Anesthesia-Led Obstructive Sleep Apnea Screening and Referral Program

Timothy N Haigh, MNA, CRNA
Johns Hopkins University School of Nursing
NR.210.889 Project Evaluation and Dissemination

Project Advisors:
Rita D'Aoust PhD, ACNP, ANP-BC, CNE, FAANP, FNAP, FAAN
Deborah Baker, DNP, CRNP
Abstract

**Background and Purpose**: Undiagnosed Obstructive Sleep Apnea (OSA) represents a global public health problem, resulting in significant morbidity and mortality. Many high-risk adult surgical patients have undiagnosed OSA, but inadequate perioperative OSA screening and postoperative primary care (PCP) referral fails to provide a path for diagnosis and treatment for most of these patients. The purpose of this quality improvement project is to implement and evaluate the effects of a 12-week obstructive sleep apnea (OSA) screening program in adult surgical patients utilizing the STOP-Bang questionnaire and a standardized PCP referral pathway.

**Methods** This project utilized a pre-post intervention design in a small urban hospital. 16 Certified Registered Nurse Anesthetists (CRNAs) participated in this project, and provider confidence was measured through a five-point validated Likert Scale. Provider compliance with administering the STOP-Bang questionnaire, STOP-Bang score, and PCP referral rates were evaluated through a random sample of 302 adult surgical patient charts (151 pre-intervention/151 post-intervention).

**Results** Providers reported an 18.9 (out of 20) confidence score with implementing the screening and referral pathway and had a 93.8% compliance rate with completing the STOP-Bang questionnaire. 0% of patients had a completed STOP-Bang score and/or post-operative PCP referral form at baseline. Post-intervention, 65.6% of adult surgical patients had a completed STOP-Bang score and 88.9% of high-risk OSA patients with a
STOP-Bang score of $\geq 5-6$ were referred to their PCP for further evaluation and treatment.

**Conclusion:** The introduction of a OSA screening and referral program utilizing the STOP-Bang questionnaire and a standardized PCP referral form resulted in a significant improvement in OSA screening and PCP referral for high-risk patients. Provider compliance with the program was high, showcasing program feasibility. These results highlight the need for a standardized screening program for at-risk OSA patients to address the gap in OSA screening and in providing a pathway for diagnosis and treatment.

**Keywords:** Undiagnosed obstructive sleep apnea (OSA), sleep disordered breathing, STOP-Bang questionnaire, adult surgical patient, perioperative, anesthesia and preoperative screening.
Anesthesia-Led Obstructive Sleep Apnea Screening and Referral Program

Introduction

Obstructive Sleep Apnea (OSA) is the most common sleep-breathing disorder characterized by partial or complete obstruction in the upper airway for at least 10 seconds during sleep (Seet et al., 2015). This disruption of breathing leads to recurrent periods of nocturnal arousal, oxygen desaturation, hypercarbia, and cardiovascular dysfunction (Gross et al., 2006). The prevalence of OSA increases with age, obesity, and male gender (Gottlieb & Punjabi, 2020). Chronic untreated OSA has been linked to multiple comorbidities including cardiovascular and cerebrovascular morbidity, neuropsychiatric dysfunction, pulmonary hypertension, metabolic syndrome and type II diabetes (Chung et al., 2016).

Despite the significant adverse health effects of OSA, approximately 90% of people living with OSA remain undiagnosed (Chung et al., 2016). And in the perioperative environment, 81% of patients found to be high risk for OSA had no previous diagnosis of OSA (Seet et al., 2015). General anesthesia and sedation provide a unique opportunity to identify patients at risk for OSA, essentially the equivalent to a pharmacologically induced sleep study (Bohringer, 2019). However inadequate and/or inconsistent perioperative OSA screening and postoperative primary care (PCP) referral fails to provide a path for diagnosis and treatment for most of these patients.
Background of the Clinical Problem

Global

OSA affects close to 1 billion people globally, with the prevalence exceeding 50% in some countries (Benjafield et al., 2019). It is estimated that 936 million adults aged 30-69 are living with mild to moderate OSA, and 425 million of these adults have moderate to severe OSA. These numbers are likely to increase based on the close association of OSA with global obesity and increasing age. According to Benjafield et al. (2019), “the worldwide obesity epidemic and the ageing population demographic are likely to contribute to the rising global prevalence of OSA.” This trend was corroborated in a recent study from the UK reporting a highly significant increase in the rates of OSA between 1990-2010, closely linked to the increasing rates of obesity (Lechner et al., 2019). Equally concerning is the abysmal rate of OSA diagnosis as noted above, with up to 90% of people living with undiagnosed moderate to severe OSA (Chung et al., 2016).

National

In the US, 17.4% of women and 33.9% of men aged 30-70 years old have at least mild OSA (Gottlieb & Punjabi, 2020). And in accordance with trends seen globally, the prevalence of OSA increased by approximately 30% between 1990 and 2010, closely linked to the “epidemic trajectories” of obesity in the US (Peppard et al., 2013). Accordingly, the economic and health costs are immense. In 2015, the cost for diagnosis and treatment of OSA in the US was approximately $12.4 billion (Benjafield et al., 2019). It is further estimated that diagnosing and treating every person with OSA in
the US would save approximately $100 billion annually (Sullivan, 2016).

OSA-associated perioperative complications are significant, with OSA patients twice as likely to have perioperative cardiac and pulmonary complications (Subramani et al., 2017). This has resulted in recommendations from the American Society of Anesthesiologists and Society of Anesthesia and Sleep Medicine for patient risk stratification, screening, and optimization preoperatively (Corso et al., 2014) (Chung et al., 2016). However, preoperative diagnosis is limited by access to sleep specialists and the impracticality of sending every at-risk preoperative patient for a costly polysomnography (sleep study) (Barrows et al., 2020). Hence, the majority of these high risk OSA patients are presenting to surgery undiagnosed and untreated. Chung et al. (2016) estimated that up to 70% of surgical patients have OSA, with the majority of these patients undiagnosed.

Local

Data focused on OSA diagnostic rates in the local population are unavailable, however patients at high risk for OSA are increasingly common at the DNP Project site. This may be closely linked to the increasing prevalence of obesity in the local population. Overall, 62% of adults were overweight or obese in Washington state, with an increase in nearly 1% each year (Obesity in Washington State, 2009). These high risk patients are often presenting to surgery without a diagnosis of OSA and as described above, it is impractical to delay surgery for every patient with suspected OSA. This necessitates an investigation of alternative pathways for diagnosis and treatment. Perioperative anesthesia care is often the first opportunity to confirm high risk OSA and
provide a referral pathway for PCP evaluation, diagnosis, and treatment (Bohringer, 2019). However, at the DNP Project site perioperative screening and PCP referral is unvalidated and inconsistent. This presents a quality improvement opportunity to develop more effective screening and PCP referral pathways for patients with suspected OSA in the perioperative environment.

**Specific Aims**

The four aims of this project are to:

1. Determine provider confidence level with correctly administering the STOP-Bang questionnaire and following the standard postoperative PCP referral pathway.

2. Determine the feasibility of the 12-week evidence-based STOP Bang screening program by assessing provider compliance with administering the STOP-Bang questionnaire and proportion of patients with completed STOP-Bang score.

3. Determine the OSA risk stratification of adult surgical patients by measuring STOP-Bang scores reported by anesthesia provider during the 12-week evidence-based STOP-Bang screening program

4. Determine the effect of the 12-week evidence-based STOP-Bang screening program on postoperative PCP referral rates for moderate to high risk OSA patients
Evidence to Support Intervention

Best practice guidelines support standardized OSA risk stratification, screening, and preoperative optimization for surgical patients (Chung et al., 2016; Corso et al., 2014). However, in the absence of standardized screening and PCP referral pathway for patients with suspected OSA in the perioperative environment, the majority of high risk adult surgical patients are presenting to surgery undiagnosed and untreated (Chung et al., 2016).

Use of a validated screening tool is integral to perioperative OSA screening success. The STOP-Bang screening tool was developed in 2008 and originally validated for use in the surgical population (Chung et al., 2008; Nagappa, Wong, et al., 2015). In comparison with the STOP, Berlin, and Epworth sleepiness score (ESS) tools, the STOP-Bang questionnaire had the highest sensitivity to detect OSA in a surgical population (Bernhardt et al., 2021; Veugen et al., 2021). The STOP-Bang questionnaire consists of four subjective items (STOP: Snoring, Tiredness, Observed apnea and high blood Pressure) and four demographic items (Bang: BMI, age, neck circumference, gender) (Chung et al., 2008; Nagappa, Wong, et al., 2015).

An extensive review of the literature was conducted in September 2021 to assess the current evidence regarding utilization of the STOP-Bang screening tool for OSA in adult surgical patients, and the subsequent impact on postoperative referral to PCP for OSA evaluation, diagnosis, and treatment. Four major themes emerged from the review of studies: (1) STOP-Bang is a validated and reliable screening tool for OSA in the adult surgical population (Nagappa, Liao, et al., 2015); (2) At-risk OSA detection
is increased with the implementation of the STOP-Bang tool in preoperative screening (Dixon et al., 2016; Kertes, 2020b; Stubberud et al., 2019; Williams, 2017); (3) STOP-Bang screening tool standardized OSA screening (Bazemore et al., 2019b; Dixon et al., 2016); (4) Compliance with the tool is high (Bazemore et al., 2019b; Dixon et al., 2016; Stubberud et al., 2019). These central themes serve to outline and support the utility of the STOP-Bang screening tool as an integral part of perioperative OSA screening in adult surgical patients. Postoperative referral to PCP had limited measurement in this literature review, with only 1 study reporting a 38.8% postoperative referral rate to PCP for suspected OSA (Dixon et al., 2016).

Translation Framework

Knowledge transformation is integral to optimizing evidence-based practice (EBP), and translational frameworks are useful in this process to guide research into a definable foundation for nursing practice (White et al., 2021). The ACE Star Model of Knowledge Transformation is an example of a framework that “considers the nature of knowledge transformation necessary for utility and relevance in clinical decision making” (Stevens, 2004). This translation results in an efficient summary of all relevant research, enabling the practitioner to make clinical decisions based on evidence-based recommendations in the form of clinical practice guidelines (Stevens, 2004). The model consists of a five-point star relating to the five stages of knowledge transformation during EBP project implementation (Appendix A). The five stages, integral to implementing a change process, are (1) Discovery Research; (2) Evidence Summary; (3) Translation to Guidelines; (4) Practice Integration; (5) Process, Outcome Evaluation
The ACE Star model provides a useful framework for this EBP project focused on implementing an anesthesia-led obstructive sleep apnea (OSA) screening and referral program for adult surgical patients. Knowledge transformation for this project is based on implementing best-practice recommendations that are compiled from all available research and expertise, making the ACE Star Model the ideal framework for this EBP project.

The first step in the ACE Star Model is Discovery Research, resulting in a multitude of research studies linking undiagnosed OSA with significant healthcare cost, morbidity and mortality (Benjafield et al., 2019; Chung et al., 2016; Sullivan, 2016). Research further supports use of a validated OSA screening tool, specifically the STOP-Bang Questionnaire, in successful OSA identification, diagnosis and treatment (Nagappa, Wong, et al., 2015). In the project site, the discovery was the lack of a standardized screening tool utilized to screen for moderate to high risk OSA in adult surgical patients during the perioperative process, and a subsequent referral process to primary care provider for further evaluation and treatment (problem).

The second step is evidence summary. An Integrated Review completed in September 2021 (Figure 1) overwhelmingly supports use of a validated OSA screening tool for all adult surgical patients (Bazemore et al., 2019b; Dixon et al., 2016; Kertes, 2020b; Nagappa, Wong, et al., 2015; Stubberud et al., 2019; Williams, 2017). This is evidenced by the clinical practice recommendations from ASA and SASM for OSA risk stratification, screening, and optimization for all adult surgical patients preoperatively (target of intervention) (Chung et al., 2016; Corso et al., 2014). The evidence summary and national recommendations provide the basis for evidence-based clinical practice
guidelines, or Translation into Guidelines, the third step of the ACE Star Model.

The third step will focus on combining the research evidence and expertise to extend recommendations for practice. These recommendations entail following ASA and SASM guidelines by implementing a validated OSA screening tool, specifically the STOP-Bang Questionnaire, for all adult surgical patients (Nagappa, Wong, et al., 2015).

The fourth step of the ACE Star Model focuses on practice integration, ensuring that practice is aligned to reflect best evidence. Organizational actions include incorporating the STOP-Bang Questionnaire into the electronic medical record (EMR), providing efficient accessibility by anesthesia providers during the preoperative assessment. Individual actions entail provider education and support for correct utilization of the STOP-Bang Questionnaire and process for referral of at-risk patients to primary care for further evaluation and treatment. Key stakeholders include organizational perioperative leadership and anesthesia providers.

The fifth and final step of the ACE Star Model is the Outcome Evaluation of the knowledge transformation. Once the STOP-Bang Questionnaire is implemented based on best-practice guidelines, information will be collected to determine the provider compliance with the screening tool, patient risk stratification based on STOP-Bang scores, and effect on referral rates for moderate-high risk patients to PCP for further evaluation and treatment.

The ACE Star Model provides the ideal framework for transformation of best practice guidelines into clinical practice, and evaluation of the impact of the translation on healthcare outcomes.
Methods

Design

This project will utilize a pre-intervention, post-intervention design.

Setting

This project will be conducted at a small, 18-bed, urban hospital. Inpatient and outpatient surgical services are provided in 7 operating rooms on patients greater than 1 year old. Labor and Delivery, Transplant services, Cardio-Thoracic, and surgeries requiring postoperative ICU care are not performed at this facility. 5861 surgical cases were performed in 2021 and 271 cases were performed in January 2022 (Kaiser Permanente, 2022). The anesthesia care team consists of 16 Certified Registered Nurse Anesthetists (CRNAs) and 15 Anesthesiologists, operating under a medical supervision model with 1:3 supervision ratio of Anesthesiologists to CRNAs.

Sample

Two samples will be included in this project: (1) A convenience sample of participating anesthesia providers practicing at project site. (2) A convenience sample of all adult surgical patients aged 18 years or older without a preexisting diagnosis of OSA, scheduled to receive general anesthesia or monitored anesthesia care (MAC) for elective or emergent surgery, will be included in the project.
Sample Size

(1) Anesthesia provider size will be determined based on voluntary participation of anesthesia providers, currently 16 Certified Registered Nurse Anesthetists (CRNAs) providing anesthesia care at project site. (2) A sample size of 151 randomly selected adult surgical patients pre-intervention and 151 randomly selected adult surgical patients post-intervention will be targeted for the project. Power analysis confirmed statistically significant sample size utilizing G*Power (Faul et al., 2009). In addition, Stubberud et al. (2019) achieved statistical power with 100 patients pre-implementation and 100 patients post-implementation for a similar project on implementing preoperative STOP-Bang Screening for surgical patients aged 18-75. Williams (2017) also demonstrated statistical significance utilizing 100 pre-implementation patients and 100 post-implementation patients in an evidence-based practice project implementing the STOP-Bang Questionnaire into preoperative surgical screening.

Ethical Review Approval Plan

Ethical review approval for this quality improvement project has been obtained from The Johns Hopkins School of Nursing Project Ethical Review Committee and the Institutional Review Board at the project site.

Participant Recruitment

Anesthesia providers will be recruited based on voluntary participation. Patient participants will be recruited through a retrospective randomized chart review of 151
surgical patients 12-weeks pre-intervention and 151 surgical patients during the 12-week intervention (post-intervention).

**Intervention Procedures**

*Sequence and Timing*

The intervention will entail a 12-week project utilizing the STOP-Bang Questionnaire (Appendix B) to screen adult surgical patients scheduled to receive general anesthesia or monitored anesthesia care (MAC intravenous sedation). Patient STOP-Bang scores and provider observation of apneic events will be included in the referral to PCP for further evaluation and treatment (Appendix C). STOP-Bang Questionnaire and referral form will be integrated into the EPIC electronic medical record (EMR) for ease of completion.

Prior to the 12-week project, CRNAs scheduled to work at the project site will receive detailed instruction on patient inclusion parameters, STOP-Bang Questionnaire, as well as the postoperative referral process for patients tested and observed to be moderate to high risk for OSA. The instruction will be provided via a workflow diagram emailed to providers. A five-point Likert scale (Appendix D) will be administered to providers to assess post-instructional confidence level in the STOP-Bang screening and OSA referral process. Prior to this intervention, STOP-Bang screening and the OSA referral process were not a part of standard workflow at this clinical site. Accordingly, pre-intervention/educational provider confidence level could not be assessed.
During the 12-week project, anesthesia providers will complete the STOP-Bang questionnaire as part of the standard preoperative anesthesia evaluation. STOP-Bang scores will be entered into the EMR. Patients with scores placing them at moderate to high risk for OSA will be referred to PCP for further evaluation using the standard referral form. The anesthesia provider will also be able to note any witnessed periods of obstructive apnea in the referral form.

Patients will be informed postoperatively of their moderate to high risk status of OSA and resulting referral to PCP. Patients will be discharged with a printed OSA informational sheet (Appendix E).

**Data Collection and Instruments**

The STOP-Bang Questionnaire will be the instrument utilized to determine patient OSA risk. The STOP-Bang screening tool was developed in 2008 and originally validated for use in the surgical population (Nagappa, Wong, et al., 2015). In comparison with the STOP, Berlin, and Epworth sleepiness score (ESS) tools, the STOP-Bang questionnaire had the highest sensitivity to detect OSA in a surgical population (Bernhardt et al., 2021; Veugen et al., 2021). The STOP-Bang questionnaire consists of four subjective items (STOP: Snoring, Tiredness, Observed apnea and high blood Pressure) and four demographic items (Bang: BMI, age, neck circumference, gender) (Nagappa, Wong, et al., 2015). STOP-Bang scores of 0-2 represent low risk for OSA; Scores of 3-4 represent moderate risk for OSA; Scores of 5-8 represent high risk for OSA (Nagappa, Wong, et al., 2015). A systematic review and meta-analysis confirmed a STOP-Bang score of $\geq 3$ has a 91% sensitivity to detect OSA in the surgical
population, with the probability of moderate to severe OSA increasing with the STOP-Bang score (Nagappa, Wong, et al., 2015). The STOP-Bang screening questionnaire represents a validated, highly sensitive tool for detecting at-risk OSA in surgical patients. Institutional permission has been granted for use of the STOP-Bang questionnaire at the DNP Project site.

Data collection following the 12-week project period will be obtained through a randomized chart review of 151 patients pre-intervention and 151 patients post-intervention. Chart selection will be randomized through the EPIC EMR database, accounting for patient selection project criteria. Charts will be reviewed for STOP-Bang Questionnaire completion, Stop-Bang score, referral to PCP, and anesthesia provider of record. Information will be recorded on project spreadsheet stored on encrypted jh1 drive, without any patient identifiers. Charts will be numbered 1-151 (pre-intervention) and 151-302 (post-intervention). Data will be used to measure project outcomes per the stated project aims: (1) Determine provider confidence level with correctly administering STOP-Bang questionnaire and following standard postoperative PCP referral pathway. (2) Determine provider compliance with administering the STOP-Bang Questionnaire; (3) Determine OSA risk stratification of adult surgical patients by measuring STOP-Bang scores; (4) Determine effect of STOP-Bang screening program on postoperative PCP referral rates for at-risk OSA patients. DNP student project coordinator will perform chart review and enter data on project spreadsheet to enable subsequent statistical comparison of pre and post-intervention variables.
Data Analysis Plan

Data related to each project-specific aim will be analyzed using SPSS version 25.

**Aim 1:** Determine provider confidence level with correctly administering STOP-Bang questionnaire and following standard postoperative PCP referral pathway post-educational intervention

**Analysis:** Five point Likert scale questionnaire will be administered to every participating anesthesia provider upon completion of instructional intervention. Likert scale responses will assess provider confidence level with correctly administering the STOP-Bang questionnaire and following the OSA post-operative referral process. Scores will range from 1 = not at all confident to 5 = extremely confident. Descriptive statistics will be utilized to analyze provider confidence post-educational intervention.

**Aim 2:** Determine the feasibility of the 12-week evidence-based STOP Bang screening program by assessing provider compliance with administering the STOP-Bang questionnaire and completed preoperative STOP-Bang score.

**Analysis:** Completed STOP-Bang score and anesthesia provider completing STOP-Bang questionnaire will be recorded pre and post-intervention through patient chart review. Descriptive statistics will be utilized to analyze percentage of anesthesia providers completing STOP-Bang questionnaire. To assess mean difference in patient STOP-Bang completion, I will use a pre and post group design with a dependent variable (STOP-Bang completion) that is categorical (Y/N) and a sample size of 151 pre-intervention and 151 post-intervention (302 total patient charts). Therefore, this aim will be analyzed using a Chi-square test. I will report the p-value to determine statistical
significance and the percentages to interpret the direction of the relationship. The null hypothesis would be there is no difference between pre and post-intervention completion of a patient STOP-Bang score.

**Aim 3: Determine the OSA risk stratification of adult surgical patients by measuring STOP-Bang scores reported by anesthesia provider during the 12-week evidence-based STOP-Bang screening program**

**Analysis:** STOP-Bang scores will be recorded pre and post-intervention through patient chart review. Descriptive statistics will be utilized to determine mean patient STOP-Bang score allowing for patient OSA risk stratification. STOP-Bang scores 0-2 (low risk), 3-4 (moderate risk), 5-8 (high risk).

**Aim 4: Determine the effect of the 12-week evidence-based STOP-Bang screening program on postoperative PCP referral rates for moderate to high risk OSA patients.**

**Analysis:** Postoperative PCP referral for moderate to high risk OSA patients will be recorded pre and post-intervention through patient chart review. To assess mean difference in PCP referral rates, I will use a pre and post group design with a dependent variable (PCP referral) that is categorical (Y/N) and a sample size of 151 pre-intervention and 151 post-intervention (302 total patient charts). Therefore, this aim will be analyzed using a Chi-square test. I will report the p-value to determine statistical significance and the percentages to interpret the direction of the relationship. The null hypothesis would be there is no difference between pre and post-intervention postoperative referral rates.
Discussion and Results

Undiagnosed OSA represents a widespread public health concern, associated with significant comorbidity and healthcare cost (Benjafield et al., 2019; Chung et al., 2016; Peppard et al., 2013; Sullivan, 2016). In the perioperative environment, patients with OSA are twice as likely to have cardiac and pulmonary complications, resulting in recommendations from the American Society of Anesthesiologists and Society of Anesthesia and Sleep Medicine for patient risk stratification, screening, and optimization preoperatively (Chung et al., 2016; Corso et al., 2014; Subramani et al., 2017). Standardized OSA screening programs have been shown to increase overall screening rates by health care providers (Bazemore et al., 2019b). However inadequate and/or inconsistent perioperative OSA screening and postoperative primary care (PCP) referral at the project site failed to provide a path for diagnosis and treatment for most of these patients. The purpose of this quality improvement project was to address this lack of standardization by introducing a standardized OSA screening and referral pathway for adult surgical patients utilizing the STOP-Bang questionnaire and a PCP referral form incorporated into the EMR.

This project evaluated both provider confidence and compliance, as well as patient-related outcomes with the standardized OSA screening and referral pathway. Providers reported an 18.9 (out of 20) confidence score with implementing the screening and referral pathway and had a 93.8% compliance rate with completing the STOP-Bang questionnaire. 0% of patients had a completed STOP-Band score and/or post-operative PCP referral form at baseline. Post-intervention, 65.6% of adult surgical
patients had a completed STOP-Bang score and 88.9% of high-risk OSA patients with a STOP-Bang score of ≥ 5-6 were referred to their PCP for further evaluation and treatment. These findings are consistent with existing literature, which has shown at least a 66% provider compliance rate for STOP-Bang completion based on ease of use and provider acceptance of the efficacy of the screening tool (Bazemore et al., 2019a; Stubberud et al., 2019). In addition, the literature has shown at least a 25% increase in OSA detection rate with implementation of preoperative STOP-Bang screening (Dixon et al., 2016; Kertes, 2020a; Stubberud et al., 2019; Williams, 2017). The results of this quality improvement project highlight the significant improvement in OSA detection and referral for further treatment utilizing this standardized OSA screening pathway, as well as the high provider compliance with the STOP-Bang tool.

Additional results provide an OSA risk stratification for the population sample. 99 adult surgical patients (65.6%) had a completed STOP-Bang score, with a mean of 3.7, SD 1.1. This places the sample patient population at moderate risk for OSA. A total of 67 patients (68%) had a STOP-Bang score of 3-4 (moderate risk) and a total of 18 patients (18%) had a STOP-Bang score of 5-6 (high risk). This is consistent with the literature estimates of up to 70% of surgical patients at risk for OSA (Chung et al., 2016). In addition, this information can be utilized for perioperative planning and guideline development to optimize care for this patient population at increasing risk for OSA.

As stated above, 18 total patients scored 5-8 (high risk) for OSA on the STOP-Bang questionnaire, of which 16 patients received a PCP referral (88.9%). However, no patients scoring 3-4 (moderate risk) were referred to PCP. This difference may be
explained by individual anesthesia provider assessment of OSA risk, reserving PCP referral for high risk patients to conserve institutional resources and limit unnecessary referrals.

Project limitations include the condensed project timeframe, single institution study, as well as the lack of a mandatory STOP-Bang screening requirement at the project site. Mandatory OSA screening incorporated into the EMR has been shown to maximize provider compliance and patient screening to 100% (Dixon et al., 2016). Evaluating the results of implementing mandatory STOP-Bang screening into the EMR at multiple sites over a longer time period would be warranted to improve the clinical utility and applicability of project results.

Implications of this project highlight the value of a standardized OSA screening and referral pathway for moderate to high risk adult surgical patients. Increasing diagnosis and treatment of OSA, as well as providing OSA risk stratification of the adult surgical patient population provides a basis for implementing evidence-based protocols for management of patients at risk for OSA and may reduce perioperative complications for this patient population.

Conclusion

Inadequate and/or inconsistent perioperative OSA screening and PCP referral often fails to provide a path for diagnosis and treatment for at-risk OSA patients. The introduction of an OSA screening and referral program utilizing the STOP-Bang questionnaire and a standardized PCP referral form resulted in a significant
improvement in adult surgical patient OSA screening and PCP referral for high-risk patients. Anesthesia provider compliance with the program was high, further showcasing program feasibility. These results highlight the need for a standardized screening program for at-risk OSA patients in not only addressing the gap in OSA screening, but in providing a pathway for diagnosis and treatment.

**Dissemination Plan**

*Study site:* Written results are provided to key stakeholders at the project site institution (Perioperative Services leadership, Department of Anesthesiology leadership, anesthesia providers, perioperative nursing staff). Findings are presented at a meeting of the monthly Anesthesiology Morbidity and Mortality conference and at a quarterly Perioperative educational in-service.

*Conference:* Findings are presented at Washington State Association of Nurse Anesthetists (WANA) biennial conference, as well as American Association of Nurse Anesthesiologists (AANA) yearly conference. Advocacy for anesthesia involvement in OSA screening and referral programs.

*Journal:* Submit findings for publishing in the AANA Journal and Journal of Clinical Sleep Medicine to advocate for anesthesia involvement in OSA screening and referral programs.
Sustainability Plan

Short and long-term goals: (1) 100% OSA screening rate for adult surgical patients utilizing the STOP-Bang questionnaire. (2) 100% PCP referral rate for high-risk OSA adult surgical patients. (3) Guideline development for moderate risk OSA adult surgical patient PCP referral. (4) Quarterly reporting of key metrics associated with at-risk OSA adult surgical patients (risk stratification (STOP-Bang score), PCP referral rates, OSA diagnosis rates, and moderate-high risk patient demographics)

Plan:

Upon conclusion of study project: Evaluation of project findings and presentation/dissemination to key organizational stakeholders. Communication with stakeholders to reach consensus on ongoing project utility and/or changes to standardized OSA screening and referral program. Project changes/optimization suggestions include: (1) implementation of mandatory OSA screening for all adult surgical patients, (2) hybrid standardized program involving preoperative screening by RN and post-operative PCP referral by anesthesia provider.

Ongoing (Quarterly): Department reporting of aggregate adult surgical patient OSA risk-stratification (STOP-Bang scores), PCP referral rate, OSA diagnosis rate obtained through Sleep Medicine, and aggregate patient demographics of moderate-high risk OSA patients. The reported data will be utilized to assess outcomes of project changes and provide ongoing feedback for program optimization.
References


https://doi.org/10.1097/00000542-200605000-00026


Lechner, M., Breeze, C. E., Ohayon, M. M., & Kotecha, B. (2019). Snoring and breathing pauses during sleep: interview survey of a United Kingdom population sample reveals a significant increase in the rates of sleep apnoea and obesity over the last 20 years - data from the UK sleep survey. *Sleep Med, 54*, 250-256. https://doi.org/10.1016/j.sleep.2018.08.029


https://doi.org/10.1093/aje/kws342
https://doi.org/10.11622/smedj.2015034


https://doi.org/10.1016/j.jsmc.2016.10.003


https://doi.org/10.1007/s11325-020-02219-6


https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=rzh&AN=121128722&site=ehost-live&scope=site&authtype=ip,shib&custid=s3555202
Appendix A: ACE Star Model of Knowledge Transformation

ACE Star Model of Knowledge Transformation for Obstructive Sleep Apnea Screening and Referral for Adult Surgical Patients

Evaluate: (1) provider compliance with tool, (2) Patient OSA risk stratification, (3) Referral rates

Process, Outcome Evaluation

Evidence Summary

(1) Incorporating STOP-Bang Questionnaire into EMR; (2) Provider education and support for screening and referral process; Organizational Support

Practice Integration

ovidens
Appendix B: STOP-Bang Questionnaire Integrated Into EMR
Appendix C: Standard Referral Form

(Primary Care Provider Name),

Mr./Mrs. (Patient Name) underwent a (Procedure Name) at (Hospital Name) on (Date of Procedure). I completed a preoperative STOP-Bang Questionnaire which resulted in a score of (STOP-Bang Score). This places the patient at (Moderate or High) risk for obstructive sleep apnea. In addition, obstructive apneic events were witnessed intraoperatively during the course of anesthesia care. I highly recommend further evaluation for OSA, and potentially a referral to the Sleep Clinic for a polysomnography.

Thank you for your continued care of Mr./Mrs. (Patient),

(Anesthesia Provider, Credentials)
Department of Anesthesia and Perioperative Services
(Hospital Name)

STOP-Bang Score Reference:

Low Risk for OSA: 0-2
Moderate Risk for OSA: 3-4
High Risk for OSA: 5-8
Or Yes to 2 of 4 STOP Questions + Male gender
Or Yes to 2 or 4 STOP questions + BMI ≥ 35 kg/m2
Or Yes to 2 or more of 4 STOP questions + neck circumference (17”/43cm in male, 16”/41cm in female)
Appendix D: Anesthesia Provider Post-Educational Assessment

STOP-Bang Obstructive Sleep Apnea Screening and Postoperative Primary Care Referral Process

1. Describe your confidence level with accessing the STOP-Bang Questionnaire in EPIC
   - Extremely Confident
   - Very Confident
   - Somewhat confident
   - Not so confident
   - Not at all confident

2. Describe your confidence level with completing the STOP-Bang Questionnaire in EPIC
   - Extremely Confident
   - Very Confident
   - Somewhat confident
   - Not so confident
   - Not at all confident

3. Describe your confidence level with completing the postoperative PCP referral form in EPIC
   (ANESOSA)
   - Extremely Confident
   - Very Confident
   - Somewhat confident
   - Not so confident
   - Not at all confident

4. Describe your confidence level with recognizing OSA risk factors through patient assessment and
   airway management
   - Extremely Confident
   - Very Confident
   - Somewhat confident
   - Not so confident
   - Not at all confident
Appendix E: Obstructive Sleep Apnea Patient Educational Material

What are the symptoms?
- Adaptive servo ventilation (ASV). It senses pauses in breathing and adjusts air pressure. It’s mostly used for central sleep apnea.
How can you care for yourself at home?

- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 

Credits for Learning About Sleep Apnea

healthwise