Utilization of STOP-BANG to identify OSA prior to upper Endoscopy

Yvonne M. Douglas, MS, APRN, CRNA
Johns Hopkins School of Nursing
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Project Advisors: Deborah Baker, DNP, CRNP, FAAN
Rita D’Aoust, PhD., ACNP, ANP-BC, CNE, FAANP, FNAP, FAAN
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On my honor, I pledge that I have neither given nor received any unauthorized assistance on this paper. April 9, 2023
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Abstract

Background and Purpose: Obstructive sleep apnea (OSA) is independently associated with obesity and is largely undiagnosed. Patients with OSA are at increased risk for difficult airway management, prolonged artificial ventilation, and delayed discharge. When utilized prior to an anesthetic, the validated STOP-BANG screening tool provides clinicians with crucial information necessary to devise a safe and effective anesthetic plan. The project aimed to implement consistent pre-anesthetic OSA screening of upper endoscopy patients within an ambulatory setting and to refer identified individuals for further evaluation.

Methods: A pre-post intervention model was applied to assess perioperative nurses’ and anesthesia providers’ knowledge of OSA at baseline and after an education session. Pre-anesthetic OSA screening via the STOP-BANG questionnaire and patient and primary care provider (PCP) notification were implemented. An anonymous survey was utilized to obtain feedback from anesthesia providers.

Results: A total of 22 registered nurses, 12 anesthesia providers, and 116 patients met the inclusion criteria for the project. All clinicians completed the pre-and post-tests and the educational sessions. There was no significant improvement in clinician knowledge of OSA. However, 43% of the screened patients were identified as having moderate to severe risk for OSA. The findings revealed that individuals with mild chronic disease had an equal likelihood of moderate to severe OSA as healthy individuals (22.4%).

Conclusions: The findings further support the importance of pre-anesthetic OSA risk stratification. The insidious nature of undiagnosed OSA within the ambulatory surgery population constantly threatens patient safety and safe anesthetic administration. Therefore,
consistently utilizing the validated and evidence-based STOP-BANG questionnaire allows clinicians to identify and inform patients and implement an appropriate anesthetic plan to reduce intra and post-operative complications.

**Implications:** To date, published data on pre-anesthetic OSA screening within endoscopy is limited. The high staff compliance rate supports the feasibility of site-wide implementation of consistent OSA screening and future quality improvement initiatives.

**Keywords:** OSA, STOP-BANG, anesthesia, endoscopy, ambulatory

**Introduction**

Obstructive Sleep Apnea (OSA) is a sleep-induced breathing disorder marked by recurrent episodes of partial or complete upper airway obstruction and blood oxygen desaturation (Deslate et al., 2021; Senaratna et al., 2017; Yang & Chung, 2013). OSA is independently associated with obesity and largely undiagnosed within the adult population (Deslate et al., 2021; Isono et al., 2009). The most common clinical symptoms of daytime sleepiness and snoring are often considered benign by patients and their intimate partners (Mehta et al., 2014; Peppard et al., 2013). The prevalence of OSA is estimated to be between 9% and 25% of the general adult population, accounting for over 25 million people (Peppard et al., 2013; Seet et al., 2021). Within the scope of anesthesiology, patients with OSA are at increased risk for difficult airway management, prolonged artificial ventilation, and delayed discharge. The reliable and validated OSA screening tool known as the STOP-BANG questionnaire was first reported by Chung et al. in 2008 and has been supported by the American Society of Anesthesiologists (ASA), the American Association of Nurse Anesthetists (AANA), and the American Academy of Sleep Medicine (Chudeau et al., 2016; Chung & Elsaid, 2009; Deslate et al., 2021; Gali et al., 2017; Nagappa et al. 2017). When utilized prior to an anesthetic, this evidence-based risk stratification
tool provides clinicians with crucial information necessary to devise a safe and effective anesthetic plan for surgical, diagnostic, and interventional procedures (Chung et al., 2014; Memtsoudis et al., 2018).

**Significance of the Problem**

As the prevalence of obesity has risen globally, so has the incidence of OSA (Choudhury et al., 2019; Jehan et al., 2017). OSA is defined as five or more apneic episodes greater than ten seconds in duration or a decline in oxyhemoglobin saturation of 4% or greater. Largely underdiagnosed and untreated, it may contribute to poorly controlled systemic hypertension, pulmonary hypertension, cardiac arrhythmias, vascular disease, type 2 diabetes, stroke, erectile dysfunction, depression, and sudden death (Chen et al., 2021; Jehan et al., 2017; Li et al., 2021). OSA screening via STOP-BANG has been incorporated into the specialty practices of cardiology, pulmonology, otolaryngology, and dentistry as well as internationally (Bazan et al., 2021; Nurgul, 2021; Pivetta et al., 2021). Although polysomnography (PSG), a lab sleep study is the definitive diagnostic tool, it is time-consuming, requires an appointment, often requires pre-authorization by private insurers, and may bear a significant out-of-pocket expense for the patient (Boese et al., 2014). Furthermore, sleep studies are often not accessible or feasible for citizens of remote or rural regions and underdeveloped nations (Choudhury et al., 2019; Punjabi, 2008; Senaratna et al., 2017).

Traditionally, the pre-procedural medical history forms at the project site have included some components of the STOP-BANG questionnaire; however, scores were not tallied. Subsequently, no OSA risk levels were identified, and pre-anesthetic evaluations have been strictly subjective. Seet et al. (2021) estimates that 25% of cis-males and 10% of cis-females have OSA. This large segment of the population will likely require anesthetic services for a
diagnostic, interventional, or surgical procedure within their lifetime (Boese et al., 2014; Mehta et al., 2014). According to Peery et al. (2019), over 6.1 million diagnostic, surveillance, and interventional gastroenterology procedures, specifically esophagogastroduodenoscopies (EGDs), are performed annually within the United States. An EGD, commonly referred to as upper endoscopy, is considered an objective tool for inspecting the mucosal lining of the esophagus, stomach, and duodenum (Amornyotin, 2013; Katz et al., 2022). According to Kling (2022) and Sharp et al. (2017), the most common indications for EGDs are patient-reported complaints of reflux, regurgitation, epigastric pain, and dysphagia, which are consistent with gastroesophageal reflux disease (GERD). In addition, patients with previous diagnoses of upper gastrointestinal disorders require surveillance EGDs (American Gastroenterological Association, 2019; Sharma et al., 2019).

A patient scheduled for an EGD with undiagnosed OSA poses significant challenges for the anesthesia provider. Deep levels of sedation are required to suppress the gag reflex for an EGD and to minimize patient distress (Boese et al., 2014; Deslate et al., 2021). The administration of sedatives and opioids increases the risk of hypoxia and apnea, particularly in OSA patients prone to pharyngeal airway collapse (Choi et al., 2018; Wang et al., 2019). Patient positioning and the use of an intraoral bite block to allow for the insertion of the endoscope inhibits any intraoral manipulation of the sedated patient with upper airway obstruction (Kuzhively et al., 2019; Metzner et al., 2011). The stretcher and procedural monitor are adjusted to the optimal height and position for the comfort of the gastroenterologist and further impede airway management. With a limited view of the patient in a dimly lit room, the anesthesia provider relies on the use of capnography and pulse oximetry to monitor air exchange and oxyhemoglobin saturation of the sedated patient per the practice guidelines and standards set
forth by the American Association of Nurse Anesthesiology (AANA, 2019) and the American Society of Anesthesiologists (ASA, 2014).

According to E. Gorham (personal communication, 2022), in the year 2021, a total of 472 EGDs were performed at the free-standing surgery center located within the Mid-Atlantic region of the United States. Therefore, incomplete pre-anesthetic screening for OSA prior to EGDs increases the likelihood of adverse events in the endoscopy suite and contributes to the discomfort of anesthesia providers.

This evidence-based quality improvement project aims to incorporate the best practice of pre-anesthetic screening for OSA in adults scheduled for elective EGDs by:

1. Educating the pre-operative and post-operative nurses on OSA and the STOP-BANG tool, including OSA’s risks related to intraoperative and post-operative complications.
2. Reviewing STOP-BANG scoring with anesthesia providers, the impact of pre-anesthetic OSA risk scoring, and the hypersensitivity to sedatives of OSA patients.
3. Identifying and informing all patients of their risk factors for OSA and reporting findings to the primary care providers via the gastroenterologist’s procedural report.
4. Assessing the anesthesia providers’ perceptions of the efficiency of the process change via an anonymous four-question survey.
Literature Review

After a thorough literature review, the four emergent themes regarding the pre-anesthetic screening for OSA were: the prevalence of undiagnosed OSA within the surgical population, the association between OSA and difficult airway management, the risk of intraoperative and postoperative complications associated with OSA, and the high sensitivity rate of the STOP-BANG tool.

Undiagnosed OSA in pre-surgical patients

Baniak et al. (2023), Burns-Mullet & Zhang (2022), Cozowicz & Memtsoudis (2021), Hwang et al. (2022), and Nagappa et al. (2018) concurred that OSA is the most prevalent sleep-related-disorder, highly underdiagnosed, and patients often are unaware of the symptoms and long-term implications. The prevalence of OSA within the surgical population has been reported to be greater than 60% (Baniak et al., 2023; Burns-Mullet & Zhang, 2022). Baniak et al. (2023), Cozowicz & Memtsoudis (2021), Hwang et al. (2022), and Nagappa et al. (2018) further agreed that anesthetics and sedatives cause respiratory depression, alter consciousness, and suppress ventilatory drive. The authors’ findings support incorporating pre-anesthetic screening protocols for OSA to minimize the risks associated with deep sedation and general anesthesia.

The association of OSA with difficult airway management

Burns-Mullet & Zhang (2022), Cozowicz & Memtsoudis (2021), and Nagappa et al. (2018) reported that the anatomic features of a large tongue, narrow upper airway, large neck, and fat deposits within the pharynx with easily collapsible excess pharyngeal tissue predispose individuals to OSA. These anatomical findings contributed to difficult mask ventilation, delayed intubations, and rapid oxygen desaturation. These authors determined that OSA increases morbidity and mortality and is a risk factor for difficult endotracheal intubation.
Risk for intraoperative and postoperative respiratory complications

Baniak et al. (2023), Burns-Mullett & Zhang (2022), Cozowicz & Memtsoudis (2021), Hwang et al. (2022), and Nagappa et al. (2018) identified the increased risk of intraoperative and immediate postoperative respiratory adverse events in OSA and suspected OSA patients. These events contributed to increased use of resources, operating room time, emergent and difficult intubations, hypoxia, hypercapnia, prolonged post-operative mechanical ventilation, and delayed discharge. Furthermore, the authors identified the need for a thorough pre-anesthetic interview and assessment for all patients. These authors concluded that an anesthetic and surgical procedure in undiagnosed and unscreened patients might increase the morbidity and mortality of such patients within the intraoperative or immediate postoperative periods.

High OSA sensitivity rate of STOP-BANG tool

Baniak et al. (2023), Burns-Mullett & Zhang (2022), Cozowicz & Memtsoudis (2021), and Hwang et al. (2022) determined the widely adopted and validated STOP-BANG tool to be highly sensitive for mild and severe OSA risk identification. Baniak et al. (2023) and Burns-Mullett & Zhang (2022) further identified the screening tool to be highly specific for risk scores greater than or equal to five (5) in the absence of an in-lab sleep study.
**Translational Framework**

Clinicians as project managers must thoroughly evaluate frameworks and models to identify the ideal strategies for translating a proposed project to evidence-based practice (EBP) (Fineout-Overholt et al., 2005; White et al., 2021). The Rosswurm and Larrabee model (1999) was identified as a suitable approach for implementing the quality improvement (QI) initiative of pre-anesthetic OSA screening of upper endoscopy patients (see Appendix A). The Rosswurm and Larrabee model promotes EBP changes in the presence of qualitative and quantitative data. The model comprises six iterative steps and incorporates a means for modification throughout the process (Fineout-Overholt et al., 2005; Rosswurm & Larrabee, 1999; Thurston & King, 2004). According to Rosswurm and Larrabee (1999), the primary step required identifying the implications of gaps in practice, the lack of uniform pre-anesthetic OSA screening, and documentation. The second step involved addressing efficiency and patient safety concerns with the medical director, site administrator, gastroenterologists, and anesthesia providers. The third step involved a literature review for variables and the synthesis of the best evidence in determining the safety profile and utility of the QI initiative. The fourth step required the development of the educational materials, scheduled educational sessions, and the plan for implementation of pre-anesthetic OSA screening via the STOP-BANG tool. The fifth step required the application and appraisal of the ongoing process, including the availability of the questionnaire for all direct care clinicians, patient referrals, frequent face-to-face meetings with stakeholders, and the retrieval of archived forms within the medical records department. The final stage of this model encompassed advocating for standardized pre-anesthetic OSA screening with the clinicians and the stakeholders, incorporating the anesthesia practice guidelines in clinical practice, and continuous assessment of the paper charting system for efficiency.
Methods

Design

The quality improvement project was comprised of a pre-post intervention model to assess perioperative nurses’ and anesthesia providers’ knowledge of OSA, pre-upper endoscopy OSA screening, and anesthesia provider feedback. Outcomes of interest include a) increased OSA knowledge among clinicians, b) documented patient identification and notification of OSA risk, and c) electronic notification of primary care providers of moderate-severe OSA risk.

Setting and sample

The project site is a free-standing ambulatory surgery center within the Mid-Atlantic region of the United States. The anesthesia department is staffed by 12 anesthesia providers comprised of eight (8) Certified Registered Nurse Anesthetists (CRNAs) and four (4) physician Anesthesiologists with a mean of 14.8 years of anesthesia experience. The pre and postoperative units are staffed by 22 registered nurses (RNs) with a mean of 25.0 years of nursing experience. The facility has two (2) endoscopy suites where elective upper endoscopies are performed on adult patients. All patients scheduled for upper endoscopies were screened via the STOP-BANG questionnaire by perioperative RNs from September 11, 2022, through December 12, 2022. The anesthesia provider recorded each patient’s ASA physical classification on the STOP-BANG forms. A total of 116 patients were screened during the three months, and any patients canceled upon arrival to the facility or with a known diagnosis of OSA were excluded from the sample.

Ethical considerations

The Johns Hopkins University Project Ethical Review Committee (PERC), the project site administrator, and the medical director reviewed and approved this QI project. There was no participant recruitment or conflicts of interest.
Intervention

The supporting stakeholders— the perioperative nurse manager and gastroenterologists were informed of the approvals from the JHU PERC, the administrator, and the medical director. This evidence-based, patient-centered initiative to address undiagnosed OSA within the patient population was promoted through an email to the perioperative RN staff, memos, and in-person meetings with the registration staff, clinicians, and gastroenterologists.

Daily sessions were held to administer the clinician baseline knowledge assessments, education sessions, and post-intervention assessments from September 8, 2022, through September 14, 2022, to account for staff scheduling. The OSA screening tool was added to each EGD chart, and extra copies were made available within the pre-op holding area for completion by the pre-op RN. The anesthesia provider then reviewed the questionnaire and informed the patient of their risk level and the implications of untreated OSA. The gastroenterologists were advised of the OSA risk level and documented the need for further evaluation within their electronic procedural report for the PCP. Upon arrival to the recovery room, the receiving RN was informed of the patient’s OSA risk level. Prior to discharge, patients with moderate to severe OSA risk were given an OSA leaflet and a written referral for follow-up with their PCP.

Instruments

The project utilized pre and post-tests consisting of ten (10) true or false questions to assess the knowledge of OSA of the sample groups of the RNs and anesthesia providers. Each question was worth ten (10) points, and the possible scores ranged from 0% to 100%. The STOP-BANG Scoring Model has been recommended within the practice guidelines of the ASA, AANA, and AASM as a reliable, specific, and concise OSA screening tool that takes less than five minutes to administer (Nagappa et al., 2017; ASA, 2014). This validated standardized tool
was utilized specifically for upper endoscopy patients and consisted of eight questions. Each question requires a response of yes or no. The value assigned to a “no” reply is zero, and a “yes” reply is given the value of one. The Stop portion of the questionnaire consists of subjective questions about snoring, daytime tiredness, obstructive breathing, and hypertension. The Bang portion incorporates the demographic items of body mass index (BMI), age greater than 50, neck circumference greater than 16 inches for females or greater than 17 inches for males, and male gender. The perioperative RNs measured patients’ necks with plastic tape measures, and the values were tallied. A score of zero to two was identified as a low suspicion for OSA. Scores ranging from three to four indicated a moderate OSA risk, and scores of five to eight indicated a high suspicion of OSA (Chung et al., 2016). Chung et al. (2016) and Nurgul (2021) further identified the tool’s sensitivity to detect moderate to severe OSA as 93% and 100%, respectively, with specificity rates of 43% and 37%.

The four-question anonymous anesthesia provider survey comprised three “yes” or “no” questions to assess the availability of the completed STOP-BANG questionnaire, anesthetic dose adjustments based upon the score, opinions on the utilization of screening tool within the pre-op area, and a write-in option to assess the efficiency of the process change. Each question offered an opportunity to comment on the OSA screening process. A total of 23 surveys were collected.

Data collection and analysis

The completed clinician pre-tests, post-tests, STOP-BANG questionnaires, and provider surveys remained on-site and were manually documented within Microsoft Excel®, and random identifiers were assigned. Once de-identified, the data was uploaded to SPSS 27© (IBM) and stored on the JHU OneDrive. The outcomes of aim one were analyzed via the Wilcoxon signed-rank test. This non-parametric t-test was utilized to compare the mean pre and post-intervention
OSA knowledge scores of the perioperative RNs. In addition, the distribution of the mean pre and post-test scores of the RNs was determined and compared with the years of nursing experience. The pre and post-test scores of the RNs were not grouped with those of the anesthesia providers due to the specialty’s focus on the airway and extensive pre-operative assessment.

As for aim two, the anesthesia provider knowledge assessments were analyzed using the Wilcoxon signed-rank test. The mean pre and post-tests were calculated and compared to the years of anesthesia experience.

In accordance with aim three, the mean age, STOP-BANG score, ASA classification, gender, BMI group, and hypertension status were determined via measured frequencies and descriptive statistics. A total of five STOP-BANG questionnaires were not completed prior to the anesthetic.

Aim four’s findings on the anonymous anesthesia provider surveys were reported as frequencies of “yes” or “no” and the free-text comments provided.
Results

Data analysis of the RN pre and post-tests on OSA knowledge revealed a statistically significant 10% increase in the median score of the participants after the education session. However, no significant change was noted when comparing the mean scores, and the null hypothesis was rejected ($p<.011$). The demonstrated knowledge may be associated with the mean of 25 years of nursing experience within the perioperative department (see Figure 1 below).

**Figure 1**

Similarly, analysis of the anesthesia providers’ pre and post-tests identified a statistically significant 6.7% increase in the mean score after the educational session. However, no significant change was noted among the median post-test scores, and the null hypothesis was rejected ($p<.011$). The demonstrated knowledge of the anesthesia providers on OSA and screening utilizing the STOP-BANG questionnaire may be associated with the average of nearly 15 years of practice and continued education within the specialty of anesthesiology (see Figure II and Table I below).
Within the population of screened EGD patients, although the diagnosis of hypertension (HTN) is a component of the STOP-BANG score, it was not associated with an increased risk for OSA. Furthermore, individuals identified as ASA I or II had an equal likelihood of moderate to severe OSA risk identification (22.4%). This finding supports the argument that otherwise healthy or individuals with well-controlled chronic conditions may present with an elevated risk for OSA (see Tables IIa and IIb below).
Table IIa  Baseline characteristics of upper endoscopy patients screened for OSA via STOP-BANG tool

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>n =116</th>
</tr>
</thead>
<tbody>
<tr>
<td>missing</td>
<td>5 (4.2%)</td>
</tr>
<tr>
<td>Age, mean (SD)</td>
<td>66.7 (11.7)</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28 (23.1%)</td>
</tr>
<tr>
<td>Female</td>
<td>88 (72.7%)</td>
</tr>
<tr>
<td>ASA status</td>
<td></td>
</tr>
<tr>
<td>I  healthy</td>
<td>1 (0.8%)</td>
</tr>
<tr>
<td>II mild systemic dis.</td>
<td>69 (57%)</td>
</tr>
<tr>
<td>III multiple systemic dis.</td>
<td>46 (38%)</td>
</tr>
<tr>
<td>IV constant threat to life</td>
<td>0</td>
</tr>
<tr>
<td>V  gravely ill</td>
<td>0</td>
</tr>
<tr>
<td>Diag. HTN</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>57 (47.1%)</td>
</tr>
<tr>
<td>No</td>
<td>59 (48.8%)</td>
</tr>
<tr>
<td>BMI &gt;35</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9 (7.4%)</td>
</tr>
<tr>
<td>No</td>
<td>107 (88.4%)</td>
</tr>
<tr>
<td>STOP-BANG score (OSA risk)</td>
<td></td>
</tr>
<tr>
<td>0-2 (mild)</td>
<td>64 (52.9%)</td>
</tr>
<tr>
<td>3-4 (moderate)</td>
<td>40 (33.1%)</td>
</tr>
<tr>
<td>5-8 (high)</td>
<td>12 (9.9%)</td>
</tr>
</tbody>
</table>

SD=standard deviation  
ASA= Anesthesiology Physical classification  
HTN= Hypertension

Table IIb

<table>
<thead>
<tr>
<th>ASA_Score vs. OSA_Risk Crosstabulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSA Risk Level</td>
</tr>
<tr>
<td>Low  Mod.  High  Total</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>ASA_Score</td>
</tr>
<tr>
<td>I. healthy</td>
</tr>
<tr>
<td>II. Mild systemic disease</td>
</tr>
<tr>
<td>III. Moderate systemic disease</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Of the 23 anonymous anesthesia provider surveys collected, over 90% of the polled clinicians agreed that pre-anesthetic OSA screening should occur within the holding area. Armed with the STOP-BANG scores, most clinicians declined to adjust the anesthetic plan, likely due to
the brief nature of EGDs. The lack of free-text comments on the surveys highlighted the limitations of paper documentation within the project site’s fast-paced environment. Clinician feedback was compiled and depicted in Table IV.

**Table IV**  \( n=23 \)

<table>
<thead>
<tr>
<th>Question #</th>
<th>Responses</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Stop-Bang score was tallied and easily identified before leaving preop with the patient.</td>
<td>Yes:17 (74%) No: 6 (26%)</td>
</tr>
<tr>
<td>2</td>
<td>Based on the STOP-BANG score, I adjusted the dose of anesthetics.</td>
<td>Yes: 9 (39%) No: 14 (61%)</td>
</tr>
<tr>
<td>3</td>
<td>The STOP-BANG tool should be administered in preop holding.</td>
<td>Yes:21 (91%) Blank: 2 (8.7%)</td>
</tr>
<tr>
<td>4</td>
<td>A change I would like to see is:</td>
<td>2 (8.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 (91.3%)</td>
</tr>
</tbody>
</table>

**Discussion**

Clinician-focused education on OSA and the validated and reliable STOP-BANG tool increased pre-anesthetic OSA screening for EGD patients. The STOP-BANG model has been well studied and demonstrates the highest sensitivity in detecting OSA, and nocturnal pulse oximetry shows the highest specificity among all available screening techniques (Ankichetty & Chung, 2011).

Published data on pre-anesthetic OSA screening within endoscopy is limited. This quality improvement initiative incorporated evidence-based practices to educate clinicians, and screen, identify, and inform patients of the OSA risk before elective EGDs. OSA screening via questionnaires has been identified as an effective means of identifying patients with low, moderate, and severe risk for OSA demonstrating sensitivity rates of 88%, 90%, and 93%, respectively (Chiu et al., 2017; Dwarakanath et al., 2016). The limited specificity of STOP-
BANG for low, moderate, and severe OSA risk has been reported by Bernhardt et al. (2021) to be 35%, 27%, and 26%, respectively. The low specificity of the STOP-BANG screening tool was not a deterrent to identifying and referring at-risk patients who were unaware of the signs, symptoms, and long-term implications of untreated OSA.

Limitations

Throughout the 12 weeks of the QI project, the facility’s COVID restrictions on visitors within pre-op holding limited the opportunity for input regarding loud snoring or witnessed apneic episodes. In addition, the absence of electronic health records, staff vacancies, peak case volumes, the principal investigator’s full clinical caseload, and a single gastroenterologist’s resistance posed a significant challenge to clinicians’ consistent implementation and compliance with the QI project. Archived and incomplete forms subsequently completed by other clinicians within the pre-op area were attributed to the fast-paced environment. No specific limitations to statistical analysis have been determined. The OSA knowledge assessment of anesthesia providers revealed proficiency in identifying the risk factors and the utility of the STOP-BANG screening tool. However, the facility continues to utilize a paper pre-operative patient health form without STOP-BANG tallying. This practice contributes to inconsistent documentation of OSA risk and does not allow for a direct line of communication with a patient’s primary care provider.

Strengths

The principal investigator’s rapport with fellow clinicians and the continuous support of the administrator, medical director, and gastroenterologists contributed to the success of the QI initiative. As patients return to the facility for subsequent procedures, several previously screened individuals have reported upcoming consults with sleep medicine specialists. Although
there are no known plans to implement an electronic health management system, the majority of anesthesia providers have continued implementing STOP-BANG screening into their patient assessments. All have since adopted consistent methods of quantifying and documenting OSA risk levels and notifying patients of their risk factors for OSA. All individuals identified within the pre-op, intra-op, or post-op area are given a written referral for further consultation with their PCP. Subsequently, visitor restrictions have been repealed, and significant others or caregivers are now available to contribute critical information.

**Recommendations**

The screening of patients for OSA should be performed prior to any anesthetic. The administration of STOP-BANG within the pre-surgical screening calls or the introduction of an upgraded patient health form, allowing for tallying the subsequent score, would support consistent and accurate quantification of OSA risk.

**Conclusion**

This project confirmed the importance of OSA risk stratification and the clinicians’ commitment to patient safety. The insidious nature of undiagnosed OSA within the ambulatory surgery population constantly threatens patient safety and safe anesthetic administration. Therefore, consistent utilization of the validated and evidence-based STOP-BANG questionnaire allows clinicians to identify and inform patients as well as implement an appropriate anesthetic plan to reduce intra and post-operative complications. The high staff compliance rate supports the feasibility of site-wide implementation.

**Dissemination**

The findings of this QI project will be presented to the stakeholders and clinicians at the site. Plans have been made to present the manuscript at a local nurse anesthetist conference and
to submit it for publication in a peer-reviewed nursing journal. Additionally, key points of relevance and interest will be shared on Twitter or LinkedIn.

**Sustainability**

Without electronic records, the project site will implement wide-scale STOP-BANG screening within three months. Education of the pre-operative screening RN staff is required, and compliance with the new process is expected. Consistent OSA screening, documentation, and patient notification will be performed for all patients excluding individuals with known OSA. The administration of the questionnaire during the pre-operative screening call reduces the workload on the pre-operative nurses. Upon arrival at the facility, the patient’s weight and neck measurements will be obtained, and the score will be tallied and made readily available for the anesthesia provider.
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Appendix A

Translational Framework-Rosswurm and Larrabee Model (1999)