Decreasing the Risk for Postoperative Pulmonary Complications from Obstructive Sleep Apnea by Utilizing the STOP-Bang Questionnaire

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Abstract

Obstructive sleep apnea is a medical condition affecting up to 26% of the general population and is the most common sleep disorder that practitioners will encounter. Patients presenting for a surgical procedure with obstructive sleep apnea, diagnosed or undiagnosed, have an increased risk for multiple perioperative complications. The purpose of this quasi-experimental study was to determine the impact of evidence based perioperative management with short-acting narcotics on decreasing the postoperative respiratory complications in patients screening at risk for obstructive sleep apnea. This study was implemented at a small community hospital in the Midwest over a four-month period on 47 patients. The evidence-based interventions were implementation of the preoperative screening tool for obstructive sleep apnea and utilization of short-acting narcotics in patients undergoing general anesthesia who screened at risk for obstructive sleep apnea. Outcomes measured included postoperative respiratory complications and unplanned intensive care unit admissions. The results of this study showed that at-risk patients for obstructive sleep apnea who received evidence based management interventions had a lower incidence rate of respiratory complications as well as intensive care unit admissions as compared to published findings. Through the use of evidence-based practice of screening and management of obstructive sleep apnea, quality of care may be enhanced for surgical patients at risk for complications from obstructive sleep apnea.

Keywords: obstructive sleep apnea, postoperative, respiratory, STOP-Bang, screening

Decreasing the Risk for Postoperative Pulmonary Complications from Obstructive Sleep Apnea by Utilizing the STOP-Bang Questionnaire

Obstructive sleep apnea (OSA) is a medical condition affecting up to 26% of the general population (Chung et al., 2012) and is the most common sleep disorder that practitioners will encounter (Xie, Pan, Ren, Du, & Guo, 2013). It is a common medical condition with adverse health consequences including an increased risk for hypertension, coronary vascular disease, congestive heart failure, cerebrovascular disease, and glucose intolerance (Hiestand, Britz, Goldman, & Phillips, 2006). An estimated 80% of patients with OSA are undiagnosed (Adesanya, 2010). Untreated OSA can cause cognitive impairment leading to daytime somnolence, loss of work productivity, and increased risk of automobile collisions (Heistand et al., 2006; see Appendix A, Table 2).

Significance

The prevalence of OSA in the surgical population ranges from 4.7% (Chung, Yuan, & Chung, 2008) to 80% (Memtsoudis et al., 2013). An estimated 70% of patients who have OSA present to the surgical suite undiagnosed (Adesanya, 2010; Chung et al., 2008). These patients may be more vulnerable to the effects of sedation, anesthesia, and analgesia throughout the perioperative period (S. A. Chung et al., 2008; Shafazand, 2009). A study by K. Hansen (2012) found that one patient with postoperative respiratory complications resulted in an extra cost of $17.252.

Local Issue

The American Society of Anesthesiologists (ASA) task force on perioperative management of patients with OSA established practice guidelines in 2005 for the perioperative care of patients with OSA (Gross et al., 2006) with an updated version released in 2014 (Gross et

al., 2014). At the 25-bed critical access hospital, the utilization and implementation of these practice guidelines had not been placed into effect. Due to the lack of implementation of the ASA guidelines, there was the possibility that a health disparity existed for patients with OSA.

Diversity

Obstructive sleep apnea has a prevalence ranging between 5-9% of the population (Vasu, Grewal, & Doghramji, 2012). Males are affected more than females and the prevalence of OSA in the surgical population is higher than the general population and varies with surgery types (Kapur, 2010). The pathogenesis of OSA is multifactorial, and it is likely that there is different underlying pathophysiology between ethnic groups due to contributions of craniofacial factors (Sutherland, Lee, & Cistulli, 2012).

Problem and Purpose

Problem Statement

Obstructive sleep apnea is independently implicated in increased perioperative morbidity and mortality (Adesanya, 2010). Patients with OSA, diagnosed or undiagnosed, presenting for a surgical procedure have an increased risk for multiple perioperative complications. Complications include higher reintubation rates, hypercapnia, oxygen desaturation, cardiac arrhythmias, myocardial injury, delirium, unplanned intensive care unit admissions, and longer hospital stays (Adesanya, 2010; Kaw, 2012).

Purpose Statement

The purpose of this study was to determine the impact of utilizing recommendations by the American Society of Anesthesiologists task force addressing perioperative management of patients with OSA, related to short-acting narcotics, on diminishing the rate of postoperative respiratory complications in patients at risk for OSA. The incidence of postoperative respiratory

complications were compared to the published incidence to determine if the utilization of short-acting narcotics on patients at risk for OSA decreased respiratory complications. Research has shown that there is a gap in evidence-based care provided to OSA patients due to lack of identification of those who are at an increased risk for perioperative complications due to OSA. This study determined if the quality of care of these patients was improved by utilizing the evidence on short-acting narcotics to decrease postoperative pulmonary complications in patients at risk for OSA.

Facilitators

The major facilitators for this study were the preoperative registered nurses who were responsible for performing the screening for OSA risk with the STOP-Bang questionnaire (see Appendix B) and accurately documenting the results. Another facilitator was the postoperative registered nurse who was in charge of appropriate documentation. The anesthesia provider and director of surgery were also key contributors as their input, cooperation, and working as champions for the study encouraged the perioperative personnel to appropriately perform the screening and documentation. The anesthesia provider administered the intraoperative narcotics and was essential in assuring that the at-risk patients received only short-acting narcotics.

Barriers

A major challenge with this study was buy-in from the personnel who were performing the assessments and documentation. Participation from all perioperative staff members and continued support from management was addressed prior to the study through staff meetings and collaboration with the perioperative team. Continued support from the researcher and managers to encourage appropriate screening techniques and accurate documentation was central to overcoming this barrier.

Review of Evidence

PICOT

In patients presenting for general anesthesia who screen at risk for obstructive sleep apnea, does the utilization of short-acting narcotics versus long-acting narcotics decrease the incidence of postoperative pulmonary complications as compared to published incidence rates?

Search Strategies

A systematic review of literature utilized the key words OSA, perioperative, and screening. The databases included your journals@Ovid, journals@Ovid full text, Cochrane Database of Systematic Reviews, the American College of Physicians Journal Club, the Cochrane Central Register of Controlled Trials, the Cochrane Methodology Register, Health Technology Assessment, the NHS Economic Evaluation, as well as Healthstar and MEDLINE. The search was limited to the previous five years, 2010-2015 and to English print only.

The initial results of the search revealed 20,292 articles on OSA, perioperative 142,258, and screening 612,634. Limiting the literature search to five years was the first step to avoid reviewing outdated material. Next, each individual search was combined to determine literature containing all three key words resulting in 324 articles. Of these, 269 were excluded based on a title review. The remaining 55 were evaluated based on the inclusion and exclusion criteria.

The inclusion criteria for the literature review content were perioperative screening tool for OSA, statistics related to the prevalence of OSA, perioperative complications related to OSA, randomized controlled trials, cohort studies, and opinion statements. Letters to the editor were excluded in this literature review. The result was 38 articles reviewed and used as evidence for this study. Included was one meta analysis, two systematic reviews of literature, one prospective randomized controlled trial, four prospective cross sectional, two prospective cohort, one

prospective observational, six retrospective cohort, one matched cohort study, one clinical practice guideline, and one critical appraisal.

Synthesis of Evidence

The literature review provided a range of information about OSA and utilization of the perioperative screening tool as well as practice guidelines and approaches that may allow the provision of a higher quality of care for OSA patients (see Appendix A, Table 3). The most recent consensus statement published by the Society for Ambulatory Anesthesia in 2012 was the result of a systematic review of literature on adult OSA patients presenting for ambulatory surgery (Joshi, Ankichetty, Gan, & Chung, 2012). The results of the review found that the STOP-Bang screening questionnaire is useful due to high sensitivity of 93% and simplicity of use (Joshi et al., 2012; Seet & Chung, 2010). Setaro (2012) also noted a gap in the consistency of care provided to OSA patients in the perioperative area was identified.

Polysomnography (PSG) is the gold standard for OSA diagnosis (Chung et al., 2008a; Gali, Whalen, Schroeder, Gay, & Plevak, 2009), but due to the inability to utilize it as an efficient and cost effective resource, the use of a more simplistic effective alternative preoperative screening tool to identify patients who are likely to develop postoperative complications related to OSA is indicated in healthcare practice (Chung et al., 2008a; Chung et al., 2008b). Validation of the use of this questionnaire was completed by Chung et al. (2008a) with a study of 1,875 patients utilizing the STOP-Bang questionnaire and comparing it to a PSG. Recommendations exist for utilization of a preoperative screening tool to identify patients with OSA prior to surgery (Adesanya, 2010; Chung & Elsaid, 2009; Gali et al., 2009; Seet & Chung, 2010; Shafazand, 2009).

Obstructive Sleep Apnea Risk in the Perioperative Patient

Implementation of a screening tool may be useful in identifying the perioperative patients who may present to surgery with undiagnosed OSA and untreated OSA. In a recent study performed at Loyola University Medical Center in Maywood, Illinois, 367 patients presenting for outpatient surgery underwent prospective screening to determine risk for OSA utilizing the STOP-Bang questionnaire (Kulkarni, Horst, Eberhardt, Kumar, & Sarker, 2014). The study showed a prevalence rate of 64.3%, which is higher than the general population. Similar results were obtained by Agrawal, Gupta, Lahan Mastafa, & Kaur (2013) in evaluating the STOP-Bang tool and showed a high prevalence of OSA in the surgical patient.

A systematic review of literature was performed to discuss the importance of identifying the patients at risk for OSA in the perioperative setting (Vasu et al., 2012). It was determined that OSA screening questionnaires are easy to administer preoperatively and have been shown to identify patients at high risk for OSA. The authors also addressed the clinical significance of identifying OSA patients preoperatively so that perioperative care is appropriate and the best quality outcome is achieved.

A study was performed to determine how often a surgeon and anesthesia provider missed the diagnosis of a patient with OSA in the preoperative area (Singh et al., 2013). The research found that the surgeon did not diagnose moderate OSA in 93% of patients and severe OSA in 90% of patients while the anesthesia provider missed the diagnosis of moderate OSA in 65% of patients and severe OSA in 53% of patients. It is possible to decrease the amount of unrecognized OSA by implementing a screening tool in the perioperative area (Singh et al., 2013).

The need for routine preoperative screening was also evaluated in a retrospective cohort study performed on 882 morbidly obese patients undergoing either bariatric surgery or a total

joint replacement (Nepomnayshy et al., 2013). The conclusion statement noted that there may be no clinical relevance in the routine preoperative screening for undiagnosed OSA in the morbidly obese patient. However, Nepomnayshy et al. noted that a limitation to the study was that the postoperative care was not standardized so the results may be inaccurate and further investigation is needed.

Validity, Reliability of the STOP-Bang Questionnaire

To utilize the STOP-Bang questionnaire as an appropriate tool for screening in the perioperative period, the tool should be valid and reliable. In the study performed at Loyola University Medical Center, 237 out of 371 patients screened were determined as high risk for OSA while only 49 actually underwent PSG testing to determine the validity of the STOP-Bang questionnaire (Kulkarni et al., 2014). The positive predictive value of the questionnaire was found to be 76% and the sensitivity was 92%. The validity results are echoed in a study performed at the preoperative clinics of Toronto Western Hospital and Mount Sinai Hospital where it was found that an increase in score from three to seven or eight resulted in the increased predictive probabilities from 0.36 to 0.60 (Chung et al., 2012). Chung et al. (2012) noted that the STOP-Bang questionnaire is useful due to high sensitivity for scores of three or greater but that it leads to a high rate of false positives. In another study by Chung, Yang, & Liao (2013), 667 patients were screened utilizing the STOP-Bang questionnaire and then underwent PSG to determine the predictive performance of the questionnaire.

A critical appraisal including 11 clinical studies and two evidence based guidelines was performed to evaluate the clinical utility of the STOP-Bang questionnaire for screening (*Canadian Agency for Drugs and Technologies in Health,* 2014). The appraisal concluded that the STOP-Bang questionnaire may be an appropriate method for screening the surgical patient

for OSA. These results reiterate the outcome of the study by El-Sayed (2012) which found that the STOP-Bang questionnaire is appropriate to utilize due to ease of use and high sensitivity.

Another study was performed to evaluate the predictive performance of alternate STOP-Bang models (Chung, Yang, Brown, & Liao, 2014). The conclusion of this study was that not all items on the STOP-Bang questionnaire hold the same predictive weight, meaning that some are more important than others in determining OSA in the perioperative patient. For ease of use, however, each item on the questionnaire should remain equal in predictive value (Chung et al., 2014). This screening tool was further validated in a retrospective cohort analysis of 49 patients undergoing bariatric surgery (Khodabandeh et al., 2012) showing a high sensitivity to detect OSA in bariatric surgery patients.

Part of the scoring system for the STOP-Bang questionnaire includes a measure of neck circumference and body mass index (BMI) (Ravesloot, van Maanen, Hilgevoord, Van Wagensveld, & De Vries, 2012). A prospective observational study was performed to determine if increased neck circumference, increased BMI, or increased Epworth Sleepiness Scale (ESS) are independent predictors of OSA (Ravesloot et al., 2012). Each parameter on the STOP-Bang questionnaire does not hold the same predictive value (Chung et al., 2014; Ravesloot et al., 2012).

A professional opinion is that the patient needs to be identified as at risk for OSA prior to surgery and then to undergo PSG for confirmation (Chong et al., 2013). A retrospective cohort study was performed to assess whether obtaining the PSG in patients who screened at high risk for OSA utilizing the STOP-Bang questionnaire decreased the postoperative complication rate (Chong et al., 2013). The findings showed no significant difference in the cardiac, respiratory, or

neurologic complications between the patients who had the STOP-Bang screening versus those that also underwent PSG for diagnosis.

Complications and Outcomes

Several studies discussed the multitude of perioperative complications associated with OSA (Adesanya, 2010; Gali et al., 2009; Shafazand, 2009). With appropriate assessment of the patient preoperatively utilizing the STOP-Bang questionnaire and an educational process that increases staff health literacy about the disease process and postoperative complications, the health disparity that is currently present for the OSA patient will be overcome (Setaro, 2012). Utilizing a retrospective cohort study, 180 patients undergoing elective surgery were evaluated to determine if a higher score on the STOP-Bang questionnaire correlated with a higher incidence of postoperative complications (Vasu et al., 2010). Statistical analysis found that a higher STOP-Bang score was associated with an increased risk of postoperative complications. A summary review of multiple studies was performed (*Canadian Agency for Drugs and Technologies in Health,* 2014). A score of greater than three on the STOP-Bang questionnaire was associated with an increased risk of post-operative cardiovascular and pulmonary complications.

One of the complications associated with OSA in the perioperative patient includes an increase in intensive care unit admissions (Chia, Seet, Macachor, Iyer, & Wu, 2013). A retrospective cohort study of 5342 patients scheduled for elective surgery was completed with a multivariate analysis performed (Chia et al., 2013). The results of the study showed that patients with higher STOP-Bang scores had a higher rate of critical care admissions postoperatively.

Guidelines and Treatment

A 12-member task force evaluated randomized controlled trials, non-randomized controlled trials, and a large-scale survey of anesthesiologists to develop a consensus statement on the identification and management of the perioperative patient with OSA (Gross et al., 2014). The agreement was that the perioperative patient should be screened for OSA and the surgeon and anesthesia provider, as well as a discussion with the patient, should address options for management of the patient during the perioperative period. Avoiding the use of long-acting medications is preferred in OSA patients as long-acting narcotic respiratory depressant effects will persist into the postoperative setting (Kaw, 2012). A consensus statement was also released specifically regarding the perioperative patient in the outpatient surgical environment (Joshi et al., 2012). The reviewers concluded that the STOP-Bang questionnaire was the preferred screening tool due to ease of use.

The use of auto-titrated positive airway pressure (APAP) is thought to decrease the postoperative apnea-hypopnea index (AHI) and improve oxygenation in patients with moderate to severe OSA (Liao et al., 2013). A randomized controlled trial was performed on 177 patients who were high risk for OSA or who had untreated OSA (Liao et al., 2013). The results found that perioperative APAP treatment effectively reduces AHI and improves oxygenation in patients with moderate to severe OSA.

Theory

Kurt Lewins' theory of planned change was first published in 1951 (McEwen & Wills, 2011). An expanded version of this theory known as the eight-step plan for implementing change was published by John P. Kotter in 1995 (McEwen & Wills, 2011). This study emphasized a process of planned change in the implementation of a preoperative screening tool for the identification of patients at risk for OSA (see Appendix A, Diagram 1). Kotters' eight-

step plan for implementing change is a predictive theory as the utilization assists the researcher in anticipating that a particular outcome will occur if specific change steps are followed (McEwen & Wills, 2011).

Methods

Institutional Review Board Approval

The institutional review board (IRB) was the University of Missouri, Kansas City IRB. The primary contact person at the clinical site was the director of nursing of Girard Medical Center in Girard, Kansas. Site agreement for conducting the study at the site was obtained.

Ethical Considerations

One of the major research ethics was the protection of human subjects. By acknowledging that patients may be at an increased risk of postoperative complications due to possible OSA, the investigator and participants made a decision to utilize this information to possibly change the course of their perioperative care. Protection of patient privacy during the data collection and sharing of information was also an ethical aspect of this study.. The current study can also be viewed as an evidence-based quality improvement study as an implementation of standard of care practices.

Funding and Costs

Direct costs. The benefit to cost ratio is a factor to consider when implementing new change into an institution. A 30-minute educational conference cost was approximately $163.30 in total. Education of the four anesthesia providers cost approximately $200.00. Another direct cost was the paper for the screening questionnaire which totaled approximately $1.60 (see Appendix A, Table 1).

Indirect costs. An indirect cost was the administrative cost of contacting personnel to inform them of the educational meeting. Administrative cost was also incurred while scheduling an appropriate time and place for this education session.

Funding. The hospital incurred the costs of the study in anticipation of an economic gain after the implementation of the clinical practice guidelines for the care of OSA patients in the perioperative area.

Setting

The evidence-based practice study was implemented at a small community hospital in the Midwest, specifically in the perioperative area. The medical center is a small community hospital in southeast Kansas that performs an average of 800 surgeries per year (Peterson, personal communication, April 5, 2015). There is one full-time certified registered nurse anesthetist (CRNA) employed with three other CRNAs that work on an as-needed basis.

Participants

The participants for the study were patients requiring general anesthesia over a five-month period. Inclusion criteria were patients over the age of 18 who received general anesthesia for any surgical procedure and screened at risk for OSA. Exclusion criteria included any patient experiencing a respiratory crisis preoperatively or a recent cough/cold, current pulmonary embolism, or pneumonia. The number of patients who met the inclusion criteria over the five-month period was 47. Recruitment occurred on the day of surgery and the patients were screened on the same day.

Evidence Based Practice Intervention and Implementation

The first evidence-based intervention was implementation of the preoperative screening tool for OSA (see Appendix A, Diagram 3). The STOP-Bang questionnaire identified patients

who were at a higher risk of postoperative complications due to the possibility of OSA. The initial step of the intervention process involved educating the perioperative staff about the complications associated with the OSA patient in the perioperative period. The education was provided by the student investigator and was performed in one 30-minute session prior to implementation of the STOP-Bang questionnaire. The perioperative staff then administered the STOP-Bang questionnaire to all patients presenting for general anesthesia over the four-month period.

The second evidence-based intervention was for the anesthesia provider to administer only short-acting narcotics to the patients who screen at risk for OSA. The incidence of postoperative respiratory complications was compared to published outcomes for OSA patients in the perioperative period who received screening. This comparison was analyzed to determine if the patients at the study site had a lower or similar incidence rate of postoperative pulmonary complications than the published incidence rates.

Change Process and EBP Model

John P. Kotters' eight-step plan for implementing change was used in this study (McEwen & Wills, 2011). The steps are associated with detailed directions on how to utilize them for change (McEwen & Wills, 2011). The Iowa model of evidence based practice (EBP) was mentioned by Lakdawala (2011) and was discussed in relation to implementing a quality improvement initiative to promote EBP for perioperative nurses to screen patients for OSA. This practice theory and model was originally published by M. G, Titler et al. (1994) with the purpose of guiding practitioners in the use of evidence to improve health care outcomes (Titler, 2010). A component of the model is sustainability of the evidence based practice change.

Study Design

The purpose of this quasi-experimental study, utilizing a post measurement only with the intervention group and published findings as control group, was to determine if utilizing only short-acting narcotics in patients at risk for OSA undergoing general anesthesia diminished the rate of postoperative respiratory complications. The outcome data was compared to published outcome data on postoperative respiratory complications as related to OSA. This study collected data on postoperative respiratory outcomes in the perioperative setting of all patients that screened at risk for obstructive sleep apnea undergoing general anesthesia (see appendix A, Diagram 2 for Logic Model).

Internal Validity

Internal validity was supported through the use of published outcomes from previous studies on OSA patients. This data served as a control measure to compare outcomes of the incidence rate of postoperative complications from this study. Providing evidence based standardized education on outcomes and complications to assess, implementing the STOP-Bang questionnaire, and accurate documentation supported internal validity.

External Validity

To maintain external validity, transparency of the study design and data collection was imperative. By including all patients over the age of 18 who present for general anesthesia, the patient population was varied and can be generalized to larger surgical populations. The study took place at a small community hospital, and there was the possibility that the external validity of the participants may be questioned due to the type or acuity of patients who present to surgery at the study facility.

Outcomes

The evidence based practice outcome measured was the postoperative pulmonary complications of patients who screen at high risk for OSA. The outcomes specifically identified were postoperative hypoxemia which was defined as oxygen saturation of < 90%, postoperative use of bi-level positive airway pressure (BIPAP) or continuous positive airway pressure (CPAP) devices, re-intubation following surgery occurring in the PACU and acute respiratory failure which is ventilator use for greater than 24 hours postoperatively. Unplanned intensive care unit admissions were also measured.

Measurement Instrument

The tool used to determine if patients are at a high risk for OSA was the STOP-Bang questionnaire. This tool has been utilized and validated by multiple studies to identify patients at risk for OSA and verified by utilizing the gold standard of OSA diagnosis which is the PSG (Chung et al., 2012). It has the highest methodological validity, reasonable accuracy, and ease of use (Abrishami, Khajehdehi, & Chung, 2010). Permission was obtained to use this screening tool from Chung.

Data Quality

The level of the quality of the data collected for this study depended on many factors. In answering the questions on the STOP-Bang questionnaire, the professional completing the questionnaire had to use accurate data to achieve an appropriate score; therefore, standardized education was provided (see Appendix D). Collection of post data from the documented medical records was performed by the student investigator (see Appendix C). A methodological approach to ensure accuracy and completeness of the information collected was performed. By utilizing appropriate inclusion and exclusion criteria, the quality of the data was enhanced

(Melnyk & Fineout-Overholt, 2011). A power analysis was performed and 42 participants was the minimum sample size to achieve a 0.8 power, medium effect, and alpha of 0.05.

Analysis

The primary measure in this study was the incidence rate of complications. Effect measures included standardized incidence ratio and odds ratio (Ressing, Blettner, & Klug, 2010). The incidence rates were included in the statistical analysis and compared to published incidence rates utilizing a one-tailed independent samples t-test to determine significance (see Appendix C).

Results

Setting and Participants

The study took place at 25-bed critical access hospital. This is a small community hospital in the Midwest that performs an average of 800 surgeries per year (personal communication, April 5, 2015). The implementation took place in the perioperative area. The study occurred from December 2015 to April 2016. All patients over the age of 18 who were to undergo general anesthesia and who met the inclusion criteria and no exclusion criteria were screened utilizing the STOP-Bang screening tool for OSA on the day of surgery. The number of patients meeting the inclusion criteria in this time frame was 47. Participants ranged from two to four on the ASA Physical Status classification which is an indicator of the patient's level of physical state and wellness (ASA House of Delegates, 2014).

Intervention Course

The STOP-Bang questionnaire was initiated in the perioperative area to determine which patients may be at a risk for postoperative complications from OSA. The facility initiated the STOP-Bang screening questionnaire as part of their practice change for care of the perioperative

patient. Patients who were identified as at risk for OSA or already diagnosed with OSA and scheduled for general anesthesia received only short acting narcotics during the intraoperative period for pain management as well as alternative methods of pain management which included intravenous Tylenol 1000 mg, intramuscular Toradol 60 mg, intravenous Toradol 30 mg, or a brachial plexus block. They did not receive any long-acting narcotics, and all patients received Sevoflurane to maintain anesthesia. Of the 200 patients who presented for surgery, 100 screened at risk for OSA while only 47 received general anesthesia and were included in the study results.

Outcomes

The incidence rates for, BiPAP/CPAP utilization, re-intubation and postoperative ventilator utilization in PACU, acute respiratory failure, and unplanned ICU admissions were entered into SPSS. The incidence rates were then compared to published incidence rates for the same outcomes. The test utilized was the one-tailed independent samples t-test, The published studies utilized to compare incidence rates included research by Gupta, Parvizi, Hanssen & Gay (2001), Gali et al. (2007), Gali et al. (2009), Kaw (2012), Liao, Yagneswaren, Viaravanathan, Zilberman, & Chung (2009), Vasu et al. (2010), and Weingarten et al. (2011). Multiple studies were used for comparison as reported outcomes differed in information provided. The patient populations differed in all of these studies with no two being the same as the other nor did they match the current study population. All of the patient populations are specific to outcomes regarding OSA patients. None of the research used for comparison noted the utilization of only short-term narcotics during the intraoperative period nor did the studies specify which narcotics were used intraoperatively and some also analyzed patients undergoing monitored anesthesia care and regional anesthesia as well as general anesthesia.

Hypoxemia

The incidence of hypoxemia in the current study population was 10 out of 47, resulting in a rate of 21.28%. Six of the seven studies utilized for comparison of outcomes showed incidence rates for hypoxemia associated with OSA patients undergoing general anesthesia. In two of these six studies, there was a significant difference in hypoxemia outcomes which supported the use of short-acting narcotics during the intraoperative period to lower hypoxemia postoperatively.

The study by Gali et al. (2007) had 115 participants with 47 meeting the criteria for hypoxemia. This resulted in an incidence rate of 40.87%. The p-value when comparing the Gali et al. incidence rate to the current study was 0.0055. The second study that showed a significant difference was by Gali et al. (2009) which had 221 participants and 159 meeting the criteria for hypoxemia. The incidence rate was 71.95% with a p-value when comparing this study to the current study of 0.001. The other studies showed no significant difference either negative or positive when compared to the study group.

BiPAP / CPAP Utilization

One out of the 47 patients in this study required BiPAP postoperatively to maintain oxygen saturation above 90% resulting in an incidence rate of 2.13%. Only two other studies identified incidence rates for the usage of the BiPAP or CPAP with the difference being significant for one study as compared to this study. Liao et al. (2009) reported an incidence rate of 49.17% in adult patients diagnosed with OSA undergoing elective surgery. The p-value when comparing the outcomes from Liao et al. to the current study was 0.001. A significantly lower number of patients required respiratory support from a BiPAP or CPAP postoperatively in the current study that utilized only short acting narcotics intraoperatively.

Re-intubation / Postoperative Ventilator Utilization in PACU

This outcome measure was specific to the PACU area and identified patients who required re-intubation or postoperative ventilation that resolved during the time period in the PACU. There was only one patient that required re-intubation and that occurred in the operating room immediately following extubation. For this, the incidence rate for the current study was 2.13%. Five other studies supplied incidence rates for this event but there were not any significant differences between the studies and the current study.

Acute Respiratory Failure

No patients in this study experienced acute respiratory failure with a resulting incidence rate of 0%. Two of the published studies recorded this outcome. Kaw (2010) recorded an incidence rate of 4.96% with a p-value of 0.0001 when compared to this study. Weingarten et al. (2011) showed an incidence rate of 7.54% with a p-value of 0.0001 when compared to this study. Both of these show a significant difference in rates of acute respiratory failure postoperatively. This indicates that those patients receiving only short-acting narcotics intraoperatively have significantly less incidences of acute respiratory failure when compared with published outcomes in patients receiving general anesthesia that do not distinguish the use of only short-term narcotics.

Unplanned Intensive Care Unit Transfer

There were no patients in this study that had an unplanned ICU admission, making the incidence rate 0%. Six of the studies utilized for comparison to this study noted unplanned ICU admission as an outcome measure. Gupta et al (2001) recorded an incidence rate of 21.78% with a p-value of 0.0001. Gali et al. (2007) showed an incidence rate of 4.35% with a p-value of 0.0125. The incidence rate for Kaw (2010) was 5.67% with a p-value of 0.0001. Liao et al. (2009) published an incidence rate of 2.08% with a p-value of 0.0125. Gali et al. (2009) had an

incidence rate of 7.24% with a p-value of 0.0001. The incidence rate for Vasu et al. (2010) was 1.79% with a p-value of 0.161. For all of these studies except Vasu et al. (2010), the incidence rate of unplanned ICU admissions was significantly higher than the rate for the patients who received only short-acting narcotics in the current study.

Discussion

Successes

Multiple statistically significant outcome differences showed that the utilization of short-acting narcotics intraoperatively resulted in decreased incidences of pulmonary complications. Seven studies were used to compare the published incidence rates with the current study. The significant results included a lower incidence rate of hypoxemia in this study when compared with two prior research studies which did not note the utilization of only short-term narcotics in OSA patients undergoing anesthesia. When comparing the incidence rate of BiPAP / CPAP usage in the PACU, there was a significant decrease in usage in this study when compared to one other published incidence rate not using short term narcotics during anesthesia. There was also a significant decreased incidence of acute respiratory failure when compared with the two studies that reported this outcome who did not note utilizing only short-term narcotics intraoperatively. The incidence rate was significant when comparing five of the six studies regarding unplanned ICU admission showing that this study had a decreased incidence rate.

Strengths

The participants in this study included a wide range of ages from 18 to 80 with multiple different types of surgical procedures being performed, including orthopedic, general, urological, obstetric, and bariatric. The professionals worked together diligently to perform appropriate screening for OSA, maintain communication regarding which patients screened at risk for OSA,

as well as provided adequate documentation preoperatively and postoperatively. Every patient who arrived for surgery was screened for OSA and flagged appropriately for the CRNA who would then provide the correct short-acting narcotics intraoperatively. None of the patients that screened as at risk for OSA received any long-acting narcotics intraoperatively, which means that every patient that qualified for the study was utilized as an outcome measure.

Comparing Results to Literature

The most important results showed that the utilization of only short-acting narcotics during the intraoperative period diminished the incidence of long-term negative postoperative pulmonary events. There was a statistically significant decrease in the incidence rate of patients with acute respiratory failure as well as the incidence rate of patients transferring to the ICU.

Limitations

Internal Validity

There is the possibility of bias as the student researcher was the only data collector, although the outcomes were documented by the professionals without the presence of the student researcher. As there was more than one nurse providing the preoperative screening, there is a possibility of EBP intervention process difference in the implementation of the STOP-Bang screening. While anesthesia was provided by only one person for most of the patients, there were occasionally alternate providers involved in the care of the patients.

External Validity

All patients who were over the age of 18 and undergoing general anesthesia were included in the study. While only those patients undergoing general anesthesia were included, all patients that presented for surgery of any type were screened for their OSA risk to assure that if unplanned general anesthesia was changed to general anesthesia that the intervention would be

provided. A multitude of types of surgical procedures were performed ranging from orthopedic, general, urological, obstetric, and bariatric. The age range was 18 to 80 with their ASA classification ranging from two to four.

Sustainability

This study had a small initial economic impact to the facility cost while the potential economic benefit related to a decrease in perioperative complications with the long-term implementation of practice guidelines fostering the sustainability potential after the study. Due to the minimal cost and potential economic benefit, the sustainability of this study is feasible long term. Provider buy-in was an important part of the sustainability of this implementation measure and by providing positive outcomes that are statistically significant, the providers were encouraged to maintain and sustain this change for the future.

Minimize Limitations

The student researcher specifically recorded the outcomes measured and reported in the medical record data prior to performing statistical analysis. Education of the perioperative staff was done in a single setting with all of the staff present to ensure that they had the same knowledge and training. The anesthesia staff was one person during most of the implementation but when it was an alternative provider, the provider was educated and informed of the study.

Interpretation

Expected and Actual Outcomes

The expected results were that the patients in this study who received only short-acting narcotics intraoperatively would have a decreased incidence of all postoperative pulmonary complications and unplanned ICU admissions. The actual outcomes showed statistically

significant decreases in complication outcomes in the study population compared to the published outcomes except for the re-intubation / postoperative ventilator usage in PACU.

Intervention's Effectiveness

The use of short-acting narcotics decreases the incidence of postoperative pulmonary complications and unplanned ICU admissions. Utilizing alternative methods of pain control that have less of an effect on respiratory effort may have also played a roll in the effectiveness of this treatment. Continuing to utilize alternative non-narcotic pain management techniques along with short-acting narcotics in patients who screen at risk for OSA or have OSA is an appropriate measure to maintain positive outcomes.

Intervention Revision

Utilization of alternative pain management techniques such as regional anesthesia when appropriate, Ketorolac, Acetaminophen, Ketamine, and Lidocaine, as well as others could provide another measure of pain control that does not affect the respiratory drive of these patients. If more alternative pain management methods had been utilized, the outcomes may have demonstrated a greater decrease in respiratory complications. The primary anesthesia provider verbalized an improvement opportunity with increased use of intravenous acetaminophen.

Expected and Actual Impact to Health System

The expected outcomes were that OSA patients who received short-acting narcotics intraoperatively would have less postoperative pulmonary complications and ICU admissions than published studies. The actual impact of these outcomes is that the hospital does not incur the cost that is associated with these complications. The actual cost of implementing the STOP-Bang screening tool was minimal.

Conclusion

Practical Usefulness

The OSA screening and use of short-term narcotics in at risk patients was easy to perform and required minimal cost and time from the facility and staff. It is simple to use and provides the perioperative personnel with additional information about the patient that is useful in provision of care. Continuation of this EBP intervention will be easy to maintain and provide a positive effect to the patients and the facility.

Further Study

The results of this study showed that patients with a screened risk for OSA who received evidence based management interventions had a lower incidence rate of respiratory complications as compared to published findings. The next step is to further implement perioperative guidelines established for the care of the surgical patient with OSA. Through the use of evidence-based practice of screening and management of OSA, quality of care may be enhanced for surgical patients at risk for complications from OSA.

Dissemination

The findings from this study will be shared at a monthly meeting attended by the chief medical officer, chief surgeon, director of surgery, and director of anesthesia. The study will also be presented as a poster with discussion at the spring conference for the Missouri Association of Nurse Anesthetists in April, 2016. The outcomes will also be noted in the fall newsletter for the School of Nurse Anesthesia. The dissemination will promote the use of evidence-based practice and increase the quality of care in patients who are at risk for OSA and scheduled for general anesthesia.

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Appendix A

Cost Table

Item	Cost
Nursing education	$163.30
Paper for questionnaire	$1.60
Anesthesia education	$200.00
Total	**$364.90**

Table 2. Definition of Terms Related to OSA

Term	**Definition**
Apnea	Complete cessation of airflow during sleep
Hypopnea	Reduction of airflow during sleep
Apnea Hypopnea Index (AHI)	Measure of the number of apnea and hypopnea episodes per hour of monitored sleep
Polysomnography (PSG)	Sleep study used to test sleep disorders: gold standard for diagnosis
Obstructive sleep apnea (OSA)	Breathing disorder where breathing repeatedly stops and starts during sleep
Short-acting narcotics	Relatively quick onset and short duration of analgesic activity
Long-acting narcotics	A potentially longer onset and longer duration of analgesic action

Table 3. Synthesis of Evidence Table

Citation	**Purpose**	**Research Design, Evidence Level, & Method**	**Sample / Setting**	**Measures & Reliability (if reported)**	**Analysis Used & Results**	**Limitations & Usefulness**
Kulkarni (2014). Obstructive sleep apnea in general surgery patients: Is it more common than we think? The American Journal of Surgery.	Determine the risk of OSA in surgical patients	Cross sectional, prospective Level III	367 preoperative patients greater than 18 years of age in outpatient general surgery clinic	Positive predictive values and sensitivity Reliability validated with comparison of 46 patients that received a sleep study	Positive predictive values and sensitivity compared to sleep study results STOP-Bang questionnaire shows a sensitivity of 90.2% and positive predictive value of 85.2% for any OSA	Only 46 of the 367 patients had sleep studies to compare results to Sample representative of a diverse population of patients Preoperative screening for OSA should be considered to diagnose patients at risk
Agrawal (2013). Prevalence of obstructive sleep apnea in surgical patients presenting to a tertiary care teaching hospital in India: A preliminary study. Saudi Journal of Anaesthesia.	Evaluating the usefulness of the STOP-Bang screening tool in predicting preoperative patients with OSA	Prospective cohort study Level IV	3452 perioperative patients greater than 18 years of age scheduled for elective surgery	SPSS Version 17.0	Chi-square used to compare proportions Independent sample t-test used to compare means Found that there is a high prevalence of OSA in surgical patients and the STOP-Bang questionnaire identified these patients that are at	P Single institution data that may not be generalizable Did not follow the patient's postoperative course Confirmed that there is a high prevalence of OSA in the surgical patient

					risk	
Vasu (2012). Obstructive sleep apnea syndrome and perioperative complications: A systematic review of the literature. Journal of Clinical Sleep Medicine.	Discuss the importance of identification of perioperative patients with OSA	Systematic review of literature Level I	11 studies included in the review Case control, historical cohort, prospective cohort, retrospective matched cohort, and cohort studies	Oxford level of evidence and grade of recommendation assigned for each article	Two independent authors assigned the Oxford level of evidence and grade of recommendation for each article with 100% agreement between the authors Screening questionnaires are easy to administer preoperatively and have been shown to identify high risk patients	Only had two authors reviewing the literature Excluded surgeries involving bariatric patients and the OSA population It is important to identify OSA patients preoperatively so that their perioperative care is appropriate
Singh (2013). Proportion of surgical patients with undiagnosed obstructive sleep apnea. British Journal of Anaesthesia.	Evaluate the proportion of surgical patients with undiagnosed moderate to severe OSA	Retrospective cohort study Level IV	819 patients visiting preoperative clinics over four years	SAS 9.2	Bootstrap resampling method used to calculate confidence interval, Fisher exact test, chi-squared test, Cochrane-Armitage trend test The surgeon / anesthetist did not diagnose 93% and 65% of patients with moderate OSA and 90% and	Self selection bias High rate of drop out High refusal rate Retrospective Possible to decrease the amount of unrecognized OSA by implementing a screening tool

					53% of patients with severe OSA	
Nepomnayshy (2013). Sleep apnea: Is routine preoperative screening necessary? Obesity Surgery.	Evaluate the need for routine preoperative OSA screening	Retrospective cohort study Level IV	882 morbidity obese patients undergoing bariatric surgery or total joint replacement	Univariate and multivariate analysis with logistic regression	Fisher's exact test, Student's t-test, odds ratio and 95% confidence interval No difference in cardiopulmonary complications between the unscreened and screened groups of patients	Limited study to morbidly obese patients Retrospective study Postoperative care was not standardized There may be no clinical relevance to routinely preoperatively screen for undiagnosed OSA in morbidly obese patients
Chung (2012). High STOP-Bang score indicates a high probability of obstructive sleep apnea. British Journal of Aneasthesia.	Evaluate association between STOP-Bang scores and the probability of OSA	Cross-sectional, prospective Level III	746 preoperative patients greater than 18 years of age presenting for elective surgery	Predictive parameters including sensitivity, specificity, positive predictive values, negative predictive values, odds ratio, confidence intervals, and logistics regression SAS software version 9.2 utilized	Predictive parameters STOP-Bang score of 5-8 identified patients at high probability of moderate to severe OSA	Two different methods of PSG utilized Study population was limited to patients referred to the perioperative clinic prior to surgery STOP-Bang score can help the healthcare team identify patients with undiagnosed

						OSA
Chung (2013). Predictive performance of the STOP-Bang score for identifying obstructive sleep apnea in obese patients. Obesity Surgery.	Determine the predictive performance of the STOP-Bang questionnaire in obese and morbidly obese patients	Cross sectional, prospective Level III	667 preoperative patients greater than 18 years of age 310 obese patients 140 morbidly obese patients	Predictive parameters including sensitivity, specificity, positive predictive values, and negative predictive values SAS software version 9.2 utilized Comparison of means utilizing unpaired t-test, medians with Mann-Whitney test, proportions with chi-square test	Predictive parameters Predicted probability of OSA increased as the STOP-Bang score increased	Two different methods of PSG utilized Study population was limited to patients referred to the perioperative clinic prior to surgery Patients having OSA symptoms may be more motivated to consent to the study STOP-Bang questionnaire validated for use in the obese and morbidly obese surgical patient
(2014). Pre-operative screening and post-operative monitoring of adults with obstructive sleep apnea: A review of clinical effectiveness and guidelines. Canadian Agency for Drugs and Technologies in Health.	Evaluate the clinical utility of screening questionnaires	Critical appraisal Level IV	11 clinical studies and two evidence based guidelines included in final analysis Non-randomized studies including longitudinal cohort, prospective, retrospective, and cross-sectional	95% confidence intervals, negative predictive values, positive predictive values, p-values, sensitivity, and specificity were used to report results Reliability of score validated with comparison to sleep study results	Summary review of multiple studies Scoring greater than 3 on the STOP-Bang questionnaire was associated with increased risk of post-operative cardiovascular or pulmonary complications	Different time frames for utilizing reference standard and different use of reference standard Different cut-off points utilized for surgical outcomes STOP-Bang

						questionnaire may be an appropriate method for screening surgical patients for OSA
El-Sayed (2012). Comparison of four sleep questionnaires for screening obstructive sleep apnea. Egyptian Journal of Chest Diseases and tuberculosis.	Compare the four questionnaires as regards to their predictive probabilities for OSA	Cross-sectional study Level IV	234 patients presenting to the sleep clinic	SPSS for Windows version 17.0	Descriptive statistics including sensitivity, specificity, positive predictive values and negative predictive values The Berlin, STOP and STOP-Bang questionnaires had high sensitivity but low specificity	Specific to a certain patient population Low specificity can result in false positive results and failure of exclusion for those patients at low risk
Chung (2014). Alternative scoring models of STOP-Bang questionnaire improve specificity to detect undiagnosed obstructive sleep apnea. Journal of Clinical Sleep Medicine.	Evaluate predictive performance of STOP-Bang alternative scoring models	Prospective cohort study Level IV	908 patients undergoing surgery	SAS version 9.2	Mann-Whitney U test, chi-squared test, and Fisher-exact test STOP-Bang score greater than three offers a high sensitivity to detect obstructive sleep apnea Not all items on the STOP-Bang score have the same predictive weight	Self-selection bias Central apneas were not evaluated separately Information specific to surgical patients For ease of use, each item on the questionnaire should remain equal in predictive value although

						different items actually hold higher predictive values than other items do
Khodabandeh (2012). STOP-Bang questionnaire as a preoperative screening tool for obstructive sleep apnea in bariatric surgery patients. European Respiratory Journal	Validate the STOP-Bang screening tool for use in patients undergoing bariatric surgery	Retrospective cohort study Level IV	49 perioperative patients who were to undergo bariatric surgery	Sensitivity, specificity, positive predictive values, and negative predictive values	Predictive parameters The STOP-Bang questionnaire has a high sensitivity to detect bariatric surgery patients with obstructive sleep apnea	Small sample size Retrospective May be utilized to routinely screen for undiagnosed OSA in bariatric surgery patients
Ravesloot (2012). Obstructive sleep apnea is underrecognized and underdiagnosed in patients undergoing bariatric surgery. European Archives of Oto-Rhino-Laryngology.	Evaluate the predictive values of body mass index (BMI), neck circumference (NC), and Epworth Sleepiness Scale (ESS) for OSA in bariatric patients undergoing surgery	Prospective observational study	279 patients ear, nose and throat patients	SPSS statistical software version 18	Unpaired t-test and Mann-Whitney test Linear regression Increased NC, BMI, or ESS are insufficient predictors of OSA	Recruited patients Specific patient population Increased NC, BMI, or ESS cannot reliably predict the presence of OSA
Chong (2013). Management plan to reduce risks in perioperative care of patients with obstructive sleep apnea averts the need for pre-surgical polysomnography.	Determine if it is clinically safe to proceed with surgery in patients identified as at risk for OSA without further screening measures or treatment	Retrospective cohort study Level IV	463 patients greater than 18 years of age in a preoperative clinic	STATA 10.0 statistical software	Independent student t-test, Mann-Whitney U test, chi-squared test, Fisher's exact tests, two-tailed tests No statistical difference in the cardiac,	Retrospective study – may not have been able to obtain all information for every patient No significant increase in postoperative complications in

Annals of the Academy of Medicine, Singapore.					respiratory, or neurologic complications between the patients that had the STOP-Bang screening only versus the PSG	patients who only received the STOP-Bang screening versus those who underwent PSG for confirmation
Vasu (2010). Obstructive sleep apnea syndrome and postoperative complications: Clinical use of the STOP-Bang questionnaire. Archives of Otolaryngology–Head & Neck Surgery.	Determine whether high risk scores on the STOP-Bang questionnaire correlate with a higher rate of complications from obstructive sleep apnea syndrome	Retrospective cohort study Level IV	180 perioperative patients greater than 18 years of age undergoing elective surgery	STATA 10 statistical software	Wilcoxon rank sum, Fisher exact tests, multiple logistic regression analysis with odds ratio and 95% confidence intervals High risk score for OSA on the STOP-Bang questionnaire is associated with an increased risk of postoperative complications	Conclusions based on retrospective review – potential for errors of omission and methodological inconsistencies STOP-Bang questionnaire is useful for preoperative identification of patients with higher than normal risk for surgical complications
Kaw (2012). Meta-analysis of the association between obstructive sleep apnoea and postoperative outcome. British Journal of Aneasthesia	Review current evidence related to OSA in the perioperative patient and postoperative complications / outcomes.	Systematic review, quantitative, meta-analysis of cohort and case control studies Level I Literature search restricted to	13 studies included in the final analysis. Heterogeneous studies including perioperative patients with OSA with at least one postoperative	Study quality was rated on a 4-point scale. Key points of the study were assessed for quality utilizing the MOOSE collaboration 5-point scale.	Followed reporting guidelines for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)	No standard for respiratory failure was used between the studies. Inconsistent reporting between studies and a wide range

		adults with OSA with outcomes postoperatively	complication / outcome in patients with or without OSA.		statement. Incidence of postoperative complications is higher in OSA patients.	of cardiac events makes interpretation difficult. Respiratory difficulties dominate the postoperative complications in patients with OSA.
Chia (2013). The association of pre-operative STOP-Bang scores with postoperative critical care admission. Anaesthesia.	Determining if the STOP-Bang questionnaire will determine a patients need for postoperative critical care admission	Retrospective cohort study Level IV	5342 perioperative patients greater than 18 years of age scheduled for elective surgery	Statistical Product and Service Solutions software; IBM SPSS Statistics for Windows, version 20.0	Multivariate analysis with odds ratio Multiple logistics regression Higher STOP-Bang score was associated with higher rate of critical care admission	Could incorrectly diagnose OSA if only utilize the STOP-Bang questionnaire STOP-Bang questionnaire may be useful to stratify the need for postoperative critical care
Gross (2014). Practice guidelines for the perioperative management of obstructive sleep apnea. Anesthesiology.	Systematically developed recommendations to assist the practitioner and the patient in making decisions about OSA	Clinical practice guidelines from randomized controlled trials and non-randomized controlled trials Level I	Critical analysis of data from a large-scale survey of practicing anesthesiologists Updated evaluation of scientific literature	Scientific evidence and opinion based evidence broken down into categories based on the strength and quality of evidence of findings	12 member task force Highest level of evidence is included in the summary report for each intervention Consensus statements on the identification and management of perioperative	Opinion-based evidence can be biased Consensus that the patient should be screened preoperatively for OSA and the surgeon and anesthesia provider discuss options for

					patients with OSA are identified	management with the patient
Joshi (2012). Society for ambulatory anesthesia consensus statement on preoperative selection of adult patients with obstructive sleep apnea scheduled for ambulatory surgery. Anesthesia & Analgesia.	Provide guidance for the appropriate selection of OSA patients scheduled for ambulatory surgery	Systematic review of literature of randomized controlled trials, prospective observational trials and retrospective trials Level I	7 studies included	Literature search performed utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines Studies graded for strength based on the Scottish Intercollegiate Guideline Network Recommendations were formulated by a working group using the Delphi method of collate rounds of individual comments on the evidence	Independently assessed for inclusion The STOP-Bang questionnaire is preferred because of ease of use	Varying approaches were used to diagnose OSA Control groups did not undergo appropriate OSA testing Significant variations in the definition of complications Recommend that if OSA is suspected during the preoperative evaluation, one should proceed with the assumption that the patient has OSA and treat them as such
Liao (2013). Perioperative auto-titrated continuous positive airway pressure treatment in surgical patients with obstructive sleep apnea: A randomized controlled trial. Anesthesiology.	Determine whether auto-titrated continuous positive airway pressure (APAP) treatment decreases the postoperative apnea-hypopnea index (AHI) and improves oxygenation in	Prospective randomized controlled trial Level II	177 patients at high risk for OSA or a history of OSA without CPAP treatment	SAS 9.2	Two-tailed tests, sample t-test, Mann-Whitney U test Perioperative APAP treatment effectively reduces AHI and improves oxygenation in patients with	High drop-out rate and low rate of compliance with APAP use Not a double blind study Patients that screen high on the STOP-Bang questionnaire may benefit

	patients with moderate to severe OSA				moderate to severe OSA	from postoperative APAP treatment
Mutter (2014). A matched cohort study of postoperative outcomes in obstructive sleep apnea: Could preoperative diagnosis and treatment prevent complications? The Journal of the American Society of Anesthesiologists.	Evaluate whether preoperative diagnosis and implementation of continuous positive airway pressure (CPAP) therapy will reduce postoperative complications in OSA patients	Matched cohort Level IV	1,571 undiagnosed OSA patients before treatment intervention and 2,640 diagnosed OSA patients after treatment intervention 16,277 control patients with low risk of OSA 7 days postoperatively	SAS software version 9.2 and 9.3 used Results reported as odds ratio with 95% confidence interval	Univariate and multivariate analysis of respiratory and cardiac complications; sensitivity analysis used Cardiac complications increased for undiagnosed OSA (UOSA), not diagnosed OSA (DOSA) Respiratory complications increased for DOSA & UOSA	Poor UOSA definition may have contaminated the control group with UOSA patients; unable to measure all relevant variables; use of international classification of diseases codes to define complications Use of CPAP perioperatively may not be sufficient to limit respiratory complications

Diagram 1. Kotter's Eight-step Plan for Change

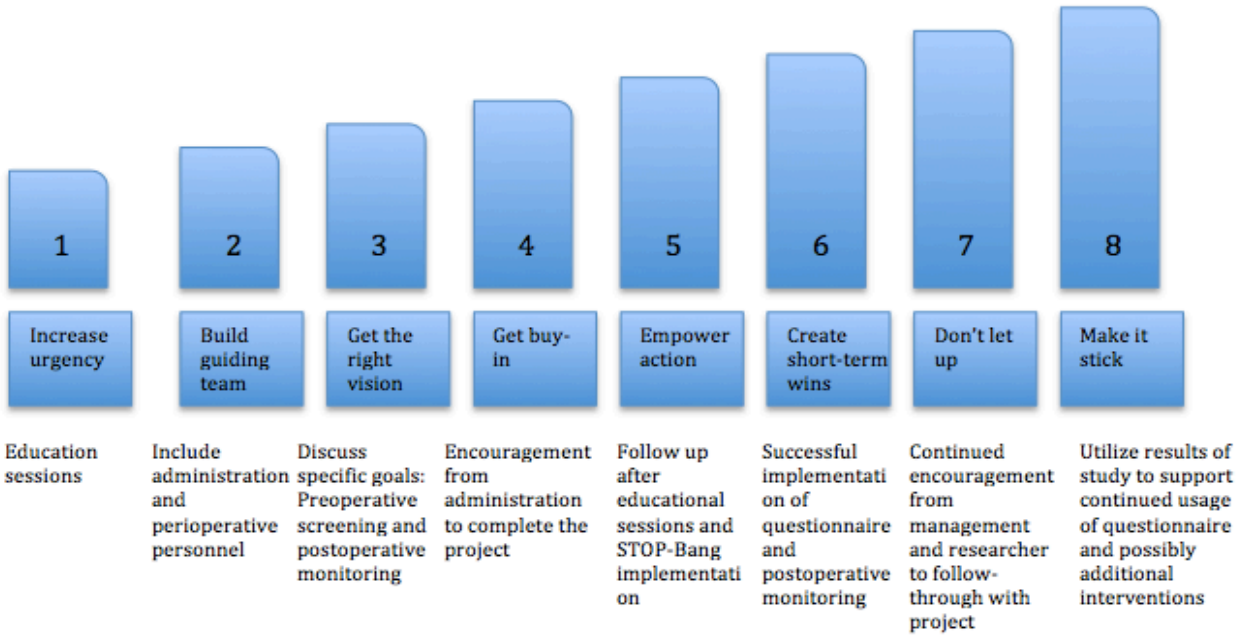
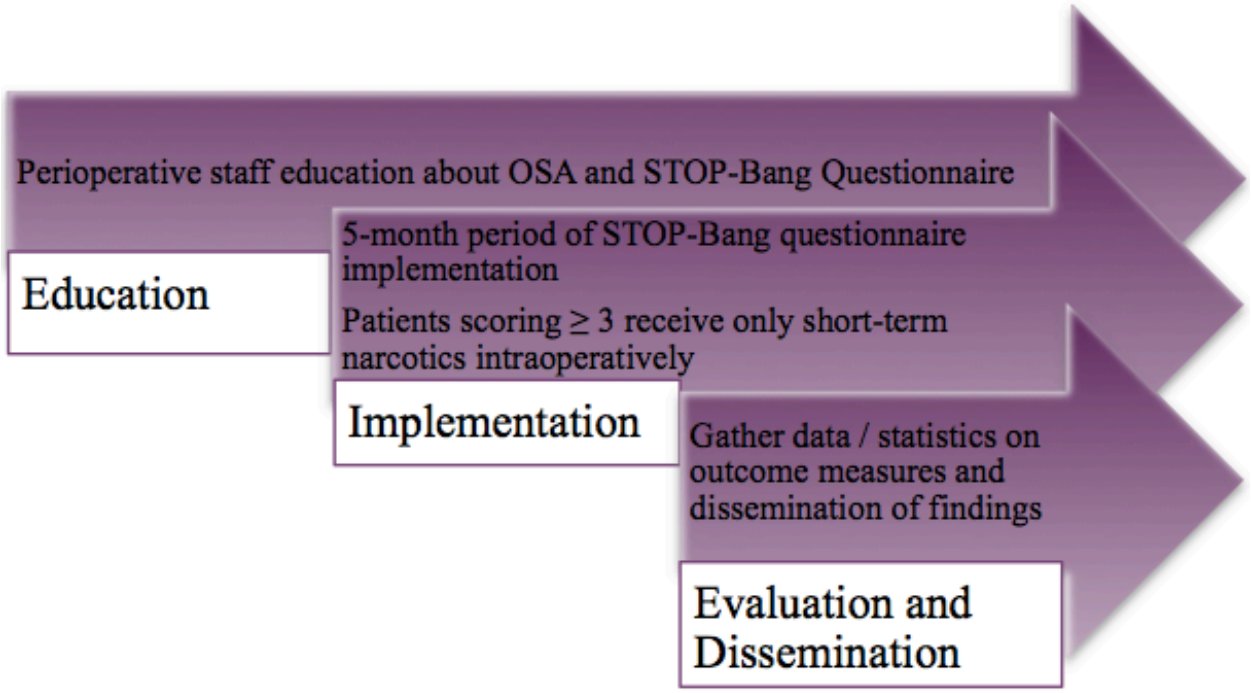


Diagram 2. Logic Model

Inputs	Intervention(s) *Activities*	Outputs *Participation*	Outcomes – Impact *Short*	*Medium*	*Long*
Evidence/Sub-topics: **Consensus statement and clinical practice guidelines** **Studies including meta-analysis, cross sectional, prospective cohort, systematic reviews of literature, retrospective cohort, critical appraisals, and observational** **OSA risk** **STOP-Bang questionnaire** **Complications and outcomes** **Guidelines and treatment** **Major Facilitators or Contributors:** **Perioperative nursing personnel** **-Preoperative RN** **-Postoperative RN** **-Anesthesia provider** **Jeannie Peterson, Assistant Director of Surgery** **Carol Diskin, Director of Surgery** **Major Barriers or Challenges:** **Participation and accurate documentation from all staff**	**The EBP intervention which is supported by the evidence in the Input column:** **Evaluation of the postoperative complications of patients who screen at high risk for OSA utilizing ht4 STOP-Bang questionnaire to determine if further interventions are necessary** **Major steps of the intervention:** **Obtain consent from facility to evaluate patients utilizing STOP-Bang questionnaire and document postoperative complications** **Obtain consent to utilize STOP-Bang questionnaire from F. Chung** **Educate staff on use of questionnaire and evaluation of postoperative respiratory status** **Use of short-acting narcotics on at risk patients (3 or greater score on STOP-Bang questionnaire)** **Set up guidelines for postoperative evaluation**	**The participants:** **Girard Medical Center preoperative staff and anesthesia personnel** **Girard Medical Center laparoscopic surgery patients** **Site:** **Girard Medical Center, Girard, KS** **Time Frame:** **IRB approval and study proposal Summer 2015** **Study implementation fall 2015** **Data collection and analysis over a 6 month period** **Consent Needed:** **No consent needed** **Person(s) collecting data:** **DNP student** **Perioperative nursing staff** **Others directly involved:** **Statistician** **Perioperative anesthesia staff**	**Perioperative staff increase in knowledge of OSA and perioperative implications** **Determine the need for further clinical practice guideline implementation for care of the OSA patient during the perioperative period** **Outcome(s) to be measured with reliable measurement tool(s):** **Postoperative pulmonary complications including desaturation, oxygen requirement, increased length of stay (greater than 1 hour) in the post anesthesia care unit** **Measurement tools:** **STOP-Bang questionnaire developed by F. Chung** **Statistical Analysis:** **Logistic regression model**	**Perioperative staff has increased awareness of postoperative complications related to OSA patients** **Faculty has positive attitudes towards monitoring patients with OSA**	**If a need is identified, perioperative clinical practice guidelines for the care of the OSA patient are implemented** **Facility has improved patient outcomes for OSA patients postoperatively**

Diagram 3. Intervention Implementation Plan



Appendix B:

STOP-Bang Screening Tool

1. *S* noring
   Do you *s* nore loudly (louder than talking or loud enough to be heard through closed doors)?
   Yes No
2. *T* ired
   Do you often feel *t* ired, fatigued, or sleepy during daytime?
   Yes No
3. *O* bserved
   Has anyone *o* bserved you stop breathing during your sleep?
   Yes No
4. Blood *p* ressure
   Do you have or are you being treated for high blood *p* ressure?
   Yes No
5. *B* MI
   B MI more than 35 kg/m^2?
   Yes No
6. *A* ge
   A ge over 50 yr old?
   Yes No
7. *N* eck circumference
   N eck circumference greater than 40 cm?
   Yes No
8. *G* ender
   G ender male?
   Yes No

High risk of OSA: answering yes to three or more items
Low risk of OSA: answering yes to less than three items

Questionnaire reproduced from Chung et al. (2008) with permission.

IRB Approval Letter

Principal Investigator: Lyla Lindholm UMKC Health Sciences Building Kansas City, MO 64108

NOTICE OF NEW APPROVAL

Protocol Number: 15-343Protocol Title: Decreasing the risk for postoperative pulmonary complication from obstructive sleep apnea by utilizing the STOP-Bang questionnaire Type of Review: Designated Review

Date of Approval: 12/11/2015 Date of Expiration: 12/10/2016

Dear Dr. Lindholm,

The above referenced study, and your participation as a principal investigator, was reviewed and approved, under the applicable IRB regulations at 21 CFR 50 and 56 (FDA) or 45 CFR 46 (OHRP), by the UMKC IRB. You are granted permission to conduct your study as described in your application.

- This study is approved with a waiver of consent and a waiver of authorization.

This approval includes the following documents:

Attachments

Proposal_Approval_Letter_Version1_Date_9-6-2015 IRB_Acceptance_GMC_Dated_10-7-15 Girard_Site_Approval_Version1_Dated_9-6-2015 Privacy_Approval_1_Dated_9-29-15 (1) (1) Data_Collection_Template_Version1_Date_9-6-2015 HIPAA_Waiver_Dated_10:20:15 Girard_HIPAA_Policy_Version1_Dated_9-6-2015 STOP_Bang_Questionnaire_Version1_Dated_9-6-2015 Education_Session_Topic_Outline_Version1_Dated_9-6-2015 STOP_Bang_License_Agreement_Version1_Date_9-6-2015 Methods_Version1_Dated_9-6-2015

If a consent is being used in this research study you may find the stamped version in section 16 of your application.

The ability to conduct this study will expire on or before 12/10/2016 unless a request for continuing review is received and approved. If you intend to continue conduct of this study, it is your responsibility to provide a Continuing Review form prior to the expiration of approval.

This approval is issued under the University of Missouri - Kansas City's Federal Wide Assurance FWA00005427 with the Office for Human Research Protections (OHRP). If you have any questions regarding your obligations under the Board's Assurance, please do not hesitate to contact us.

There are 5 stipulations of approval:1) No subjects may be involved in any study procedure prior to the IRB approval date or after the expiration date. (PIs and sponsors are responsible for initiating Continuing Review proceedings).2) All unanticipated or serious adverse events must be reported to the IRB.3) All protocol modifications must be IRB approved prior to implementation unless they are intended to reduce risk. This includes any change of investigator. 4) All protocol deviations must be reported to the IRB.

5) All recruitment materials and methods must be approved by the IRB prior to being used.Please contact the Research Compliance Office (email: umkcirb@umkc.edu; phone: (816)235-5927) if you have questions or require further information. Thank you,

Simon MacNeill UMKC IRB

Appendix C:

Data Collection Template

	Type of surgery	Adjuncts used (toradol, regional, Tylenol, local)	Oxygen saturation <90%	BIPAP/CPAP use in PACU	Re-intubation	Acute Respiratory Failure	Unplanned ICU admission
	lap sleeve gastrectomy with hiatal hernia repair and EGD	IV Tylenol	x				
	lap chole and EGD						
	Bunionectomy						
	L knee scope / heel injection						
	lap nissen fundoplication		x				
	lap nissen fundoplication	IV tylenol					
	R mastectomy	IV tylenol					

	R knee scope						
	L knee scope / foot injection	Toradol 60 IM					
	L knee scope	Toradol 60 IM					
	Vasectomy						
	Open ventral hernia repair, chole, hiatal hernia repair						
	Lap umbilical incisional hernia repair with mesh						
	Lap chole						
	Lap sleeve gastrectomy / EGD	IV tylenol					
	Lap chole / EGD						
	orchiectomy	Toradol 60 IM					

	Vasectomy	Toradol 60 IM					
	Lap umbilical hernia repair	IV tylenol	x				
	open umbilical hernia repair		x				
	R knee scope		x				
	L knee scope						
	PPBTL	Toradol 60 IM					
	lap sleeve gastrectomy with hiatal hernia repair and EGD	IV tylenol		CPAP 5L O2			
	lap sleeve gastrectomy with hiatal hernia repair and EGD						
	R knee scope	Toradol 60 IM					
	lap sleeve gastrectomy with hiatal hernia repair and EGD	IV tylenol	x				

	Vasectomy	Toradol 60 IM					
	R shoulder scope	Brachial plexus block					
	Lap bilateral inguinal hernia repair, open ventral incisional hernia with mesh	Toradol 60 IM	x		In OR - extubated after 1 hr	X	
	Bilateral CTR	Toradol 60 IM					
	EGD / Anal EUA / Colonoscopy						
	Open chole						
	Lap sleeve gastrectomy / EGD / Umbilical hernia repair		x				
	Ex laparotomy, reduction incarcerated hernia						
	Lap Chole	Toradol 30 IV					
	Lap Chole / EGD / umbilical hernia with mesh		x				

	Shoulder scope	Brachial plexus block					
	Knee scope	Toradol 60 IM					
	Shoulder scope with acromioplasty, debridement rotator cuff tear	Toradol 60 IM Brachial plexus block					
	Lap chole	Toradol 60 IM					
	Laparoscopic ventral hernia repair with mesh		x				
	L plantar fascia release	Toradol 60 IM					
	lap sleeve gastrectomy with hiatal hernia repair and EGD						
	lap nissen fundoplication	IV tylenol					
	L shoulder scope	Brachial plexus block					
	Lap Chole						

Statistical Analysis of Outcome Measures							
Total Patients				47	47		
Total for specific outcome				1	1		
Incidence				0.021276596	0.021276596		

Statistical Analysis Template

Study Author	(n)	Hypoxemia	BiPAP / CPAP	Re-intubation / Ventilator Use in PACU	Acute Respiratory Failure	Unplanned ICU Admission
Current Study	47	10	1	1	0	0
Incidence Rates		21.28%	2.13%	2.13%	0.00%	0.00%
Gupta 2001	101	28	/	2	/	22
Incidence Rates		27.72%	/	1.98%	/	21.78%
One sided two independent sample t-test p-value		*0.1965*	/	*0.4770*	/	*0.0000*
Gali 2007	115	47	/	/	/	5
Incidence Rates		40.87%	/	/	/	4.35%
One sided two independent		*0.0055*	/	/	/	*0.0125*

sample t-test p-value						
Kaw 2012	282	35	/	4	14	16
Incidence Rates		12.41%	/	1.42%	4.96%	5.67%
One sided two independent sample t-test p-value		*0.0840*	*/*	*0.3765*	*0.0000*	*0.0000*
Liao 2009	240	71	118	1	/	5
Incidence Rates		29.58%	49.17%	0.42%	/	2.08%
One sided two independent sample t-test p-value		*0.1100*	*0.0000*	*0.2170*	*/*	*0.0125*
Gali 2009	221	159	6	/	/	16
Incidence Rates		71.95%	2.71%	/	/	7.24%
One sided two independent sample t-test p-value		*0.0000*	*0.4035*	*/*	*/*	*0.0000*
Vasu 2010	56	6	/	1	/	1
Incidence Rates		10.71%	/	1.79%	/	1.79%
One sided two independent		*0.0770*	*/*	*0.4560*	*/*	*0.1610*

sample t-test p-value						
Weingarten 2011	358	/	/	12	27	/
Incidence Rates			/	3.35%	7.54%	/
One sided two independent sample t-test p-value			/	*0.3005*	*0.0000*	/

Appendix D:

PowerPoint Outline for Education Session

Obstructive Sleep Apnea in the Perioperative Patient

- Valerie Smith MA, CRNA
- OSA
- Affects up to 26% of the general population
- Most common sleep disorder
- 80% of patients undiagnosed
- Males affected more than females
- Prevalence in surgical population: 4.7-80%
  - 70% of surgical patients undiagnosed
  - Prevalence higher in the surgical population than general population
- Adverse Health Consequences
- Hypertension
- Coronary vascular disease
- Congestive heart failure
- Cerebrovascular disease
- Glucose intolerance
- Daytime somnolence
- Loss of work productivity
- Increased risk of automobile collisions

Surgical patients:

- More vulnerable to effects of sedation, anesthesia, and analgesia
- One patient with postoperative respiratory complications results in an extra cost of $17,252

- Perioperative Complications
- Increased risk for:
  - Reintubation
  - Hypercapnia (increased CO2)
  - Oxygen desaturation
  - Cardiac arrhythmias
  - Myocardial injury
  - Delirium
  - Unplanned ICU admissions
  - Longer hospital stays
- Intervention Plan
- Initiate the STOP-Bang questionnaire to identify patients at risk for postoperative pulmonary complications due to OSA
- Utilize alternative methods of pain control to provide the patient with best ability to breath postoperatively
- Monitor pulmonary outcomes and length of stay for these patients
- **STOP-Bang Questionnaire**
- **S**
  - **Snoring**
- **T**
  - **Tired**
- **O**
  - **Observed obstruction**
- **P**
  - **Blood pressure (HTN)**
- **B**

  - **BMI > 35 kg/m^2**
- **A**
  - **Age > 50**
- **N**
  - **Neck circumference > 40 cm**
- **G**
  - **Gender male**
- **STOP-Bang**
- **S**
  - **Do you snore loudly?**
  - **Louder than talking OR**
  - **Loud enough to be heard through closed doors**
- **T**
  - **Do you feel tired, fatigued, sleepy during the day?**
  - **Do you feel like you will fall asleep while driving?**
- **O**
  - **Has anyone observed you stop breathing during your sleep?**
  - **Do you wake up gasping for air?**
- **P**
  - **Do you have or are you being treated for high blood pressure?**
- **B**
  - **Use BMI tool provided**
  - **Please weight and measure each patient when they come in. We have to have accurate information so we can't trust the patient on height or weight ☺**
- **A**

  - **Over 50 years old**

- **N**

  - **Use provided tape measures to get neck circumference**

  - **Measure at Adams apple or larynx**

- **G**

  - **Male gender**

- Participants

- All patients presenting for general anesthesia

  - To make it simple, please do this for all patients

  - We can probably utilize this data for other research at a further point

- Identification

- Please place a yellow sticker on the anesthesia record and the front of the chart to identify those patients that score a 3 or higher on the STOP-Bang questionnaire to identify them as “at risk” for OSA

- Anesthesia

- Alternative methods for pain control will be given by the anesthesia provider to provide the best pulmonary outcomes postoperatively

  - Acetaminophen PO / IV / PR

  - Toradol IV / IM

  - Local injection by surgeon

  - Regional anesthesia

  - Ketamine infusion

  - Lidocaine infusion

  - Short acting opioids

- Outcomes

- Use of oxygen for greater than 30 minutes postoperatively

- Oxygen desaturation (<90%) for greater than one minute in PACU
- BiPAP / CPAP use in PACU
- Re-intubation
- Prolonged PACU stay
- Unplanned extended stay admission
- Unplanned ICU admission
- PACU Data Sheet

Thank you for your assistance with this project!!!!