP-Bang compliance increased at an upwards of 60.8% over a 4–week period. It was also shown that 14.8% of the surgical population was identified as intermediate to high-risk for OSA development. The STOP-Bang questionnaire is well documented for its reliability, precision, and ability to aid in provider identification of surgical patients at risk for OSA. Considering the specialized, individualized, and careful management OSA patients require to prevent perioperative complications, screening with the STOP-Bang questionnaire is recommended.

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Prevalent in varying surgical populations, obstructive sleep apnea (OSA) is chronic sleep related breathing disorder characterized by intermittent upper airway collapse, ultimately resulting in recurring episodes of airflow cessation and hypoxemia (Nagappa & Patra, et al., 2017). Outside of the operating room (OR), OSA is associated with significant comorbidities including cerebrovascular disease, cardiovascular disorders, metabolic dysfunction, and depression (Chung, Memtsoudis, et al., 2016). OSA is also strongly associated with adverse perioperative outcomes in adult surgical patients undergoing elective procedures (Nagappa, Wong, et al. 2017). Patients with a known OSA diagnosis are treated preemptively throughout the perioperative period to prevent or decrease known complications, such as periods of apnea, high respiratory rates, oxygen desaturations, difficult mask ventilation, or difficult intubation (Legler, 2018).

Poor screening rates for OSA preoperatively may lead to higher rates of intraoperative and postoperative complications. Postoperative pulmonary outcomes may have a significant impact on the postoperative course and hospital resource use (Fernandez-Bustamante et al., 2017). While under anesthesia, patients who suffer from OSA can experience a myriad of critical complications due to the aggravating effects of sedatives and opioids, including death or near death events (Subramani et al., 2017). It estimated that 82% of males and 93% female patients are unaware of their illness; thus, it is evident that a large number of patients circle through the OR lacking a formal OSA diagnosis (Young et al., 1997). Undiagnosed OSA patients will not receive appropriate and equivalent preoperative preparation, intraoperative management, and

postoperative monitoring. Effective screening can help eliminate the contributory dangers of OSA.

Problem Description

It is estimated that approximately 12% of Americans are afflicted with OSA, and up to 80% of those with OSA, or 23.5 million Americans, remain undiagnosed, yielding inadequate interventions during surgery (Frost & Sullivan, 2016). Treatment options for OSA include positive airway pressure (PAP) therapy, oral appliances and surgical intervention (Pavwoski & Shelgikar, 2017). OSA patients who receive perioperative PAP therapy experience significantly fewer cardiopulmonary and cardiovascular complications (Abdelsattar et al., 2015; Mutter et al., 2014). Therefore, diagnosis and subsequent treatment of OSA is essential to improve patient outcomes. In 2015, the American Academy of Sleep Medicine reported undiagnosed OSA cost the United States an estimated $149.6 billion dollars; a savings of approximately 33% in healthcare costs would be seen if all patients were diagnosed and appropriately treated (Frost & Sullivan, 2016).

Considering the large number of undiagnosed patients, the heightened risk for perioperative complications, and the growing financial burden to healthcare systems, it is imperative that surgical patients are identified preoperatively with OSA screening. Polysomnography (PSG) testing is indicated as the diagnostic standard for OSA in adult patients (Kapur et al., 2017). However, due to cost and complexity, the use of PSG as a diagnostic tool is not feasible in the preoperative assessment period, necessitating an alternative screening method in the operative setting.

Founded in 1751 as the nation’s first, a large, urban hospital in Philadelphia is not adequately utilizing the STOP-Bang questionnaire for OSA risk stratification amongst the

surgical population. A significant problem within this institutions' surgical department is that anesthesiologists are minimally compliant in screening patients for OSA via the STOP-Bang questionnaire. In the electronic medical record, STOP-Bang presents as a nonobligatory component of the anesthesiologist's preoperative assessment, rendering minimal utilization of the screening tool.

In addition to anesthesiologists anecdotally verbalizing noncompliance to preoperative STOP-Bang screening, a report from Penn Medicine's data analytics center objectively showed the true extent of this problem. Between January 1, 2019 and January 1, 2020, this hospital encountered 15,489 patients undergoing surgical procedures. Although 12.1% of the surgical patient population, n = 1,869 patients, were formally diagnosed with OSA via International Classification of Diseases coding, there was only a 1.6% compliance rate with STOP-Bang questionnaire screening to assess OSA risk (S. Chiu, personal communication, June 2, 2020). If an average of 80% of patients remain undiagnosed, this would equate to 1,495 patients in danger of experiencing perioperative complications. This data equates to an estimate of a 0.13% monthly compliance rate, confirming the severity of this institutional problem. When analyzing the ambulatory short procedure unit (SPU), this surgical department encountered 2,623 patients. Within this population, data revealed a 4.3% formal OSA diagnosis, a 1.4% yearly STOP-Bang compliance, and a 0.11% monthly STOP-Bang compliance (S. Chiu, personal communication, June 2, 2020). In this context, it is critical to acknowledge how continued unawareness of OSA, and subsequent absentee interventions, can negatively affect surgical patients' outcomes.

Available Knowledge and Rationale

The STOP-Bang questionnaire is a convenient, validated, and easy to administer screening tool that can be used in the perioperative setting to identify at risk patients. Based on

an eight–question screening tool, the anesthesia provider goes through the acronym STOP-Bang, which represents the categories of snoring, tired, observed apnea, blood pressure, body mass index (BMI), age, neck circumference, and gender to generate a score representative of their OSA risk. Scoring highly is associated with increased odds of perioperative complications compared to people with lower scores [OR = 3.83; 95% CI = 1.75, 8.36; p = 0.008] (Nagappa, Patra, et al., 2017).

The STOP-Bang questionnaire has been widely adopted in the surgical population due to its high efficiency and has proved beneficial in identification of OSA (Chung, Abdullah, et al., 2015). The STOP-Bang screening tool is highly sensitive in detecting OSA in patients with varied degrees of Apnea–Hypopnea Index (AHI) severity (AHI ≥ 5: 84%, AHI ≥ 15: 93%, AHI ≥ 30: 100%) (Abrishami et al., 2010). Thus, in the absence of PSG results, and in situations where conducting a PSG test would not be practical, such as during the perioperative period, the STOP-Bang screening tool may be used to accurately identify patients at risk for OSA. Unsatisfactory screening of OSA with STOP-Bang is associated with airway challenges, cardiopulmonary compromise, mortality, and resource utilization (Chung, Memtsoudis, et al., 2016). All aforementioned adverse consequences are substantial concerns and can dramatically affect patients' health in the perioperative course.

Specific Aims

A proposed approach to address the large amount of undiagnosed OSA in the surgical population is to begin by identifying those at risk. Incorporation of the STOP-Bang questionnaire into the preoperative packet at this institution will encourage providers to comply and allows patient stratification into low, intermediate, or high-risk groups for OSA. With increased adherence to the STOP-Bang screening tool, patients will learn of their OSA severity and may

later seek further assessment of their presumed sleep disorder, and anesthesia providers will heighten preoperative precautions, with intent to decrease potential perioperative complications. Therefore, the aim of this project is to increase overall compliance of the STOP-Bang questionnaire and ultimately, increase detection of OSA risk in the undiagnosed surgical population at this Philadelphia hospital.

Method

Context

In order to successfully execute the proposed intervention to increase the use of the STOP-Bang questionnaire as a preoperative assessment for risk of OSA at Pennsylvania Hospital, contextual elements were considered. Unique factors that can directly or indirectly influence behavior surrounding the intervention were addressed prior to implementation. These may consist of individual opinions within the anesthesia and nursing departments, varying patient characteristics, and the societal norm in the designated surgical setting. Key elements especially included the interaction of leadership, teamwork, and communication amongst participating stakeholders. Pre-established responsibilities of nurses and anesthesia providers were practiced consistently and cohesively, as they both adapted to a changing environment. Professional interrelationships flourished to achieve uptake of the intervention. It was important to gain a thorough understanding of how the interplay of contextual elements had a significant impact on the adoption of healthcare innovations and evidence-based practice.

Located in the metropolitan area of Center City Philadelphia, this private, non-profit, teaching hospital is comprised of 520 beds and 35 OR suites throughout the main building equating to hundreds of surgical patients being treated daily. Within the hospital, there is an ambulatory SPU, consisting of 6 ORs, averaging about a sixth of the daily surgical procedures.

Since the compliance rate for the STOP-Bang screening tool to ascertain OSA risk is a mere 1.4% within the SPU at this institution, it is imperative that this intervention is put in place in order to detect those at an increased risk for OSA before undergoing elective surgery.

Intervention

Three doctorate of nursing practice (DNP) student registered nurse anesthetists conducted this project under the direct supervision of an anesthesiologist, and in collaboration with the anesthesia and nursing departments within the institution. The implementation of the STOP-Bang questionnaire was trialed for 4 weeks in the SPU of the hospital secondary to manageable sample size. Patients under the age of 18 years of age were excluded. Patients undergoing electroconvulsive therapy were also excluded, as they present for weekly sessions and are not representative of the targeted surgical population. Patients with a formal diagnosis of OSA were screened for PAP therapy utilization only, as the goal of this project was to assess OSA risk in undiagnosed surgical patients.

To begin, knowledge dissemination via education workshops amongst participating stakeholders increased provider awareness of the importance of assessing for OSA risk in the preoperative setting. An educational powerpoint was created, presented, and shared electronically to inform nursing staff on the severity of the issue and the upcoming changes (Figure 1). This presentation started by illustrating the anatomical airway differences that exist in individuals with OSA. Next, statistics, representative of total surgical patients, total OSA diagnosis, and STOP-Bang compliance, at Pennsylvania Hospital and the SPU was revealed. It continued by explaining the problem via definition, statistics, risk factors, and associated comorbidities. It also discussed the gold standard for OSA diagnosis – PSG, which is unfeasible preoperatively, including details on the AHI classification for adults. Next, it addressed the threat

of perioperative implications that undiagnosed OSA patients pose. The presentation also showed that the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) voices concerns on the lack of training and guidelines healthcare professionals receive to screen for OSA and recommends provider education to allow for early identification in the surgical planning process (Chung, Memtsoudis, et al., 2016). The relationship between STOP-Bang scores and OSA probability was also addressed during the presentation (Chung, Memtsoudis, et al., 2016). Lastly, the STOP-Bang acronym was introduced, neck circumference measurements was explained, and staff involvement regarding data collection was defined.

Next, in accordance with the nursing department, there was continually stocked disposable tape measures along with incorporation of paper versions of the STOP-Bang questionnaire into all preoperative admissions packets (Figure 2). Nurses are routinely required to review all paperwork for each patient prior to surgery. Each questionnaire included an attached disposable tape measure and was printed on red colored paper to communicate importance. At this phase, this generated a soft stop reminder in the patient's paper chart that a STOP-Bang score needs to be completed. This addition encouraged a joint effort, between patients and providers, to complete the screening prior to undergoing anesthesia.

With nursing guidance, patients filled out the questionnaire. Before completing the STOP-Bang tool, patients were asked if they were previously diagnosed with OSA. If yes, completion halted after specifying compliance with PAP treatment; if no, they continued through the acronym. The latter four demographic categories of the STOP-Bang, designated by a stop sign, however, was completed by the nurse: BMI, age, neck circumference, and gender. Once a height and weight was obtained by and documented in the electronic medical record by nursing ancillary staff, a BMI automatically generated. In order for providers to fill out and interpret the

STOP-Bang questionnaire in its entirety, a neck circumference measurement was obtained by trained nursing staff to ensure proper technique and accurate measurements. Nurses computed a STOP-Bang score and encircle the corresponding risk. Nurses were ncouraged to communicate intermediate and high risk scores to the anesthesia staff.

This screening was completed with the proposed intention that during the anesthesia evaluation, anesthesia providers were responsible to ensure every category is correctly completed. They reviewed the total STOP-Bang score to identify OSA risk, and results were interpreted. Anesthetic plans were ideally adjusted according to OSA risk severity. Lastly, upon completion of the screening tool, the nurse placed each form in a designated red lockbox; this step of the data collection process was explained during the education sessions along with staff roles and responsibilities.

Study of the Intervention

There was an ongoing daily compilation of all SPU surgical encounters during the implementation phase, which was then summed and compared with the total amount of completed STOP-Bang questionnaires over the 4–week implementation period. Post intervention compliance results were compared to the 1.4% baseline compliance data obtained prior to implementation. It is important to mention pre-intervention compliance data was not based on the same eligibility criteria within this QI project. Significant departures from the baseline STOP-Bang completion rate revealed impact the intervention had on assessing and identifying surgical patients for OSA risk.

Measures

The following measures were assessed throughout the implementation of this intervention.

STOP-Bang

The STOP-Bang screening questionnaire is a known easy, reliable, and validated tool for preoperative screening of surgical patients to determine probable OSA risk severity. The screening questionnaire includes four subjective and four demographic screening questions. These subjective questions make up the word STOP and represent snoring, tired, observed apnea, and blood pressure. The demographic questions make up the word BANG and represent BMI, age, neck circumference, and gender. A single point is given each for a BMI above 35 $kg/^{m2}$, age above 50 years old, neck circumference greater than 41 cm, and male gender. The amount of yes responses from both subjective and demographic parts are combined for a final score between 0–8, which is stratified into three different risk categories, (Nagappa, Liao, et al., 2015). A STOP-Bang score of 0–2 indicates the patient has a low risk of probable OSA, a score of 3–4 indicates an intermediate risk of OSA, and a score of 5–8 indicates a severe risk of OSA (Chung, Yegneswaran, et al., 2008).

Since its publication in 2008, the STOP-Bang screening questionnaire has been proven to be a validated and reliable tool for screening OSA in surgical adult populations. During the gold standard for obtaining an OSA diagnosis, which is an overnight PSG sleep study, the patient receives an AHI or respiratory disturbance index (Hudgel, 2016). Hudgel explained an apnea event is defined as a cessation of any flow of air for equal to or above 10 seconds and a hypopnea event is defined when there is a decrease in oxygen saturation equal to or above 4% with accompanied decrease in respiratory effort. Although a variety of cut off points for diagnosis and severity have been cited in the literature, in general minimal or no diagnosis is classified with an AHI < 5, mild OSA with an AHI between 5–15, moderate OSA with an AHI between 15–29, and severe OSA with an AHI above 30 (Hudgel, 2016). In a systematic review

comprised of 17 studies completed by Nagappa, Liao, et al. (2015), the STOP-Bang screening questionnaire had a high sensitivity for detecting OSA. For patients with a score ≥ 3, the questionnaire consistently detected moderate-to-severe OSA 94% (92–95) in sleep clinic patients and 91% (87–93) within surgical patients; for STOP-Bang scores between 7–8, the specificity for severe OSA was 75% for sleep clinic patients and 65% for surgical patients (Nagappa, Liao, et al., 2015).

The overall goal of implementing the STOP-Bang screening questionnaire was to determine the amount of unidentified surgical patients that are intermediate to high risk for OSA categories. In order to accurately identify these patients, the proportion of patients being screened must be improved. Currently at Pennsylvania Hospital, the STOP-Bang questionnaire is a component of the preoperative assessment within EPIC, however monthly screening completion is minimal at an average of 0.11% (S. Chiu, personal communication, June 2, 2020). From January 2019–2020 there was a total of 2,623 patients that were seen in SPU for surgical procedures, in which only 1.4% of the total surgical population, $n = 34$ patients, had a documented STOP-Bang screening score (S. Chiu, personal communication, June 2, 2020). Any notable increase in overall screening will be a direct result of the intervention to implement the STOP-Bang questionnaire as a standard in the preoperative process.

Proportion of Total Screened Surgical Patients

This measure was assessed by dividing the total number of eligible patients within the screening period by the total sum of completed screenings. This number was then compared to the proportion of screened patients pre-project implementation.

Proportion of Screened Patients with an Intermediate or High-Risk Result

This measure was determined based on the number of intermediate and high-risk patients per STOP-Bang criteria divided by the sum of total screened patients on a weekly basis.

Patient Characteristics

Categorical data included gender, previous high blood pressure diagnosis, snoring assessment, tiredness assessment, observable obstructions during sleep assessment, and BMI category. Numerical data that was collected included ratio levels of measurements of age and computed BMI.

Analysis

Relative frequencies will be computed for categoric variables (e.g., gender, previous high blood pressure diagnosis, snoring assessment). Continuous measurements (e.g., age) will be summarized using means, medians, standard deviations, and ranges, as appropriate.

Separate run charts were used to assess changes over time on the study outcomes weekly proportion of total screened surgical patients, and the weekly proportion of screened patients with an intermediate or high-risk result. The run chart allowed data to be displayed in an analytic view that is not only simple to interpret but is visually appealing compared to a static enumerative view (Perla et al., 2011). The horizontal access displayed the weeks of the project and the vertical axis represented both study metrics. Based on the shape of the chart, it highlights any improvement in performance for either of these two metrics (Perla et al., 2011).

Ethical Considerations

The Institutional Review Board of the University of Pennsylvania determined that this project qualified as a QI initiative. The ethical risks addressed included that of placing patients in harm's way, and it was determined early on that STOP-Bang implementation has no potential for harming patients. The risk of not maintaining patient privacy was addressed by omitting patient

information from the screenings and placing these screenings in a designated lock box which could only be accessed by the four members in the DNP team. There was potential for a conflict of interest when considering the DNP students whose DNP project required an increase in STOP-Bang screening completions were the same students in charge of collecting and documenting the completed DNP screenings. This conflict of interest was resolved by students scanning the completed forms at the hospital in the presence of nursing and hospital staff and sharing the scanned forms in an electronic group, which included the DNP team's anesthesiologist who was at no risk of having a conflict of interest. With each risk for ethical malfeasance, the DNP representatives took action to mitigate or completely resolve the issue before it ever occurred.

Intervention Implementation

An initial introduction to the project was presented by the SRNA group members and overseeing anesthesiologist at the monthly perioperative nursing in-service meeting a week prior to the start date. A PowerPoint presentation that overviewed the nature of OSA, perioperative adverse outcomes, JCAHO recommendations, and proper utilization of the screening tool was presented. Those in attendance also received a demonstration of neck circumference measurement technique and had the opportunity to practice a return demonstration. In an effort to reach all perioperative nurses, an email attachment with the educational PowerPoint and screening tool was sent by the nursing educator.

Additional efforts were made throughout the implementation period to educate staff about the ongoing project. Informal walking rounds were conducted on several occasions where group members would present a condensed educational session to available perioperative staff. The project was additionally advertised via visible displays on all perioperative nursing bulletin

board locations and common hallways. Halfway through the implementation period a reminder email was also sent out by the nursing educator.

Questionnaire forms were created and printed on red colored paper with an attached disposable tape measure via paper clip. Forms were added to the front of the patient's preoperative chart by admissions staff on a weekly basis. To facilitate seamless collection, a red colored lockbox was placed in an easily accessible location at the nurses' station. Forms were collected and information documented daily via a Microsoft Excel spreadsheet.

Results

Patient Analysis

The SPU at Pennsylvania Hospital performed 202 elective surgeries during the 4-week project implementation period. After accounting for the initial exclusion criteria 185 patients (91.6%) were deemed as eligible for OSA screening. In total, 117 STOP-Bang questionnaires were collected from the lockbox. After excluding the incomplete questionnaires, (n=2), a total of 115 patients were successfully screened for OSA and qualified for demographic analysis.

A total of 108 patients were included in the OSA patient characteristics analysis (Table 1). Additional exclusions accounted for the 6% (n=7) of patients with a previous OSA diagnosis upon screening. Continuing, not all patient characteristic information was filled out on forms in all fields. 92.6% of surveys specified an exact BMI, 94.4% of surveys identified an exact age, and 95.4% identified an exact neck circumference. This was the extent of missing data.

Patients deemed intermediate to high risk for OSA made up 14.8% (n=16) of the total patients as demonstrated by a score equal to or greater than 3. The characteristic analysis varied from the averages of the total population with an average BMI of 31.48 kg/m^2, an average age of 59.7 years old, and an average neck circumference of 39.3 cm (Table 1).

Screening Compliance

Screening compliance was computed daily and ranged from 22 – 100% (Figure 3). Overall weekly compliance decreased weekly from 80.5%, 65.9%, 66%, to 42.5% (Figure 3 and Figure 4). Out of the 185 eligible patients for screen, a total of 115 questionnaires were successfully completed, amounting to a post implementation compliance rate of 62.2%. The average baseline pre-implementation screening compliance for the SPU was 1.4%, therefore there was an increase of screening by 60.8%.

Risk Stratification

Upon exclusion of people with a previous known diagnosis of OSA (*n*=7), a total of 108 patients were included in the OSA risk stratification. Moderate risk screenings were prevalent weekly in 12.5%, 10%, 11.5%, and 15% of patients, for a monthly average of 15%. High risk screenings were prevalent weekly in 3.12%, 0%, 3.84%, and 5% of patients for a monthly average of 2.77% (Table 2). The monthly prevalence of low, moderate, and high-risk for OSA development throughout project implementation was calculated as 85.2%, 12%, and 2.8%, respectively (Figure 5). Detection of intermediate to high-risk OSA represented an average of 14.8%.

Discussion

Summary

Available knowledge and study rationales present the STOP-Bang questionnaire as a validated instrument designed to aid anesthesia providers in detecting OSA risk in adults prior to undergoing elective surgery. The STOP-Bang questionnaire was always available electronically at this healthcare organization, however, annual compliance was minimal at 1.6%. This QI project educated nursing and anesthesia on the dangers of unidentified OSA risk and further

allowed these two disciplines to collaborate in assessing preoperative OSA risk. Project goals were defined as a 50% increase in STOP-Bang compliance and a 10% increase in patients identified as intermediate to high-risk for OSA and goals were met at 63.2% and 14.8%, respectively. With increased adherence to this tool, patients' are inclined to seek further evaluation for a definitive diagnosis, while providers will ideally institute preemptive care with intent to prevent potential perioperative complications.

Interpretation

After QI interventions, the percentage of adult surgical patients who were appropriately screened for OSA risk significantly improved in the SPU at Pennsylvania Hospital. Therefore, when compared to utilization of the embedded version of STOP-Bang in the electronic medical record, it can be interpreted that implementation of a red-papered version of STOP-Bang into the nursing preoperative packet directly resulted in improved compliance and enhanced identification of intermediate and high-risk OSA. The total number of completed questionnaires are only representative of 57.9% of the patients who presented for surgery over the month of implementation, therefore, it is difficult to determine if the results accurately portray OSA risk prevalence in this facility. Within this population, 6% of patients were previously diagnosed with OSA and a combined total of 14.8% were deemed elevated risk per STOP-Bang scoring. If 80% of patients with OSA remain undiagnosed, the prevalence of OSA risk was shown to be even greater during implementation, necessitating the use of this quick and efficient screening tool.

As compared to a 4-month QI project by Lakdawala et al. (2017) where 29.8% of patients scored high-risk for developing OSA, this 4-week QI project only had a 2.8% classification of high-risk amongst 108 total screened patients. Tabet and Lopez-Bushnell (2008) found that 10% of ambulatory surgical patients had undiagnosed OSA resulting in 16% of surgeries being

cancelled, however, while the STOP-Bang can not diagnose OSA, this QI study found elevated risk for developing OSA in 14.8% of ambulatory surgical patients. Literature supports the correlation between identified moderate to high-risk patients with a prediction of airway challenges, cardiopulmonary compromise, and increased length of stay, nevertheless, it is beyond the scope of this QI project to further investigate the associations between STOP-Bang scores and perioperative complications.

Completing this QI project brought forth an increased awareness on the dangers of unidentified OSA at this healthcare institution. Upon the initial educational in-service, a significant amount of perioperative nurses had minimal knowledge of the nature the STOP-Bang questionnaire, let alone its valuable purpose in the operative setting. Through implementation, not only did nurses learn how OSA can affect the care they are providing during the perioperative period, but patients learned of their OSA risk. This ideally resulted in direct communication to the anesthesia staff regarding elevated OSA risk so that providers could adjust their anesthetic plan accordingly to minimize potential complications. Continuing, with new knowledge of their OSA risk, this QI project can follow the patient after surgery and greatly impact their future health if proper diagnosis and treatment is sought. Increasing STOP-Bang compliance and identification of moderate to high-risk OSA patients fostered a collaborative effort amongst nursing and anesthesia for the betterment of adult surgical patients.

It should be noted that implementation was originally planned to commence four months prior, however, due to the global pandemic notoriously known as COVID-19, elective surgeries ceased and implementation was delayed. Once SRNAs were granted permission to resume clinical and begin implementation, Pennsylvania Hospital was functioning at approximately 75% its daily operating schedule. Although this should not have affected STOP-Bang compliance, it

can be inferred that the calculated prevalence is not representative of actual OSA risk in this ambulatory population due to a decline in surgical cases. In addition, nursing staff variation, and consequently noncompliance, was also a major contributor to varying outcomes. Ideally, nurses would have seamlessly completed the red-colored screening form that came readily available in the required preoperative packet, however, buy-in to comply was inconsistent throughout. Nevertheless, an inference can be drawn that the educational in-service immediately prior, and the walking rounds actively during implementation, lead to increased STOP-Bang compliance.

There is a body of research supporting the myriad of negative effects undiagnosed OSA can have on patients' surgical outcomes. Completing a prescreening tool, such as the STOP-Bang questionnaire, can not only decrease complications for at risk patients, but it can also reduce healthcare spending. OSA poses a substantial economic burden for hospitals secondary to increased length of stay and healthcare expenditures related to comorbidities. Properly identifying OSA risk with a validated assessment tool is one way to improve healthcare utilization and address the hidden crisis that is costing America billions of dollars.

Limitations

Various limitations existed within the STOP- Bang QI project. This project was limited to an off-site location with a high population of individuals arriving for a procedure requiring monitored anesthesia care. This specific population can benefit from changes in anesthesia techniques caused by the identification of OSA risk. The impact on anesthesia techniques would not be generalizable to a patient population requiring intubation for their surgery. The STOP-Bang questionnaire allows for little variability other than the measurement of a patients' neck. This variable allowed for imprecision by way of inconsistent measurements across the board of

staff members. In order to minimize this limitation, the team demonstrated proper measurement form with the nursing staff who would be performing these measurements.

To prevent the limitation of bias in the design, methods, measurement or analysis the members implementing the STOP-Bang QI project eliminated subjective variables by ensuring staff members who utilized the screening tool could not benefit from the results. The detriment to this may have been less buy in from staff members than the QI team members. This was noted when six of thirteen evaluations lacked information during two of the busiest days in the SPU. This caused the evaluations to be excluded from the results, and the team members informed staff of the importance in recording all information on the STOP- Bang evaluations. Selection bias was avoided by including every patient that entered the short procedure unit with the only exception being the patients who frequently returned for electroconvulsive therapy thereby eliminating duplicate screening tools.

By selecting the SPU, the team ensured a reliable patient population that could benefit from the results of the STOP- Bang screening tool was used during the QI project. The limitation of confounding was present considering the relatively small sample size involved in the quality improvement project. This limitation was minimized by identifying each factor and anesthetic change individually in order to identify the impact each STOP- Bang factor may have on the anesthetic changes and ultimate results of these changes in the presence of OSA risk.

Conclusion

The increased utilization of the STOP-Bang screening tool can benefit copious areas outside of this QI project. Current observed practice for OSA considerations includes subjective measurements based on patient body habitus and reported sleep patterns. By utilizing a validated screening tool rather than this subjective identification process patients can receive enhanced

perioperative care. This QI project can be utilized in every area where anesthesia is practiced as well as other areas in healthcare where patients would benefit from the identification of OSA risk. Patients who are identified as high risk for OSA can benefit from increased pre-oxygenation, decreased opioid use in order to prevent obstruction during spontaneous ventilation, permissive hypercapnia to preserve the patients drive to breathe, and the use of CPAP devices to assist with ventilation. The next steps that would benefit this QI project would be implementing inside of Pennsylvania hospital where the patient population tends to have a higher BMI and comorbidities. By implementing this in a surgical population outside of the SPU, the benefits of OSA identification among a population with higher American Society of Anesthesiologists scores and risk factors can be identified.

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Figure 1

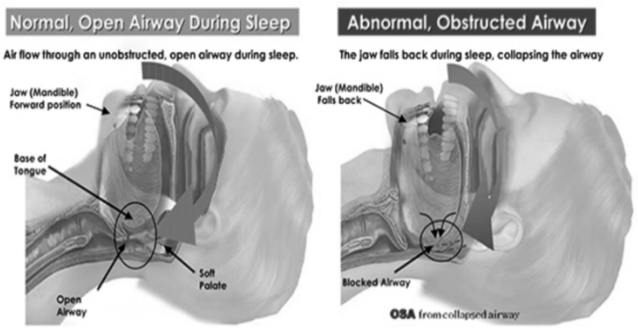
Educational PowerPoint for Nursing Staff

Penn Nursing

DNP Project Implementation 2020

The Utilization of the STOP-Bang Questionnaire for Identification of Surgical Patients at Risk for Obstructive Sleep Apnea

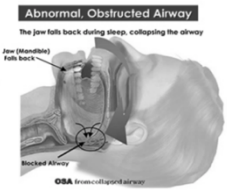
Josiah Borden, SRNA
Leslie DiVincenzo, SRNA
Natalie Masi, SRNA
Anesthesia Lead: Jason Pawlowsky, DO
Nursing Lead: Kaitlin Ronning, CNS



Problem: Obstructive Sleep Apnea (OSA)

Problem: Obstructive Sleep Apnea

- Chronic disorder characterized by repeated partial or total **collapse of the upper airway structures** during sleep
- American Academy of Sleep Medicine (AASM):
  - **12%, or 29.4 million people** diagnosed in USA
  - Approximately **90%** of this population is **undiagnosed and untreated** at the time of surgery
- Unmanaged patients are at an increased risk of perioperative complications



OSA: Who is at Risk?

- **Head & Neck Characteristics:**
  - Large neck circumference
  - Large tongue
  - Craniofacial abnormalities
  - Enlarged airway soft tissue
  - Retrognathia
  - Reduced upper airway muscle tone
- **Risk Factors:**
  - Smoking
  - Older age
  - Alcohol
  - Obesity
  - Male gender
  - Minority race
- **Associated Comorbidities:**
  - Hypertension
  - Congestive Heart Failure
  - Coronary Artery Disease
  - Diabetes Mellitus
  - Stroke
  - Gastroesophogeal Reflux Disease

OSA: Diagnosis

- **Diagnosis with Polysomnography (PSG) testing:**
  - AASM recommends an overnight sleep study with PSG testing as the **gold standard**
  - Records brain waves, measures oxygen in blood, monitors HR and breathing for periods of apnea
  - **Apnea Hypopnea Index:**
    - Sum of the number of apneas plus the number of hypopneas that occur every hour
    - Indicative of severity
    - May **worsen** post-op

➢ ***Not feasible to complete within the perioperative setting, so providers need to use screening tools to assess risk severity.***

TABLE. APNEA-HYPOPNEA INDEX SCORE CLASSIFICATION FOR ADULTS	
APNEA SEVERITY	APNEA-HYPOPNEA INDEX (AHI) (EVENTS/HOUR OF SLEEP)
Normal	<5
Mild	5 ≤ AHI < 15
Moderate	15 ≤ AHI <30
Severe	≥30

OSA: Pennsylvania Hospital

➢ Anesthesiologists are **minimally compliant** in screening patients OSA via the **STOP-Bang questionnaire**
- Presents as a nonobligatory component of the preoperative assessment
- Convenient, validated, easy screening tool
- High sensitivity for detecting OSA severity
  - **AHI ≥ 5:** 84%, **AHI ≥ 15:** 93%, **AHI ≥ 30:** 100%
- Elevated scores correlated with increased perioperative complications
- **Lack of screening:** airway challenges, cardiopulmonary compromise, mortality, resource utilization

1/1/19 — 1/1/20 @ Pennsylvania Hospital:
- **Total surgical patients:** 15,489
- **Formal OSA diagnosis:** 1,869 (12.06%)
- **Undiagnosed:** 1,495 (80% per AASM)
- **STOP-Bang yearly compliance:** 248 (1.6%)
- **STOP-Bang monthly compliance:** ~20.6 (0.13%)

1/1/19 — 1/1/20 @ SPU in Pennsylvania Hospital:
- **Total surgical patients:** 2,623
- **Formal OSA diagnosis:** 113 (4.3%)
- **Undiagnosed:** 90 (80% per AASM)
- **STOP-Bang yearly compliance:** 34 (1.4%)
- **STOP-Bang monthly compliance:** ~2.8 (0.11%)

OSA: Perioperative Implications

What does the evidence say?

- **16% ambulatory surgical patients cancelled**
- 2-fold increased risk for **prolonged ICU stay**
- 1.6 times increased odds for **step-down care**
- 2 times increased odds for **prolonged hospitalization**
  - Prolonged postoperative recovery time
  - Increasing hospital costs by 78%
  - Increasing length of stay by 114%
- 10-fold increased risk for **ventilatory support**
  - Difficult intubation
  - Difficult mask ventilation
- Increased risk for **respiratory depression**
  - Adverse effects related to sedatives & opioids
  - Increased post-op respiratory interventions
- Increased risk for postoperative **delirium and coma**
- Risk for intraoperative **hypertension or hypotension**
- Increased 30-day all-cause **mortality**

Postoperative complications almost 4-fold higher!

OSA: Perioperative Implications

- **Pre-operative**:
  - Screening tool to evaluate risk of undiagnosed patients
  - Confirm home CPAP/BiPAP settings & usage for those with known diagnosis
- **Intraoperative**:
  - Heightened awareness
  - Prophylactic utilization of CPAP
  - Less narcotic usage
  - Less paralysis usage with complete reversal
- **Post-operative**:
  - Continuous ETCO2 monitoring
  - PAP machines
  - Less narcotic usage
  - Referral for sleep study/medical management

Joint Commission

The Joint Commission cited the following concerns regarding the perioperative care of patients in the setting of OSA and these are all areas waiting on further improvement.

1. Lack of training for health care professionals to screen for and recognize OSA
2. Failure to assess patients for OSA
3. Lack of guidelines for the care and treatment of individuals at risk for and those diagnosed with OSA
4. Failure to implement appropriate monitoring of patients with risk factors associated with OSA
5. Lack of communication among health care providers regarding patients with OSA or potential risk factors associated with OSA
6. Lack of postoperative evaluation and treatment for OSA.

➢ ***Primary care providers and surgeons require education regarding the increased risk of postoperative complications present in diagnosed or undiagnosed OSA patients. They should be alert to the possibility of OSA in their patients and attempt to identify it early in the surgical planning process to allow optimal preoperative preparation and risk stratification.***

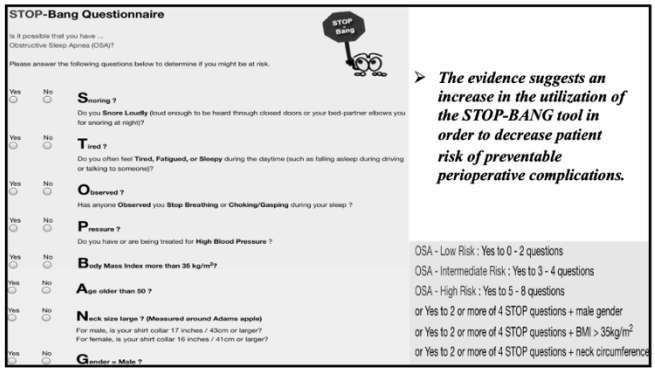
Society of Anesthesia and Sleep Medicine

- High prevalence of surgical patients at risk of OSA **(STOP-Bang ≥3)**
  - Increased rate of perioperative complications

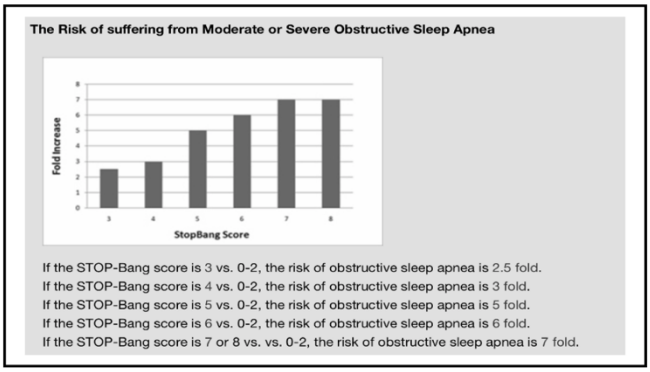
➢ ***The STOP-Bang tool is the most validated screening tool in surgical patients and also has been validated in sleep clinic patients and the general population to detect patients at high risk of OSA. In surgical patients, a greater STOP-Bang score is associated with a greater probability of moderate-to-severe OSA.***

Table 7. Summary of Recommendations for Screening to Identify Patients With Suspected OSA

Recommendations		Level of Evidence	Grade of Recommendation
1.1.1	Patients with a diagnosis of OSA should be considered to be at increased risk for perioperative complications	Moderate	Strong
2.1.1	Adult patients at risk for OSA should be identified before surgery	Low	Weak
2.2.1	Screening tools such as STOP-Bang, P-SAP Berlin, and ASA checklist can be used as preoperative screening tools to identify patients with suspected OSA	Moderate	Strong
2.3.1	Insufficient evidence exists to support canceling or delaying surgery to formally diagnose OSA in those patients identified as being at high risk of OSA preoperatively, unless there is evidence of uncontrolled systemic disease or additional problems with ventilation or gas exchange	Low	Weak



➢ ***The evidence suggests an increase in the utilization of the STOP-BANG tool in order to decrease patient risk of preventable perioperative complications.***



DNP Project

- **Setting**: Surgical Produce Unit (SPU) at Pennsylvania Hospital
- **Proposed Time Frame**: July 13th 2020 — August 21st, 2020
- **Population**: All surgical patients excluding patients with a known formal OSA diagnosis, patients under the age of 18 years old, and patients undergoing electroconvulsive therapy
- **Plan:** STOP-Bang Questionnaire will become apart of preoperative admission packet with attached disposable tape measures.
- **Goal:** Increased STOP-Bang compliance and identification of at risk surgical patients

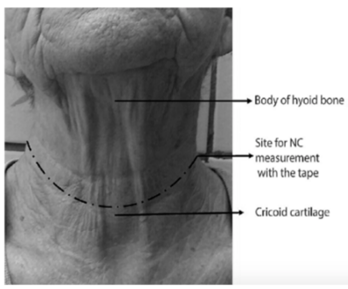
Staff Involvement

Preoperative Nursing Role:
- Instruct patient to complete upper portion of form with assistance as needed
- Nursing to complete lower portion of form
  1. Neck circumference
     - Obtain during vital signs/height & weight
       - Disposable tape measurers will be supplied
- Completed forms will be placed in a designated lock box by nursing

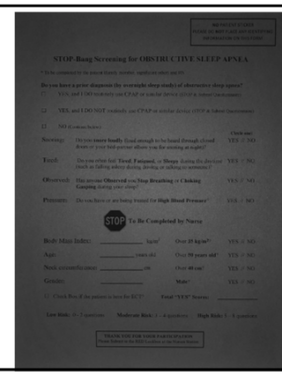
Anesthesia Role:
- Oversee correct completion of form
- Interpret score and intervene as necessary
- SRNAs will collect completed forms from lock box on a daily basis

Neck Circumference

- Measurements should be taken just above the cricoid cartilage, below the Adams' apple, and perpendicular to the long axis of the neck
- Have patient relax shoulders
- If necessary, have the patient look up to facilitate ease of measurement
- Round to the nearest ¼ inch



STOP-Bang Form



Thank You!

- **Additional Information**
  - Flyers will be accessible in SPU, 3rd floor, 8th floor, 9th floor, and basement nursing break rooms
  - Education walking rounds continued during implementation
  - **Education in-service:**
    - **July 9th, 2020**
  - **Go-Live**
    - **July 13th, 2020**
  - **End date**
    - **August 21st, 2020**
- **Contact Information**
  - Josiah Borden: (956) 975-1387
  - Leslie DiVincenzo: (215) 520-6949
  - Natalie Masi: (862) 266-6988

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STOP-BANG QUESTIONNAIRE FOR SURGICAL PATIENT

NO PATIENT STICKER
PLEASE DO **NOT** PLACE ANY IDENTIFYING INFORMATION ON THIS FORM

Figure 2

STOP-Bang Screening for Obstructive Sleep Apnea

STOP-Bang Screening for OBSTRUCTIVE SLEEP APNEA

* To be completed by the patient (family member, significant other) and RN

Do you have a prior diagnosis (by overnight sleep study) of obstructive sleep apnea?

☐ YES, and I DO routinely use CPAP or similar device (STOP & Submit Questionnaire)

☐ YES, and I DO NOT routinely use CPAP or similar device (STOP & Submit Questionnaire)

☐ NO (Continue below)

		Circle one:
Snoring:	Do you **Snore Loudly** (loud enough to be heard through closed doors or your bed-partner elbow you for snoring at night)?	YES // NO
Tired:	Do you often feel **Tired**, **Fatigued**, or **Sleepy** during the daytime (such as falling asleep during driving or talking to someone)?	YES // NO
Observed:	Has anyone **Observed** you **Stop Breathing**, **Choking**, or **Gasping** during your sleep?	YES // NO
Pressure:	Do you have or are being treated for **High Blood Pressure**?	YES // NO

To Be Completed by Nurse

Body Mass Index:	_____ kg/m^2	Over **35 kg/m^2**?	YES // NO
Age:	_____ years old	Over **50 years old**?	YES // NO
Neck circumference:	_____ cm	Over **41 cm**?	YES // NO
Gender:	_____	**Male**?	YES // NO

☐ Check Box if the patient is here for **ECT** **Total "YES" Scores:** _____

Circle one:

Low Risk: 0 – 2 questions **Intermediate Risk:** 3 – 4 questions **High Risk:** 5 – 8 questions

THANK YOU FOR YOUR PARTICIPATION
Please Submit to the RED Lockbox at the Nurses Station

Figure 3

Screening Compliance: Daily Averages

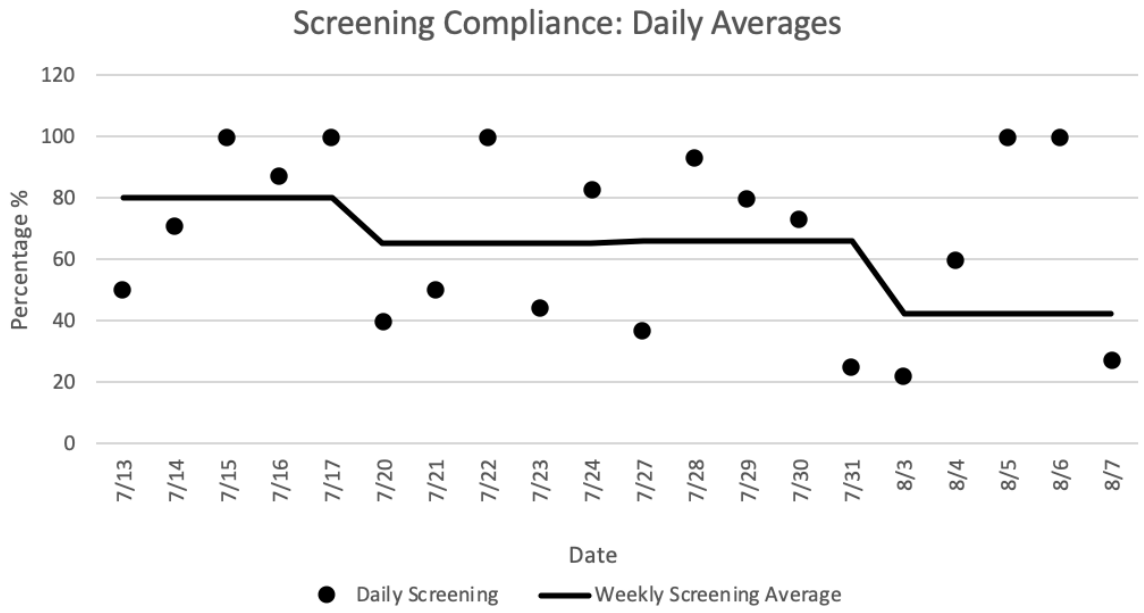

Figure 4

Screening Compliance: Weekly Averages

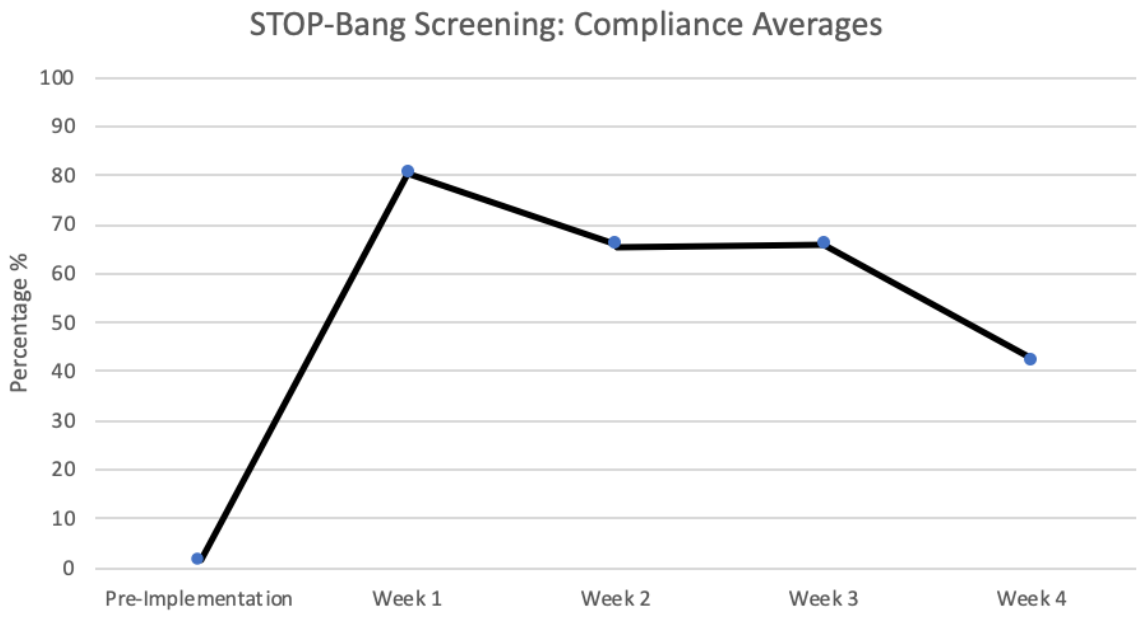

Figure 5

Risk Stratification: OSA Screening Results

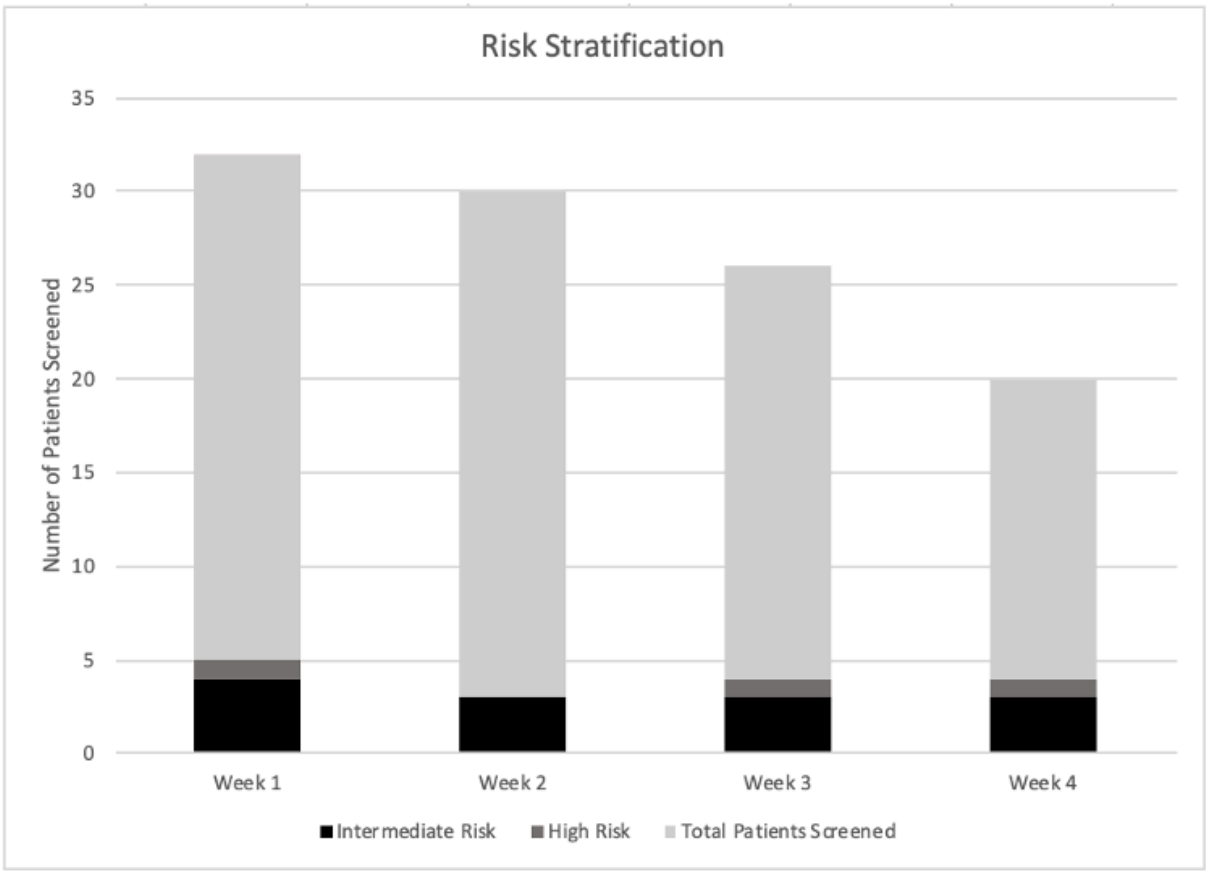

Table 1

Patient Characteristics

	Female	Male	Both Sexes	Intermediate/High Risk Patients
Completed Surveys	97 (89.9%)	11 (10.2%)	108 (100%)	16 (14.8%)
BMI Range (kg/m^2)	15.28-41.66	22.56-40	15.28-41.66	27.48-40
BMI Average (kg/m^2)	28.19	29.92	28.34	31.58
Age Range (years old)	18-80	39-73	18-80	40-76
Age Average (years old)	46.9	53.3	47.5	59.7
Neck Circumference Range (cm)	22-45	33-44.5	22-44.5	33-44.5
Neck Circumference Average (cm)	35.2	39.4	35.7	39.3

Table 2

Patients at Risk for OSA

Risk (Score)	Week 1	Week 2	Week 3	Week 4	Monthly Average
Low (0-2)	84.3%	90%	81.6%	80%	85.2%
Intermediate (3-4)	12.5%	10%	11.5%	15%	12%
High (5-8)	3.1%	0%	3.8%	5%	2.8%