Streamlining Communication of STOP-Bang Questionnaire Results

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Abstract

The anesthesia, sedation, and analgesia patients receive in the perioperative setting can negatively affect adults with obstructive sleep apnea (OSA) (Erwin et al., 2019). Preoperative screening and detection of undiagnosed OSA allow anesthesia providers and nurses to develop a care plan that improves patient safety and outcomes. The STOP-Bang questionnaire is a highly researched, reliable, and easy-to-use tool in identifying patients at risk of undiagnosed OSA (Williams et al., 2017). This project aimed to implement a preoperative OSA screening process for bariatric surgery patients using the STOP-Bang questionnaire and to streamline communication of results to perioperative staff. The screening process was implemented over a 12-week-period. Findings from the data collected demonstrated the following: the STOP-Bang questionnaire is an accurate and sensitive diagnostic tool, OSA is highly prevalent among bariatric surgery patients, and nurse compliance with patient screening was a significant barrier to project success. The implications of these findings highlight the necessity of early screening and detection of sleep apnea to allow for prompt referral, evaluation, and treatment of OSA patients. This implication aligns with the Healthy People 2030 goal to increase the number of people who seek medical evaluation for symptoms of OSA.

Keywords: sleep apnea, STOP-Bang, screening, preoperative, compliance

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I. Introduction

Background

The anesthesia, sedation, and analgesia patients receive in the perioperative setting can negatively affect adults with obstructive sleep apnea (OSA) (Erwin et al., 2019). This population is at an increased risk of postoperative complications such as respiratory failure and acute respiratory distress syndrome (Mutter et al., 2014). Patients with symptomatic OSA often require a more demanding level of nursing care within the post-anesthesia care unit (PACU), increased use of hospital resources, and an increased PACU length of stay (Brousseau et al., 2014).

Preoperative screening and detection of undiagnosed sleep apnea allow anesthesia providers and nurses to develop a care plan that improves patient safety and outcomes. The STOP-Bang questionnaire is a highly researched, reliable, and easy-to-use tool in identifying patients at risk of undiagnosed OSA (Williams et al., 2017). Screening can be done quickly in the preoperative holding area or through preoperative screening phone calls and the results communicated to the anesthesia team and PACU nurses to guide their care of OSA patients. However, little evidence exists that evidence-based standardized OSA screening tools and subsequent nursing interventions are consistently utilized in the perioperative setting (Erwin et al., 2019).

Organizational Needs Statement

There are no national benchmarks regarding the screening of OSA patients or PACU length of stay. However, this clinical agency maintains strict standards regarding operating room (OR) hold minutes, and this measure is directly impacted by PACU length of stay. If patients experience postoperative complications that require a prolonged recovery period, this leads to a decreased availability of PACU beds and an increased likelihood of placing the operating room

"on hold." Data surrounding OR hold time is compiled and assessed monthly to ensure that the

flow of patients through preop, the operating room, and PACU is functioning efficiently.

According to the *YTD Mercy WOB Times* spreadsheet created by the organization's perioperative

director, the agency consistently met its goal of using 70 or fewer OR hold minutes per week

prior to implementation. Between April 2020 and March 2021, the average OR hold minutes per

week was 38.3 (*YTD Mercy WOB Times,* March 2021). This number varies widely

based on case volume and fluctuations in staffing. Although this agency was meeting its goal,

any OR hold minutes creates unnecessary agency expenses, decreases the efficiency of patient

flow through the unit, and thus decreases health system performance. Further reducing OR hold

minutes would reduce excessive spending and optimize health system performance.

This agency aims to provide evidence-based care that improves patient safety and

outcomes. With a sizeable surgical population and fifty to sixty patients cycling through PACU

on weekdays, early recognition of OSA would improve safety and outcomes for these high-risk

patients while decreasing the use of hospital resources, cost associated with a prolonged PACU

length of stay, and cost associated with OR hold time. This organizational need aligns with The

Institute for Healthcare Improvement Triple Aim to optimize health system performance by

improving care, improving population health, and reducing healthcare costs per capita (Beasley,

2009). Improving outcomes for patients with sleep apnea also aligns with the Healthy People

2030 goal of increasing the number of adults with symptoms of OSA who seek medical

evaluation (Healthy People 2030, 2021). Through screening with the STOP-Bang questionnaire,

patients can be aware of potentially undiagnosed OSA and seek further evaluation from their

primary care provider.

Problem Statement

This agency used the STOP-Bang questionnaire during pre-screening phone calls conducted by an individual outside the perioperative department. This individual did not communicate questionnaire results to preop nurses, anesthesia staff, or PACU nurses. Throughout project development, the individual who conducts these phone calls was challenging to reach and could not provide a definitive answer regarding where to find questionnaire results within the electronic medical record (EMR). According to an informal, verbal survey conducted by the project lead of 18 PACU nurses within this agency, 100% of surveyed nurses stated that they had never received information in handoff about a patient's risk for undiagnosed OSA based on the results of their STOP-Bang questionnaire (PACU nurses, personal communication, March 2021). Thus, anesthesia staff and nurses are often unaware of a confirmed history of OSA or if undiagnosed OSA is suspected. This lack of knowledge can lead to an increased likelihood of postoperative complications, prolonged PACU length of stay, and increased use of hospital resources for patients with OSA.

Purpose Statement

The STOP-Bang questionnaire was utilized during preop phone calls conducted by preop nurses for all patients undergoing bariatric surgery. If the preop nurse could not reach the patient via phone, they were screened before entering surgery in the preop department. Patients scoring four or above on this questionnaire were flagged within their paper chart as being at high risk for postoperative complications. Through early screening and detection of OSA in the preoperative setting, nurses and anesthesia staff could be mindful of risk factors associated with anesthesia, analgesia, and the OSA patient. Postoperative nurses caring for these high-risk patients optimized the patient's recovery process by using evidence-based interventions such as upright

positioning, multimodal pain management, restrictive fluid management, and maintenance of

oxygen saturation (Olsen et al., 2020). Data regarding nurse compliance with patient screening,

PACU length of stay, the incidence of documented postoperative complications, and weekly OR

hold minutes were collected and evaluated post-implementation.

Screening with the STOP-Bang questionnaire aimed to identify undiagnosed OSA

patients and streamline communication between perioperative staff. The screening of OSA

patients preoperatively should, in theory, decrease the risk of postoperative complications,

decrease the likelihood of prolonged PACU length of stay, and decrease weekly OR hold

minutes. This goal aligns with The Institute for Health Improvement Triple Aim to optimize

patient care and improve safety and outcomes.

Section II. Evidence

Literature Review

Quality improvement projects require implementing an evidence-based intervention to create organizational change. The STOP-Bang questionnaire is an evidence-based approach to the preoperative screening of OSA patients. A literature review was conducted regarding the efficacy of the STOP-Bang screening tool in identifying undiagnosed OSA and preventing postoperative complications. The database used was OneSearch via the health sciences library of an educational institution (see Appendix A).

As the STOP-bang questionnaire is a highly researched screening tool, a narrow set of inclusion criteria was incorporated to ensure the use of only the most relevant and recent evidence. Criteria included literature published within the last five years exclusive of sentinel pieces, scholarly and peer-reviewed articles, availability of full text, and level III evidence and above as depicted by the Pyramid Model. An initial search of the literature using these inclusion criteria and the keywords "STOP-bang" and "sleep apnea" yielded 993 results. The additional keywords "Surgery" and "Postoperative" were added to condense results and ensure that all articles discussed postoperative surgical patients. Only journals considered to fall under the discipline of "Medicine" and "Nursing" were reviewed, resulting in 108 relevant articles of original research published within reputable journals. Articles in non-English languages were excluded as well as those discussing pediatric patients. Articles were then sorted by relevance, and titles that included the STOP-Bang questionnaire, sleep apnea, surgical patients, preop screening, and evidence regarding the use of the STOP-Bang questionnaire to screen surgical patients were selected, resulting in 24 articles being reviewed in entirety. Literature that discussed findings most relevant to the organization's needs and population was chosen,

resulting in 11 articles to support the current state of knowledge surrounding the STOP-Bang

questionnaire in surgical populations (see Appendix B).

Current State of Knowledge

Obstructive sleep apnea is an often-unrecognized cause of perioperative morbidity and

mortality as the hypoxic injuries sustained by OSA patients during and after surgery can be

mistaken as cardiac arrest (Wolfe et al., 2016). The anesthesia, narcotics, and sedatives

associated with the perioperative setting create an increased risk of hypoxia, respiratory failure,

and cardiac events among OSA patients. Conditions such as obesity, hypertension, diabetes,

alcohol use, and large neck circumference predispose adult patients to OSA. It is estimated that

25% of patients undergoing elective surgery have OSA, and 80% of these individuals have never

been diagnosed (Wolfe et al., 2016).

Related to the presence of comorbidities secondary to obesity, patients undergoing

bariatric surgery who also have OSA are prone to higher rates of complications, prolonged

hospital stays, and an increased 30-day mortality rate (Glazer et al., 2018). While the gold

standard for diagnosing OSA involves polysomnography, this test can be expensive, time-

consuming, and requires resources that are not available in the perioperative setting (Glazer et

al., 2018). The STOP-Bang questionnaire was initially developed as a screening tool to be used

in preop and has the advantage of familiarity amongst providers and a simple scoring system.

This tool has been proven effective in identifying moderate to severe OSA amongst bariatric

surgical patients (Kreitinger et al., 2020).

While the American Academy of Sleep Medicine recommends annual OSA screening for

all patients with comorbidities such as heart failure and diabetes (AASM, 2019), there are no

current guidelines regarding OSA screening before surgery. Current literature finds the STOP-

Bang questionnaire a sensitive and accurate diagnostic tool for detecting all severities of sleep

apnea (Chung et al., 2016). The questionnaire consists of 8 questions related to the clinical

features of the disease, and patients scoring ≥3 should be classified as having potentially

undiagnosed OSA. Patients scoring 0 to 2 can be classified as low risk, whereas patients scoring

between 5 and 8 can be classified as high risk for moderate to severe OSA (Chung et al., 2016).

When compared to other screening tools such as The Berlin Questionnaire and the ASA

Checklist, the STOP-Bang questionnaire has higher sensitivity and specificity (Williams et al.,

2017). This questionnaire has been utilized in various surgical populations, has been highly

studied and validated, and is now widely used in the preoperative setting (Williams et al., 2017).

A systematic review and meta-analysis of 47 studies conducted throughout North America,

South America, Europe, the Middle East, and Asia concluded that the STOP-Bang questionnaire

has excellent sensitivity in detecting all severities of OSA, a low false-negative rate, and is a

reliable screening tool that can be used to prevent the morbidity and mortality associated with

OSA (Pivetta et al., 2021).

Current Approaches to Solving Population Problem(s)

Pre-screening phone calls made to surgical patients are often conducted one to two weeks

before the scheduled surgery. This agency used the STOP-Bang questionnaire to screen only

patients who report "snoring" in their health history. Questionnaire scores were recorded in an

obscure location that was not easily accessible within the patient chart. Scores that indicate a

patient is at high risk for moderate to severe OSA were not communicated to the perioperative

team. Thus, the information gained from the screening process could not be used to improve

patient safety and outcomes.

To assist this agency in revising the OSA screening process to be more consistent with current evidence, screening was completed on all bariatric surgery patients regardless of self-reported snoring. There is no consensus regarding the need for bariatric patients to undergo a sleep study prior to surgery, as many patients with OSA are asymptomatic and do not experience snoring or daytime sleepiness. Sleep studies are typically reserved for individuals experiencing symptoms of OSA that negatively affect their quality of life (O'Reilly et al., 2019). Therefore, preoperative screening of all bariatric surgery patients using the STOP-Bang questionnaire is critical, not only for the prevention of perioperative complications but also for appropriate post-surgical referral and treatment. In a study of 141 patients scheduled for prospective bariatric surgery and screened using the STOP-Bang questionnaire, 75% scored ≥ 4 and were found to have some level of sleep-disordered breathing (O'Reilly et al., 2019). The literature confirms the predictive value of this tool when used preoperatively to screen for OSA.

Evidence to Support the Intervention

OSA prevalence among surgical populations varies depending on the type of surgery performed. The prevalence rate of OSA among bariatric surgery patients is 70%, compared to 8.4% among orthopedic surgery patients (Chung et al., 2016). This partnering organization offers a comprehensive bariatric surgery program that involves counseling and lifelong support groups, making it a leading provider of bariatric surgery within the city in which the organization is located. With a large population of bariatric surgery patients and the high prevalence rate of OSA among these patients, pre-surgical screening for undiagnosed sleep apnea and prompt diagnosis and treatment of OSA is imperative for patient safety (Chung et al., 2016).

The STOP-Bang questionnaire has been validated for use in obese surgical patients, but the sensitivity and specificity of the test may be affected due to the high likelihood of all obese

patients answering "yes" to the questions regarding elevated body mass index (BMI) and large

neck circumference. In the general surgical population, patients scoring ≥ 3 on the STOP-Bang

questionnaire are likely to have undiagnosed OSA, but in the obese surgical population, a STOP-

Bang cut-off score of 4 retains high sensitivity across all levels of OSA severity (Nagappa et al.,

2017). Not only has the STOP-Bang been researched in the general population, but it has proven

effective and sensitive in screening obese patients undergoing bariatric surgery (Kreitinger et al.,

2020).

Evidence-Based Practice Framework

The STOP-Bang questionnaire was validated initially as a screening tool for surgical

patients to identify those at risk for OSA (Nagappa et al., 2017). While it is now validated for use

in sleep clinics and even primary care, this organization utilized the questionnaire in its original

intended population to streamline communication of its results to all staff caring for the

individuals being screened. The execution of this project was based upon the Plan-Do-Study-Act

(PDSA) cycle, a systematic process of learning, improvement, and implementation of change.

The PDSA cycle involves identifying a goal and formulating an action plan, implementing the

plan, monitoring outcomes to test validity, and integrating the information gained to adjust

implementation methods or change the goal altogether (Deming, 2021). This cycle is used to

design and implement quality improvement projects that lead to organizational systems-level

change.

The PDSA cycle was first used within this partnering organization to identify the need for

preop screening of OSA patients and to formulate a plan of action to screen these patients using

the STOP-Bang questionnaire. The cycle continued as this project was implemented within the

bariatric surgical population, and data were collected regarding nurse compliance, postoperative

complications, and PACU length of stay. The data were analyzed to determine if there had been beneficial change resulting from project implementation, if any changes needed to be made to improve the screening process, and if this process could be the new standard of care for all bariatric surgical patients.

Ethical Consideration & Protection of Human Subjects

The targeted population for intervention included bariatric surgery patients, as many within this population have undiagnosed OSA (Glazer et al., 2018). In addition, comorbidities related to obesity place these patients at a higher risk of postoperative complications, making pre-surgical screening essential (Glazer et al., 2018). Implementing this screening process created the opportunity to improve health outcomes for a high-risk population. By identifying undiagnosed OSA, care teams can be more aware of perioperative risk factors, and patients can be referred for formal diagnosis and treatment. This project posed no potential risk to the target population, who only stood to gain from improved care and increased awareness of their health status. Patient privacy was protected by de-identifying any information collected.

Preparing for the formal approval process involved researching the requirements for Institutional Review Board (IRB) approval within the organization and collaborating with the perioperative unit director and nurse manager to create an implementation plan. The Collaborative Institutional Training Initiative (CITI) provided educational modules regarding quality improvement versus research, IRB approval, and the ethical considerations surrounding the use of human subjects to conduct research. Organizational IRB approval was obtained (see Appendix C), and the project was deemed Quality Improvement by the partnering agency. In addition, University guidelines were followed, and the project was deemed Quality Improvement, not requiring further IRB review (see Appendix D).

Section III. Project Design

Project Site and Population

This quality improvement project took place at a 150-bed hospital in an urban city. Part of a more extensive health system, this agency specializes in orthopedic, vascular, and bariatric surgery. As these surgical procedures constitute a large portion of hospital revenue, this agency was enthusiastic about a project that could decrease OR "hold" minutes and PACU length of stay (███████ personal communication, April 2021). The project population included all adult patients undergoing scheduled, non-emergent bariatric surgery, including gastric bypass, gastric banding, and sleeve gastrectomy during the timeframe of implementation. A range of five to ten bariatric surgeries are performed weekly within this agency, providing the opportunity for ample data collection. Project facilitators included agency cooperation and collaboration and a large sample size of bariatric surgery patients. Potential barriers included staff resistance to change, leading to poor screening compliance and noncompliance with American Society of Anesthesiologists guidelines (ASA) to optimize PACU recovery for OSA patients.

Description of the Setting

The project was implemented within the perioperative section of the hospital. This section included the preoperative unit, the operating room (OR), and the post-anesthesia care unit (PACU). Implementation involved screening phone calls conducted by preop nurses, but in the event the patient did not answer the phone call, preop nurses conducted screening in the preoperative unit. If the patient was flagged within their paper chart as being at high risk for undiagnosed OSA, implementation of the project continued throughout the patient's perioperative experience to include OR and PACU.

Description of the Population

As discussed in the *Current State of Knowledge,* conditions such as obesity, hypertension, diabetes, and a large neck circumference predispose patients to OSA, and most of these individuals have never been formally diagnosed (Wolfe et al., 2016). Bariatric surgery patients, by nature, have been diagnosed with morbid obesity and are therefore at higher risk of OSA. The population screened included all adult patients >18 years of age who underwent scheduled, non-emergent bariatric surgery, including gastric bypass, gastric banding, and sleeve gastrectomy. As there is abundant evidence to support the high prevalence rate of OSA among bariatric surgery patients (Chung et al., 2016), and this agency specializes in bariatric surgery, the population within this agency was well-suited to participate in pre-surgical screening for undiagnosed OSA.

The project population that implemented this screening process included all preoperative nurses within the agency. The preop department comprises fifteen registered nurses with varying levels of experience who conducted the preop phone calls and utilized the STOP-Bang questionnaire to screen all patients undergoing bariatric surgery. They were responsible for screening patients and, based on the STOP-Bang score, were responsible for flagging patients within their paper chart to notify PACU nurses of increased postoperative risk. The Post-Anesthesia Care Unit (PACU) employs 21 registered nurses who received these patients from the operating room and cared for them during recovery. These PACU nurses were responsible for implementing evidence-based guidelines to optimize the recovery process and charting any postoperative complications that may have occurred.

Project Team

The project team consisted of the project lead, the perioperative nurse manager (site champion), the perioperative services director, and the preoperative clinical supervisor. The site champion worked weekdays within the organization and ensured that project implementation ran smoothly when the project lead was unavailable on site. The perioperative services director tracked all weekly operating room hold minutes and shared this data with the project lead. The project team lead educated all preop and PACU nurses regarding their role in project implementation. Preop nurses were responsible for screening and flagging patients, while PACU nurses were responsible for optimizing recovery and documenting any postoperative complications. The project lead worked with the site champion and preoperative clinical supervisor to educate preop and PACU staff. The project lead performed all data collection, analysis, and dissemination of findings. While not involved in overseeing the implementation of this project, stakeholders such as anesthesiologists, certified registered nurse anesthetists (CRNA), and operating room nurses were made aware of the implementation process and project goals.

Project Goals and Outcome Measures

The STOP-Bang questionnaire is an 8-question screening tool used to screen bariatric surgery patients within this agency (see Appendix E). The goal of project implementation was to streamline communication of questionnaire results between perioperative staff to optimize patient safety and outcomes. The streamlined communication of STOP-Bang questionnaire results occurred when patient charts were flagged with a neon green insert. This insert stated the patient was at high risk for postoperative complications related to OSA, and ASA guidelines should be implemented to optimize recovery (see Appendix F). Before implementation, an

informal, verbal survey revealed that PACU nurses were not receiving information during

handoff regarding a patient's risk of undiagnosed OSA. PACU nurses were asked to complete a

written post-implementation survey to determine if the communication of the STOP-Bang

questionnaire results was streamlined efficiently to reach their intended audience (see Appendix

G). A project data collection tool was used to track preop nurse compliance with screening and

ensure that screening was feasible in the preoperative setting (see Appendix H).

Description of the Methods and Measurement

All patients who met the project population's inclusion criteria during the implementation

timeframe were screened using the STOP-Bang questionnaire. Inclusion criteria required all

patients to be adults >18 years of age and scheduled for a non-emergent bariatric surgery.

Patients scoring ≥ 4 on the STOP-Bang questionnaire were flagged within their paper chart using

a neon green insert stating the patient's high-risk status and ASA guidelines. PACU nurses were

expected to follow these guidelines, including upright positioning, multimodal pain management,

restrictive fluid management, and maintenance of oxygen saturation greater than 93%. Nurse

compliance with the screening process was tracked within the project data collection tool as this

was a potential barrier to implementation.

Discussion of the Data Collection Process

Collected data were obtained from the patient's electronic medical record and were stored

on an encrypted document in a password-protected computer. While data collection occurred by

accessing the electronic medical record on-site at the agency, data were recorded and stored

within the project lead's computer within the encrypted data collection tool. Data included nurse

compliance with the screening process, the patient's STOP-Bang score, any record of

postoperative complications with physician notification, PACU length of stay, date of the

surgical procedure, and weekly OR "hold" minutes. As all bariatric surgery patients underwent

screening, many were previously diagnosed with OSA and were currently wearing continuous

positive airway pressure (CPAP) machines. Therefore, data collection points also included a

previous history of OSA and whether the patient wore a CPAP.

Patients were screened using a paper copy of the STOP-Bang questionnaire. When the

questionnaire was complete, a patient label was attached, and the questionnaire was placed in a

designated folder at the preop nurses' station. To track nurse compliance, all STOP-Bang

questionnaires were reviewed to ensure every bariatric patient was screened. In the case of a

bariatric patient not being screened, the data collection tool still reflected all data points

including lack of nurse compliance with screening.

The project lead reviewed the chart of every bariatric surgery patient during the months

of implementation and recorded the data, ensuring it was de-identified and no personal health

information or identifiers were recorded. The data were stored within an encrypted excel

spreadsheet, with each patient being assigned a unique identifier and all data points collected on

each patient. All collected data were evaluated post-implementation, including post-op

complications, PACU length of stay, OR "hold" minutes, nurse compliance with screening, and

the post-implementation survey of PACU nurses. Project outcomes were evaluated using

frequencies and percentages of collected data and then displayed in graphs and tables.

Implementation Plan

It is standard procedure at this agency for preop nurses to call all patients the evening

before their scheduled surgery to discuss an expected arrival time and NPO guidelines. Over a

three-month implementation period, bariatric surgery patients were screened during their

preoperative phone call the evening before surgery using the STOP-Bang Questionnaire. If a

patient did not answer the preop phone call and complete the screening, the questionnaire was

completed within the preop setting prior to surgery.

Patients were screened using a paper copy of the STOP-Bang questionnaire. When the

questionnaire was complete, a patient label was attached, and the questionnaire was placed in a

designated folder at the preop nurses' station. If the bariatric surgery patient scored a 4 or above

on the questionnaire, they were flagged within their paper chart using a neon green insert stating:

"ATTENTION: Patient is at high risk for postoperative complications related to sleep apnea.

NURSING: please use upright positioning, multimodal pain management, and restrictive fluid

management when caring for this patient. Maintain oxygen saturation greater than 93%. Chart

any post-op complications within the physician notification section of the EMR" (see Appendix

F) (Olsen et al., 2020). Based on screening results, preop, OR, and PACU staff were made aware

of a patient's increased risk of postoperative complications and were asked to follow evidence-

based guidelines to optimize patient safety and outcomes.

Preop and PACU staff were educated in a series of in-services held by the project lead.

Two mandatory meetings were held in person within the setting of project implementation.

Verbal instructions were given with an accompanying handout to all preop and PACU staff that

participated. All PACU nurses were educated on documenting post-op complications among

these flagged, high-risk patients. All preop nurses were educated on conducting the STOP-Bang

questionnaire and interpreting screening results. A sample of the neon green flag inserted into

paper charts of high-risk patients was presented during the meeting. A roster with names of staff

members attending the in-services was signed to affirm the attendance of those educated. Those

who could not participate in the in-services were educated individually by the project lead prior

to implementation. Education points were also sent out via e-mail to all preop and PACU staff

and included the project implementation timeline.

Data were collected and reviewed weekly over twelve weeks to determine nurse

compliance with screening and if certain staff members needed follow-up education on the

screening process. Any documented postoperative complications were reviewed to determine if a

correlation existed between post-op complications and a high STOP-Bang score. Staff meetings

were held four and six weeks after the start of project implementation to discuss the PDSA cycle

review and determine if any changes should be made to the screening process. PACU nurses

were asked to comment on the communication of STOP-Bang questionnaire results to assess any

barriers to implementing ASA guidelines or charting postoperative complications. Data findings

were discussed with the project site champion during bi-weekly meetings.

Timeline

Project implementation began in September 2021 and ended in December 2021.

Education of staff regarding the implementation plan and their role in the project occurred in

September 2021, one week prior to project implementation. All data collection took place at the

end of each week to include all scheduled bariatric surgical patients. Team meetings were held in

person during the daily "team huddle" that keeps staff updated on unit changes and

announcements. A detailed timeline was developed to reflect the scheduled site champion and

staff meetings (see Appendix I). Per the PDSA cycle framework, meetings were used as an

opportunity to discuss any implementation problems and possible solutions.

Section IV. Results and Findings

Results

The intended purpose of this quality improvement project was to implement a simple, effective preoperative screening process for OSA patients and streamline communication of screening results. In doing so, the staff caring for these high-risk patients would be aware of the patient's risk status and could use evidence-based interventions to optimize the recovery process and improve patient safety. Data collection over twelve weeks was recorded within the data collection tool (see Appendix H). During the twelve weeks, 79 patients were scheduled for bariatric surgery, and all met screening eligibility criteria. Of the 79 patients, 52 (66%) were screened using the STOP-Bang questionnaire, and 42 (53%) were found to have a previous OSA diagnosis based on EMR records. Of the 52 patients screened, 27 (52%) scored ≥ 4 on the STOP-Bang. Out of 27 that scored high on the STOP-Bang, 19 (70%) had previously been diagnosed with OSA, but eight had not and were thus found to have probable undiagnosed OSA.

Prior to implementation, an informal, verbal survey of 18 PACU nurses revealed that none of the nurses had ever received information regarding a patient's risk of undiagnosed OSA based on their STOP-Bang score. A formal, 3-question, post-implementation survey (Appendix G) was completed by the 11 PACU nurses. These 11 nurses were chosen to complete the survey as they had remained employed throughout the entirety of implementation. Findings from the survey revealed that seven (64%) out of 11 nurses remembered receiving a patient who was flagged as being at high risk for complications related to OSA. Out of these seven nurses, six stated that they implemented ASA guidelines as directed. Out of 11 nurses, two said they believed they had cared for a patient during implementation who had OSA but was not screened using the STOP-Bang questionnaire.

The mean PACU length of stay for all 79 patients was 78 minutes, the mean PACU length of stay for the 27 patients scoring ≥4 on the STOP-Bang was 79.3 minutes, and the mean PACU length of stay for all patients who had previously been diagnosed with OSA was 78.8 minutes. Of the 79 patients, seven (8.8%) experienced postoperative complications, including cardiac arrhythmias, oversedation, hypertension, and hypoxia. The mean PACU length of stay amongst these seven patients was 121 minutes. Only three (42%) of the seven patients who experienced postoperative complications were screened appropriately by preop staff; thus, the STOP-Bang score for the majority of these patients is unknown.

Prior to implementation, 14 preop nurses were educated on screening patients using the STOP-Bang questionnaire. During the implementation period, the average nurse compliance with screening using the STOP-Bang questionnaire was 66%. Compliance was tracked weekly and varied widely (see Appendix J). Week one of education revealed 100% compliance with patient screening, but this decreased to 44% by week three. Re-education of all preop nurses occurred after week three, and compliance increased to 100% during week four. Compliance with screening stabilized during weeks five through nine between 75-85%. However, it decreased to 37% during week ten and as low as 0% during week twelve. Data trending demonstrated that overall compliance rates were high at the beginning of implementation, stabilized, and then decreased at the end. As preop nurses were responsible for flagging patients who scored ≥4 on the STOP-Bang, nurse compliance with screening and flagging high-risk patients directly affected communication of results to PACU nurses.

When organizational needs were being assessed in the months prior to implementation, the organization was meeting its goal of 70 or fewer total OR hold minutes per week. Total weekly OR hold minutes were collected to assess for any changes related to PACU length of stay

amongst bariatric surgery patients (see Appendix K). The average weekly OR hold minutes during implementation was 353, far exceeding the organizational goal of 70 or fewer minutes per week.

Discussion of Major Findings

Current literature finds the STOP-Bang questionnaire a sensitive and accurate diagnostic tool for detecting all severities of OSA (Chung et al., 2016). Throughout project implementation, 27 patients scored ≥4 on the STOP-Bang questionnaire, and 19 (70%) of these patients had already been formally diagnosed with OSA. This percentage indicates that the STOP-Bang screening tool has a high sensitivity rate in patients at high risk of undiagnosed OSA. In a study of 141 patients scheduled for prospective bariatric surgery and screened using the STOP-Bang questionnaire, 75% of individuals scoring ≥4 were found to have some level of sleep-disordered breathing (O'Reilly et al., 2019). Consistent with these findings, 70% of patients scoring ≥4 during project implementation were found to have a previous diagnosis of OSA.

The prevalence rate of OSA among bariatric surgery patients is 70%, compared to 8.4% among orthopedic surgery patients (Chung et al., 2016). Of the 79 bariatric surgery patients within the project population, 50 (63%) had a previous OSA diagnosis or scored ≥4 on the STOP-Bang questionnaire indicating undiagnosed OSA. However, as only 52 of the 79 bariatric surgery patients were screened using the STOP-Bang, it is unknown if more individuals in the project population may have scored ≥4 on the questionnaire. Findings from the data collected are consistent with the literature and demonstrate the overwhelming prevalence of OSA among bariatric surgery patients.

Nurse compliance with screening was a significant barrier to implementation and reduced the potential effectiveness of preoperatively screening all bariatric surgical patients. With an

average compliance rate of 66% over twelve weeks, many patients who met the inclusion criteria

were not screened. Thus, patients with potentially undiagnosed OSA were not flagged as being at

high risk for complications, and no further information was communicated to anesthesia staff or

PACU. Although it is not altogether clear why nurse compliance varied widely from week to

week, a lack of understanding surrounding the screening process and the increased surgical

caseload towards the end of implementation are probable factors. As surgical case numbers

increased, preop nurses became busier, and patient screening was likely regarded as a non-

necessity.

The literature describes that patients with symptomatic OSA often require more

demanding nursing care within the post-anesthesia care unit (PACU), increased use of hospital

resources and an increased PACU length of stay (Brousseau et al., 2014). Findings from the data

collected did not necessarily reflect this. While the mean PACU length of stay of all

postoperative patients regardless of OSA diagnosis was not tracked, the mean PACU length of

stay of all bariatric surgery patients versus those previously diagnosed with OSA was roughly the

same, around 80 minutes. However, the mean PACU length of stay amongst the seven patients

who experienced postoperative complications increased to 121 minutes. Naturally, patients who

experience these complications are likely to have a prolonged PACU stay while being treated. As

four of the patients who experienced complications were not screened, their STOP-Bang scores

cannot be evaluated as a potential indicator of complications.

This increase in surgical cases in the last quarter of 2021 directly impacted OR hold

minutes. While elevated OR hold minutes can indicate prolonged PACU length of stay amongst

patients, it is an invariable outcome of high surgical case numbers and limited PACU space. OR

hold minutes during the weeks of project implementation averaged 353 minutes per week, but

this does not reflect the success of the project or the effects it may have had on PACU length of

stay amongst bariatric surgery patients.

Section V. Interpretation and Implications

Costs and Resource Management

There were several costs associated with project implementation. These included the cost of supplies used to screen patients and flag them within their paper charts, the cost of labor from both preop and PACU nurses, and the unpaid work performed by the project lead. The cost of paper and printer ink items equated to around $35. The estimated time spent screening each patient was two to three minutes, and with 52 patients screened over twelve weeks, this equated to roughly two hours of paid labor by preop nurses. In North Carolina, the average hourly pay for a perioperative nurse is $35.56 (Indeed, 2022), bringing the total cost of preop nurse labor to $71.12. The time PACU nurses spent implementing ASA guidelines for flagged, high-risk patients is not a quantifiable cost as all flagged patients required varying levels of care. Roughly 200 hours were spent on project development and implementation. If this project had been developed and implemented during work hours while considering the average hourly pay for a perioperative nurse, the cost of this labor would equate to $7,112. The total estimated cost of project implementation, including supplies and labor, equates to $7,218.12 (Appendix L).

Screening was made simple to increase the feasibility of screening all patients preoperatively if this were to become the standard of care. Using the STOP-Bang questionnaire to screen patients required minimal time and was added to the prompt that nurses previously used to make preop phone calls. While screening patients added a few extra moments to each bariatric surgery preop phone call, it did not detract from the current level of preop nursing care. However, the project site champion spent a significant amount of time with the project lead on project development and meetings. This time could potentially have taken away from productive tasks the project champion would have otherwise worked on as the perioperative nurse manager.

PACU minutes are an expensive hospital resource. While the PACU length of stay for each bariatric surgery patient was collected, this could not be used to indicate project success. A more extensive study comparing PACU minutes before and after implementation of the screening process would be required to determine if the knowledge of an OSA diagnosis can decrease PACU length of stay. However, the findings demonstrated that patients who experienced postoperative complications required a longer PACU length of stay. Considering that the average PACU minute costs $37, if a patient with undiagnosed OSA experiences a preventable postoperative complication requiring a conservative 100 additional PACU minutes, that is $3,700 in additional cost. The cost of one patient requiring a prolonged PACU length of stay equals roughly half the total cost of project implementation. With preop screening and early recognition of OSA, it is likely that high-risk patients would receive optimized care that decreases their risk of postoperative complications. In turn, this would reduce the likelihood of a prolonged PACU stay and benefit the organization financially.

Implications of the Findings

Implications for Patients

It is important to note that the screening process elicited eight patients without a previous diagnosis of OSA who scored $\geq$4 on the STOP-Bang questionnaire. These eight patients represented 30% of all patients who scored $\geq$4 on the questionnaire, indicating a high prevalence of undiagnosed OSA within this population. One of these five patients experienced a postoperative complication involving bigeminy and a prolonged QT interval, consistent with the literature that finds OSA patients at increased risk for postoperative cardiac events (Wolfe et al., 2016). Considering that close to one-third of all patients with elevated STOP-Bang scores did not

have a previous OSA diagnosis, preop screening is essential if these patients are to receive the

diagnosis and treatment they need.

Patients who score $\geq$4 on the STOP-Bang questionnaire and do not have a previous OSA

diagnosis should be encouraged to seek follow-up care for diagnosis and treatment. Moderate to

severe OSA, when untreated, can cause cardiac arrhythmias due to tissue hypoxemia,

hypertension, coronary artery disease, and heart failure (Dredla & Castillo, 2019). These diseases

carry significant long-term consequences that may be avoided with the use of CPAP. In addition,

there are preventable costs related to the treatment of these secondary comorbidities such as

medications, doctors' appointments, and potential hospital stays. Patients with suspected

undiagnosed OSA should follow up with their primary care provider for a formal sleep study

and, if necessary, treatment with CPAP. The Healthy People 2030 goal of increasing the number

of people who seek medical evaluation for symptoms of OSA relies on early screening and

detection for appropriate referral, evaluation, and treatment to occur.

Implications for Nursing Practice

While this organization does use the STOP-Bang questionnaire to screen preop patients

with self-reported snoring, the results are not communicated to staff, and the patients do not

benefit from the current screening process. Considering the high prevalence rate of OSA

amongst the general surgical population and the high sensitivity of the STOP-Bang

questionnaire, this simple tool should be integrated into the standard of care for screening all

patients before surgery. Interprofessional collaboration and communication between nursing staff

regarding a patient's risk factors are paramount in providing safe, patient-centered care. In

addition, creating a standard of care for screening would align with the Triple Aim to improve

patient safety and outcomes. Systems-level changes that benefit both patients and healthcare

systems should be prioritized in nursing practice, and screening patients for OSA is a change that would improve patient safety and outcomes while potentially decreasing unnecessary spending within the organization.

Impact on Healthcare System(s)

This organization does not have a current policy regarding the care of OSA patients before and after surgery. Considering the increased risk of complications in patients with OSA, organizations should seek to optimize the surgery and recovery process. Healthcare systems should utilize the current state of knowledge surrounding sleep apnea, perioperative risk, practical screening tools, and the importance of prompt diagnosis and treatment of OSA. With this knowledge, organizations should apply a standard of care for screening OSA patients, anesthesia guidelines for those with high STOP-Bang scores, and postoperative treatment and referral for follow-up and diagnosis.

The cost associated with OR hold minutes and prolonged PACU length of stay may be largely preventable. With effective and affordable preoperative screening, patients with undiagnosed OSA can be identified, and their intraoperative and postoperative recovery processes can be optimized to improve outcomes and decrease the risk of complications. Results from data collected demonstrated that patients who experienced postoperative complications required lengthier PACU stays. With 100 PACU minutes costing roughly $3,700, healthcare agencies should consider early screening and detection of OSA as an avenue to decrease unnecessary spending while also benefitting patients.

Sustainability

Although this organization supported implementing a project that would improve patient safety and outcomes, several organizational changes would need to be made for the screening

process to become a standard of care. Nurse compliance with screening was the most significant

barrier to implementation. As screening occurred during preop phone calls, revising the process

of calling patients preoperatively could make screening all patients feasible.

Two potential organizational changes could improve patient screening and ensure all

eligible patients are screened appropriately. The first option is for the organization to hire an

individual to complete all preop phone calls to patients undergoing surgery the following day.

Although screening was only conducted on bariatric surgical patients, all surgical patients should

ideally be screened for undiagnosed OSA considering the increased risk of perioperative

complications associated with this diagnosis (Erwin et al., 2019). If all patients were screened

during preop phone calls, this would add considerably to the workload of preop nurses who have

already worked a full shift before conducting these calls. Hiring a designated individual to

conduct preop phone calls could ensure compliance with screening.

A second option is for the organization to create a preop phone call flowsheet within the

electronic medical record (EMR) that requires nurses to enter the STOP-Bang score or

acknowledge a previous diagnosis of OSA and CPAP use. Requiring nurses to follow a prompt

documented within the EMR would ensure compliance and create an area within the patient's

record dedicated to the STOP-Bang questionnaire. For patients scoring ≥ 4 on the STOP-Bang, it

would be beneficial to create an alert within the EMR that would notify everyone within the care

team of the patient's diagnosis and associated risks.

Dissemination Plan

A summary of project implementation will be shared during a virtual presentation to

DNP project faculty on April 14th. Dissemination at the project site will occur in a virtual

presentation with hospital leadership during their monthly meeting on May 5th, 2022.

Dissemination of the DNP paper will occur through upload to the university Scholarship platform for public access. Organizations that may benefit from the information gained through project implementation include the American Society for Metabolic and Bariatric Surgery (ASMBS), the American Society of Perianesthesia Nurses (ASPAN), and the American Sleep Apnea Association (ASAA). The North Carolina Association of Perianesthesia Nurses (NCAPAN) will hold a state conference on September 23rd, 2022, in Wilmington, NC. Plans are in progress to submit an abstract of project implementation, facilitators, and barriers for discussion at this 2022 conference.

While the project saw success in identifying individuals with undiagnosed OSA, there is significant room for improvement in nurse compliance with screening and implementing a new standard of care amongst perioperative nurses. Implications of project results and recommendations for further study could benefit other agencies trying to improve OSA screening processes or implement evidence-based practices into their standard of care. The partnering agency is part of a more extensive hospital system that, similarly, does not effectively use the STOP-Bang questionnaire to screen preop patients. This hospital system could benefit from information gained during project implementation. Based on feedback from the partnering agency's leadership team, dissemination to larger hospitals within the system is a possibility.

Section VI. Conclusion

Limitations and Facilitators

Project limitations included preop nurse compliance with screening, COVID infections amongst preop nurses, and a high preop nurse turnover rate during the months of project implementation. In retrospect, compliance with screening could have been made more appealing by creating a monthly incentive for nurses that completed the screening process. Biweekly e-mail reminders should have been sent to all perioperative staff and included the status of implementation, current compliance rates, and gratitude to all involved in improving patient safety and outcomes through implementation. Screening compliance was affected by multiple COVID infections amongst staff and a high staff turnover rate. While there was no use of temporary staff such as float pool nurses or travel nurses that may have affected compliance, there was no formal screening education process for new preop nurses hired during the implementation period. Nurse turnover and lack of education regarding screening may have contributed to poor screening compliance.

Several factors facilitated the success of project implementation. The organization and its nursing staff were supportive of the new screening process, and a large bariatric surgical population allowed for optimal data collection over twelve weeks. The perioperative nursing director and nurse manager's availability and eagerness were beneficial throughout project development and implementation, and an easy-to-navigate EMR made data collection efficient and straightforward.

Recommendations for Others

Based on implementation results, there are several recommendations for other agencies that may use the STOP-Bang questionnaire to screen surgical patients. Before implementation,

agencies should focus on a solid foundation of nurse education surrounding the screening

process and expectations. Considering the implications that early screening and detection of

OSA has on patient safety and outcomes, nursing staff must fully understand these implications.

Ensuring that staff is educated about the STOP-Bang questionnaire, the screening process, and

the importance of early screening would potentiate higher screening compliance amongst preop

nurses.

Patients with a prior history of OSA should not be screened using the STOP-Bang

questionnaire. For simplicity, all bariatric surgical patients were screened during project

implementation. However, screening is unnecessary for patients with a previous history of OSA

and those who already use CPAP. A prior diagnosis of OSA should be communicated to PACU

staff during handoff when discussing the patient's past medical history. In addition, ASA

guidelines for OSA patients are evidence-based and should be standardized in all PACU settings.

Anesthesia order sets should include ASA guidelines for all patients with a previous history of

OSA or a high STOP-Bang score. A physician order for these guidelines would ensure that

patients with OSA receive nursing care that optimizes their recovery.

Recommendations for Further Study

With high prevalence rates of OSA amongst the general surgical population, all surgical

patients could benefit from OSA screening. Expanding this project to include all surgical patients

would provide more information on STOP-Bang scores in the general population and how this

affects rates of postoperative complications and prolonged PACU length of stay. The success of

any further studies is contingent on high screening compliance rates, and thus, changes must be

made to the screening process. The sustainability of a new standard of care would rely on hiring

a staff member to make preop phone calls. In addition, creating a STOP-Bang flowsheet within

the EMR would allow for accessibility to STOP-Bang scores and ease of use. Flagging patients

within the EMR that score $\geq$4 on the STOP-Bang would enhance interprofessional

communication and ensure that everyone on the patient's care team is aware of a potential OSA

diagnosis.

Final Thoughts

This project aimed to streamline communication of STOP-Bang questionnaire results and

implement ASA guidelines in OSA patients postoperatively to improve safety and outcomes.

The screening process accomplished its intended purpose of identifying patients with

undiagnosed OSA. Eight patients without a previous diagnosis were identified as having OSA

based on a high STOP-Bang score. However, nurse compliance with screening was a significant

barrier to implementation and reduced the potential effectiveness of preoperatively screening all

bariatric surgical patients.

Findings from data collected suggest the need for OSA screening in all bariatric surgery

patients. This screening process should be included within the standard of care and regarded as

an evidence-based practice that improves patient safety and outcomes. In accordance with

Healthy People 2030, the overarching goal of early screening and detection of OSA is referral,

evaluation, and treatment. Screening patients and creating a record of their risk for undiagnosed

OSA is crucial for patients to receive the future care and treatment they need for this severe

illness.

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Appendix A

Literature Search Log

DNP Project
Literature Search Log

Student: Elizabeth Putnam

Date of Submission: 10/4/2021

Project Title: Using the STOP-Bang Questionnaire Preoperative to Streamline Communication of its Results

Date of Search	Database	Key Word Searches	Limits	# of Citations Found / Kept	Rationale for Inclusion / Exclusion (include rationale for excluding articles as well as for inclusion)
3/6/2021	OneSearch via ECU Laupus Health Sciences Library	STOP-Bang AND Sleep Apnea	Published within the last five years exclusive of sentinel pieces, scholarly and peer-reviewed articles, availability of full text, level III evidence and above as depicted by the Pyramid Model	993 results	Some articles were reviewed based on relevance and title, but further key words were added during next literature search to ensure all articles were discussing postoperative surgical patients.
3/9/2021	OneSearch via ECU Laupus Health Sciences Library	STOP-Bang AND Sleep Apnea AND Surgery AND Postoperative	Published within the last five years exclusive of sentinel pieces, scholarly and peer-reviewed articles, availability of full text, level III evidence and above as depicted by the Pyramid Model + only journals to fall under the discipline of "Medicine" and "Nursing" were considered	108 results / 24 kept	Articles discussing pediatric patients and those in non-english text were excluded. Articles were then sorted by relevance, and titles that included the STOP-Bang questionnaire, sleep apnea, surgical patients, pre-op screening, and evidence regarding the use of the STOP-Bang questionnaire to screen surgical patients were selected
3/15/2021	OneSearch via ECU Laupus Health Sciences Library	STOP-Bang AND Bariatric Surgery	Published within the last five years exclusive of sentinel pieces, scholarly and peer-reviewed articles, availability of full text, level III evidence and above as depicted by the Pyramid Model	70 results	Articles dicussing pediatric patients and those in non-english text were excluded. Articles were sorted by relevance, and titles that included the STOP-Bang questionnaire, sleep apnea, surgical patients, pre-op screening, and evidence regarding the use of the STOP-Bang questionnaire to bariatric surgical patients were selected.

Appendix B

Literature Matrix

Authors	Year Pub	Article Title	Theory	Journal	Purpose and take home message	Design/Analysis /Level of Evidence	IV DV or Themes concepts and categories	Instr. Used	Sample Size	Sample method	Subject Charac.	Comments/critique of the article/methods GAPS
Brousseau, Dobson, & Milne	2014	A retrospective analysis of airway management in patients with obstructive sleep apnea and its effects on postanesthesia care unit length of stay	N/A	Canadian Journal of Respiratory Therapy	Patients with sleep apnea are more likely to experience prolonged PACU length of stay due to apnea and oxygen desaturation.	III - Retrospective analysis	No IV or DV, retrospective analysis	A standardized form was used for documentation of patient demographics, ambulatory and admission status, PACU admission and discharge times, desaturation or apnea events in the PACU, and continuous positive airway pressure (CPAP) use	91	6 months of data collection on 91 patients at an urban hospital.	66 men, 25 women	Authors found that a confirmed diagnosis of OSA through pre-op screening may prepare anesthesia for difficult intubation or airway management and prepare PACU nurses for postoperative management.
Chung, F., Abdullah, H., & Liao, P	2016	STOP-Bang questionnaire: A practical approach to screen for obstructive sleep apnea	N/A	American College of Chest Physicians	Studies have demonstrated that the STOP-Bang questionnaire is a concise, effective, and reliable OSA screening tool.	II - Systematic Review	N/A	STOP-Bang questionnaire consists of 8 yes/no questions, each worth 1 point	N/A	N/A	N/A	Limitations: The STOP-Bang is validated in multiple populations but has been shown to be less effective amongst veterans and patients with renal failure. Prevalence rate of OSA is 70% among bariatric surgery patients and 8.4% in orthopedic patients.
Erwin, A., Noble, K., Marshall, J., & Cooper, S	2019	Perianesthesia nurses' survey of their knowledge and practice with obstructive sleep apnea	N/A	Journal of PeriAnesthesia Nursing	This study surveyed perianesthesia nurses who care for adult patients with diagnosed or undiagnosed OSA who present for elective surgery. Data was collected related to nurse perception of screening and management of OSA.	III - anonymous descriptive study	N/A	27-question online survey. SPSS was used to create descriptive data	1,222	Randomly selected ASPAN members received an email invitation to participate with a link to consent.	Mean age 52.9 years, mean years of nursing experience 28.1	Forty-nine percent of participants felt that OSA patients have increased length of stay in the Phase I PACU. Thirty percent of participants feel that patients with suspected OSA have increased complication rates in the Phase I PACU.

Authors	Year Pub	Article Title	Theory	Journal	Purpose and take home message	Design/Analysis /Level of Evidence	IV DV or Themes concepts and categories	Instr. Used	Sample Size	Sample method	Subject Charac.	Comments/critique of the article/methods GAPS
Glazer, S. A., Erickson, A. L., Crosby, R. D., Kieda, J., Zawisza, A., & Deitel, M	2018	The evaluation of screening questionnaires for obstructive sleep apnea to identify high-risk obese patients undergoing bariatric surgery	N/A	Obesity Surgery	To evaluate three standardized screening questionnaires that are utilized to identify patients at high-risk for OSA undergoing bariatric surgery.	III - retrospective analysis	N/A	Berlin Questionnaire, STOP-Bang questionnaire, Epworth sleepiness scale, standard overnight polysomnogram	277	Patients without a previous diagnosis of OSA were recruited. >18 years old, BMI >40, or >35 with obesity related illness.	84.6% female, average age 44.2	Limitations include small sample size and the fact that patients undergoing a polysomnography exam may not sleep well, which could result in underdiagnosis of sleep apnea in the patients.
Kreitinger, K. Y., Lui, M. M., Owens, R. L., Schmickl, C. N., Grunvald, E., Horgan, S., Raphelson, J. R., & Malhotra, A	2020	Screening for obstructive sleep apnea in a diverse bariatric surgery population	N/A	Obesity	The study objective was to compare the ability of four existing tools (STOP-BANG, NO-OSAS, No-Apnea, and the Epworth Sleepiness Scale) to screen for moderate to severe OSA in a diverse bariatric cohort.	III - Retrospective review	N/A	Epic Slicer Dicer software was used to identify patients who had bariatric surgery within the targeted time frame through a search of procedural codes.	214	Data from adult patients scheduled for bariatric surgery between January 2016 to March 2019.	83.2% young women, median age 39 years, half of which self-identified as Latino	STOP-BANG and NO-OSAS may be preferable to No-Apnea and ESS when screening bariatric surgery patients for moderate to severe OSA.
Mutter, T., Chateau, D., Moffatt, M., Ramsey, C., Roos, L., & Kryger, M	2014	A matched cohort study of postoperative outcomes in obstructive sleep apnea: Could preoperative diagnosis and treatment prevent complications?	N/A	Anesthesiology	The authors investigated whether preoperative diagnosis of OSA and use of CPAP therapy reduced the risk of postoperative complications.	I - matched cohort study	IV: preoperative diagnosis and use of CPAP. DV: Postoperative complications	All data was analyzed using SAS software	1,922	All patients 18-yrs old at the time of surgery with both diagnosed and undiagnosed sleep apnea undergoing various surgical procedures	No demographic information provided	Diagnosis of OSA and use of CPAP therapy were associated with a reduction in postoperative cardiovascular complications.

Authors	Year Pub	Article Title	Theory	Journal	Purpose and take home message	Design/Analysis /Level of Evidence	IV DV or Themes concepts and categories	Instr. Used	Sample Size	Sample method	Subject Charac.	Comments/critique of the article/methods GAPS
Nagappa, M., Wong, J., Singh, M., Wong, D., & Chung, F	2017	An update on the various practical applications of the STOP-Bang questionnaire in anesthesia, surgery, and perioperative medicine	N/A	Current Opinion in Anesthesiology	To provide an update on the practical applications of the STOP-Bang questionnaire in anesthesia, surgery, and perioperative medicine	III - nonexperimental systematic review	N/A	N/A - analysis of STOP-Bang questionnaire	N/A	N/A	N/A	The STOP-Bang is validated for use in the sleep clinic, surgical, and general population. Patients with a STOP-Bang score of 0-2 are low-risk for moderate-to-severe OSA. Scores 5-8 can be classified as high-risk for moderate-to-severe OSA.
O'Reilly, E., Doherty, L., & O'Boyle, C.	2019	How relevant is pre-operative obstructive sleep apnoea in the asymptomatic bariatric surgery patient?	N/A	Obesity Surgery	This study aimed to establish whether screened and unscreened BS patients are at increased risk of post-operative complications.	III - retrospective review	N/A	Data was analyzed using SPSS v24.0 software	510	Hospital records of all patients undergoing bariatric surgery between 2008 and 2017 were evaluated	75.5% female. Mean age 46. Mean BMI 49	No difference in length of stay between those with and without OSA, suggesting that not all individuals undergoing bariatric surgery are in need of a sleep study preoperatively.
Pivetta, B., Chen, L., Nagappa, M., Saripella, A., Waseem, R., Englesakis, M., & Chung, F.	2021	Use and performance of the STOP-Bang questionnaire for obstructive sleep apnea screening across geographic regions	N/A	JAMA Network Open	This study found that the STOP-Bang questionnaire has adequate sensitivity and diagnostic accuracy for detecting moderate to severe obstructive sleep apnea.	I - Systematic review and meta-analysis	N/A	PRISMA guidelines followed to extract data from all relevant articles by 2 reviewers. Data was stored using 2x2 contingency tables	26547 over 47 studies	Various databases were searched to find articles between January 2008 and March 2020.	65% men, mean BMI 32, mean age 50	A STOP-Bang of 3 or greater showed excellent sensitivity (>90%) and high specificity. Results suggest that the STOP-Bang questionnaire can be used as a screening tool to assist in triaging patients with suspected OSA and referring them for further treatment.
Williams R., Williams M., Stanton M., & Spence D.	2017	Implementation of an obstructive sleep apnea screening program at an overseas military hospital	N/A	American Association of Nurse Anesthesiology	Project aimed to determine if educating nurses about OSA and using the STOP-Bang questionnaire to screen patients was associated with increased diagnosis of OSA and physician notification of suspected OSA.	III - retrospective analysis	N/A	No information about statistical analysis tools provided	100	1 month retrospective chart review of 100 medical records in January 2011. 100 charts were reviewed after implementation in February 2011.	No demographic information provided	Findings suggest that educating nurses regarding OSA while simultaneously implementing use of the STOP-Bang questionnaire resulted in an increased proportion of patients diagnosed with high risk OSA.

Authors	Year Pub	Article Title	Theory	Journal	Purpose and take home message	Design/Analysis /Level of Evidence	IV DV or Themes concepts and categories	Instr. Used	Sample Size	Sample method	Subject Charac.	Comments/critique of the article/methods GAPS
Wolfe, R., Pomerantz, J., Miller, D., Weiss-Coleman, R., & Solomonides, T.	2016	Obstructive sleep apnea: Preoperative screening and postoperative care	N/A	*American Board of Family Medicine*	This article addresses the following questions: Should patients receiving surgery be screened for OSA? Which screening tools are best? How should patients at risk of OSA or who have OSA be cared for perioperatively?	III - systematic review, nonexperimental study	N/A	No information about statistical analysis tools provided	N/A	A keyword search of the Cochrane Library, MEDLINE/PubMed databases were searched for articles between January 1995 through July 2015.	No demographic information provided	In the authors' opinions, Hospitals need to have standardized practice guidelines to guide the management of surgical patients with OSA. Use of the STOP or STOP-Bang questionnaire should become part of every adult preoperative examination

Appendix C

Organizational IRB Approval

Other Considerations

	Yes	No
Does your project involve a vulnerable population, e.g. children, impaired adults with special consent issues, Atrium employees? See link	O	⊗
Are there plans to publish information gained from this project?	O	⊗
Will patients be consented for entry into this project?	O	⊗

What are the potential risks to participants?

No potential risks
(Please list, separate by comma (,))

What are the potential benefits to participants?

Improved patient safety and outcomes, reduced postoperative complication, decreased PACU length of stay, decreased cost.
(Please list, separate by comma (,))

Signatures

CERTIFICATION OF PROJECT LEAD:

I certify that the information provided in this IRB Review of QI and Research Projects screening form is complete and accurate. The above titled project has been/will be conducted in full compliance with the HHS/FDA Regulations and IRB requirements/policies governing human subject research. IRB review is required for projects meeting the criteria of, "Research" as noted above.

Signature of Project Lead:

Date:

03-24-2021 15:21:56

Are you a resident or student?

⊗ Yes

What category?

⊗ DNP/PhD Nursing

CERTIFICATION OF DEPARTMENT CHAIR (If a resident or student):

I certify that I have read the attached IRB Review of QI and Research Projects screening form and the project has been reviewed.

Record ID 1500 - Elizabeth Putnam (submitted: 03-23-2021)

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Signature of Department Chair:

Date:

03-25-2021 12:01:32

Please note: If the AH IRB determines your project DOES meet the definition of Human Subjects Research, you will be required to submit the Expedited/Exempt Protocol Application, prior to beginning any research activities.

The application can be found, HERE.

DNP Use Only

Reviewed completed?   ⊗ Yes

DNP Signature:

Date: 03-31-2021 09:49:14
                                                     ((click "Now" if signing now.))

IRB Use Only

Staff Section

Please be sure that the DNP section above is completed.

Reviewed by: ⊗ Jomani Cheeseman

Forward to which chair?   ⊗ Michael Runyon

Date: 03-30-2021 10:04:13
                                                     ((click "Now" if signing now.))

Chair Section

Require edits or changes?   ⊗ No

The IRB has determined this project is: ⊗ Quality Improvement

Completed By: Michael Runyon
                                                     ((Please Print Full Name))

04/06/2021 7:48am   projectredcap.org   **REDCap**

Record ID 1500 - Elizabeth Putnam (submitted: 03-23-2021)

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IRB Chair Signature

Date: 04-05-2021 11:57:27
                                                        ((click "Now" if signing now.))

Appendix D

Quality/IRB review

ECU

Click "download PDF" to save a copy of this page for your records.
Note: The IRB Office does not maintain copies of your responses.

Below is a summary of your responses   Download PDF

Quality Improvement/Program Evaluation Self-Certification Tool

Purpose:
Projects that do not meet the federal definition of human research pursuant to 45 CFR 46 do not require IRB review. This tool was developed to assist in the determination of when a project falls outside of the IRB's purview.

Instructions:
Please complete the requested project information, as this document may be used for documentation that IRB review is not required. Select the appropriate answers to each question in the order they appear below. Additional questions may appear based on your answers. If you do not receive a STOP HERE message, the form may be printed as certification that the project is "not research", and does not require IRB review. The IRB will not review your responses as part of the self-certification process. For projects being done at Vidant Health, site support will be required. Please email crg.quality@vidanthealth.com to obtain site support from Vidant Health.

Name of Project Leader:

Elizabeth Putnam

Project Title:

Using The STOP-Bang Questionnaire to Improve Safety and Outcomes for Patients at High Risk of Postoperative Complications due to Obstructive Sleep Apnea.

Brief description of Project/Goals:

The STOP-Bang Questionnaire is a screening tool used for the detection of undiagnosed sleep apnea in patients. This tool will be utilized in the pre-operative setting directly before the patient enters surgery in order to streamline communication between perioperative staff to optimize patient care and improve safety and outcomes

Will the project involve testing an experimental drug, device (including medical software or assays), or biologic?

O Yes

● No

Has the project received funding (e.g. federal, industry) to be conducted as a human subject research study?

O Yes

● No

Is this a multi-site project (e.g. there is a coordinating or lead center, more than one site participating, and/or a study-wide protocol)?

O Yes

● No

Is this a systematic investigation designed with the intent to contribute to generalizable knowledge (e.g. testing a hypothesis; randomization of subjects; comparison of case vs. control; observational research; comparative effectiveness research; or comparable criteria in alternative research paradigms)?

O Yes

● No

Will the results of the project be published, presented or disseminated outside of the institution or program conducting it?

● Yes

O No

Would the project occur regardless of whether individuals conducting it may benefit professionally from it?

● Yes

○ No

Does the project involve "no more than minimal risk" procedures (meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests)?

● Yes
○ No

Is the project intended to improve or evaluate the practice or process within a particular institution or a specific program, and falls under well-accepted care practices/guidelines?

● Yes
○ No

Based on your responses, the project appears to constitute QI and/or Program Evaluation and IRB review is not required because, in accordance with federal regulations, your project does not constitute research as defined under 45 CFR 46.102(d). If the project results are disseminated, they should be characterized as QI and/or Program Evaluation findings. Finally, if the project changes in any way that might affect the intent or design, please complete this self-certification again to ensure that IRB review is still not required. Click the button below to view a printable version of this form to save with your files, as it serves as documentation that IRB review is not required for this project. 7/22/2021

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Appendix E

STOP-Bang Questionnaire

STOP-Bang Questionnaire

Please conduct this screening on all bariatric surgery patients. Place a patient label on the bottom of the page and place the questionnaire in the designated folder at the preop nurses' station.

NOTE: For individuals scoring >4 (answers "yes" to 4 or more questions), please place the neon green insert stating risk status within the patient's paper chart.

STOP

S	So you **snore** loudly (louder enough to be heard through closed doors or louder than talking)?	Yes	No
T	Do you often feel **tired**, fatigued or sleepy during the daytime?	Yes	No
O	Has anyone **observed** you stop breathing or choking or gasping during your sleep?	Yes	No
P	Do you have or are you being treated for high blood **pressure**?	Yes	No

Bang

B	**BMI** more than 35?	Yes	No
a	**Age** – over 50 years old?	Yes	No
n	**Neck** circumference – is it greater than 17" if you are a male or 16" if you are a female?	Yes	No
g	**Gender** – are you a male?	Yes	No

Have you been diagnosed with sleep apnea (OSA)?
Yes   No

Do you wear a CPAP?
Yes   No

Patient Label

Appendix F

Patient Flag

ATTENTION:

THIS PATIENT IS AT HIGH RISK FOR POSTOPERATIVE COMPLICATIONS RELATED TO SLEEP APNEA.

NURSING: Please use <u>upright positioning</u>, <u>multimodal pain management</u>, and <u>restrictive IV fluid management</u> when caring for this patient. <u>Maintain oxygen saturation greater than 93%</u>. Chart any postoperative complications within the physician notification section of the EMR.

Appendix G

Post-Implementation Survey

Post-Implementation Survey: How well were STOP-Bang results communicated to PACU staff?

PACU Nurses: Please respond to the following questions. Your responses to this survey are anonymous.

Have you seen a paper flag within a patient's chart over the last three months indicating they are at high risk for postoperative complications related to sleep apnea?

Yes   No

If so, did you implement the ASA guidelines provided? (upright positioning, multimodal pain management, restrictive fluid management, maintenance of O2 saturation above 93%)

Yes   No

Did you care for bariatric surgery patients who you believe had undiagnosed sleep apnea (based on clinical presentation) who did NOT have a paper flag within their chart?
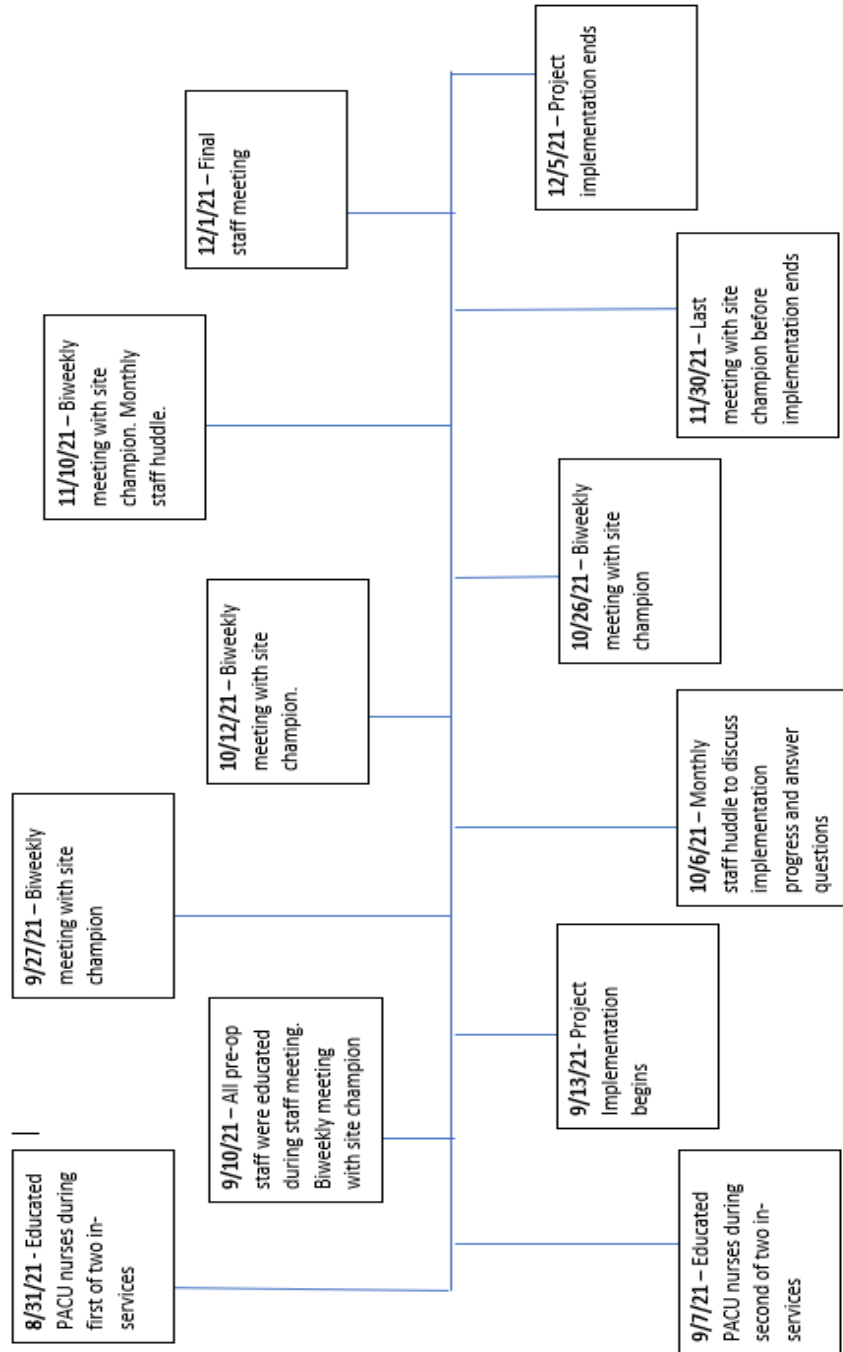
Yes   No   Not sure

Appendix H

Project Data Collection Tool

DNP Project Data Collection Tool								
Patient Identifier	Date of Surgery	Nurse Completed Scr	STOP-Bang Score	Previously diagnosed?	Wears CPAP?	PACU Length of Stay	Postoperative Complications	Compliance

DNP Project Data Summary:

Patients eligible to be screened	79 patients
Patients screened	52 patients
STOP-Bang scores $\geq$4	27 patients
Patients Previously Diagnosed with OSA	42 patients
Patients Newly Diagnosed	8 patients
Wears CPAP	39 patients
Average PACU LOS	78 minutes
Postoperative Complications	7 patients

Appendix I

Project Timeline

8/31/21 - Educated PACU nurses during first of two in-services

9/10/21 – All pre-op staff were educated during staff meeting. Biweekly meeting with site champion

9/27/21 – Biweekly meeting with site champion

10/12/21 – Biweekly meeting with site champion.

11/10/21 – Biweekly meeting with site champion. Monthly staff huddle.

12/1/21 – Final staff meeting

12/5/21 – Project implementation ends

11/30/21 – Last meeting with site champion before implementation ends

10/26/21 – Biweekly meeting with site champion

10/6/21 – Monthly staff huddle to discuss implementation progress and answer questions

9/13/21- Project Implementation begins

9/7/21 – Educated PACU nurses during second of two in-services
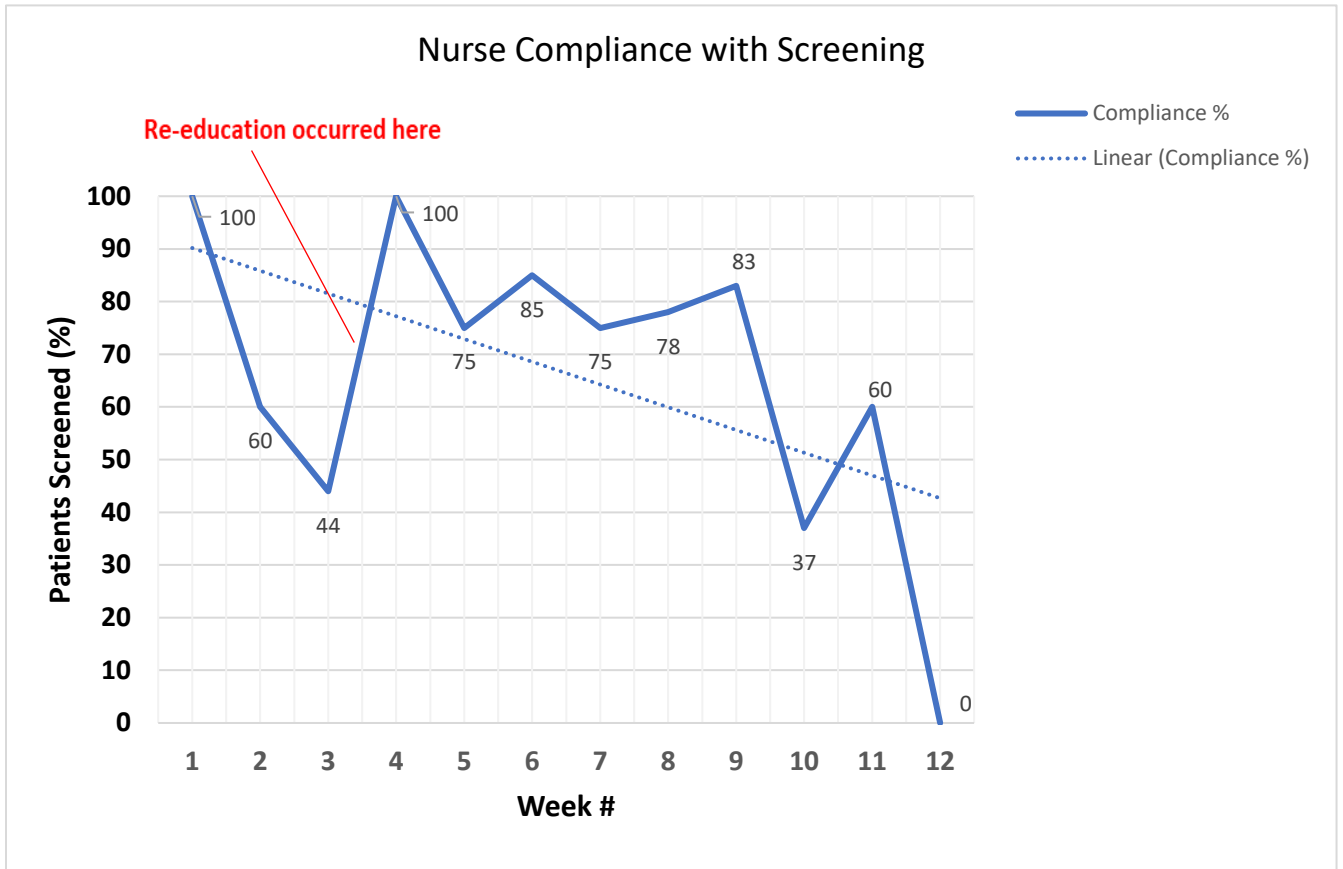
Appendix J

Nurse Compliance with Patient Screening

Figure 1

Nurse Compliance with Screening

Appendix K

Weekly OR Hold Minutes

Weekly OR Hold Minutes

Week #	Total Hold Minutes
1	124 minutes
2	472 minutes
3	411 minutes
4	486 minutes
5	242 minutes
6	113 minutes
7	0 minutes
8	1,038 minutes
9	239 minutes
10	603 minutes
11	0 minutes
12	514 minutes

Figure 2

Weekly OR Hold Minutes
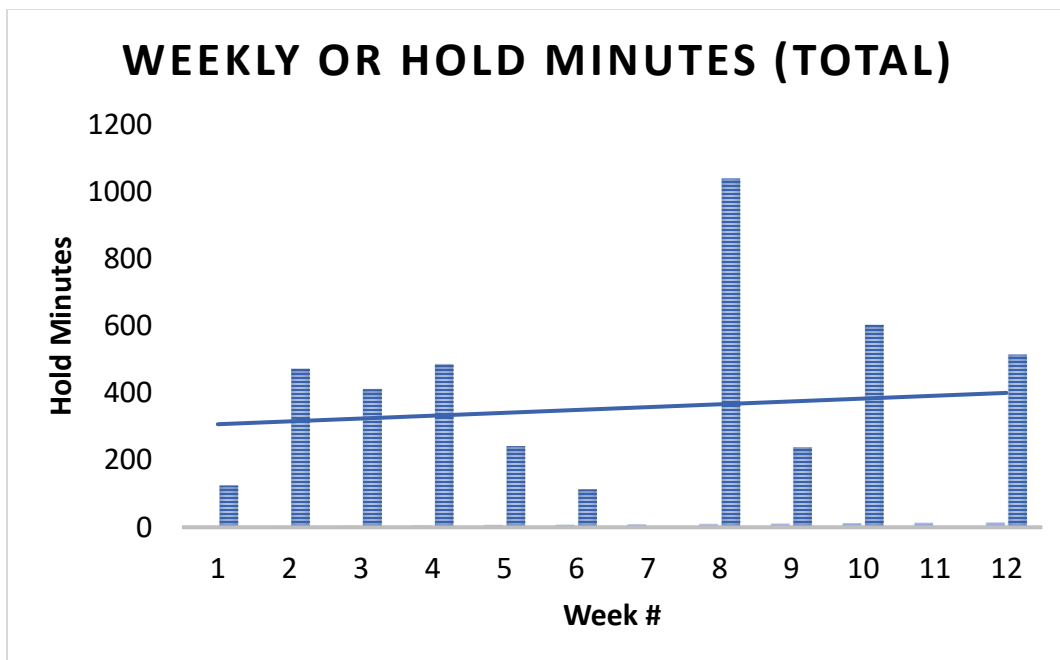
Appendix L

Itemized Budget

Costs Associated with Project Implementation:

Supplies (paper, printer ink, etc.)	$35.00
Preop Nurse Labor	$71.12
Project Lead Unpaid Labor	$7,112.00
Total Cost	**$7,218.12**

Appendix M

DNP Essentials Table

	Description	Demonstration of Knowledge
Essential I *Scientific Underpinning for Practice*	**Competency** – Analyzes and uses information to develop practice **Competency** -Integrates knowledge from humanities and science into context of nursing **Competency** -Translates research to improve practice **Competency** -Integrates research, theory, and practice to develop new approaches toward improved practice and outcomes	▪ Read 'The Doctor of Nursing Practice Project' in DNP I ▪ Multiple literature searches in DNP II and III, and IV ▪ CITI ten-part training module ▪ Recognized problem in partnering agency and developed implementation plan to improve practice
Essential II *Organizational & Systems Leadership for Quality Improvement & Systems Thinking*	**Competency** –Develops and evaluates practice based on science and integrates policy and humanities **Competency** –Assumes and ensures accountability for quality care and patient safety **Competency** -Demonstrates critical and reflective thinking **Competency** -Advocates for improved quality, access, and cost of health care; monitors costs and budgets **Competency** -Develops and implements innovations incorporating principles of change **Competency** - Effectively communicates practice knowledge in writing and orally to improve quality **Competency** - Develops and evaluates strategies to manage ethical dilemmas in patient care and within health care delivery systems	▪ Sought approval for project implementation through organizational and institutional IRB approval ▪ Constructed and revised DNP paper and peer-reviewed others ▪ Effectively communicated project goals, implementation, and evaluation both written and orally ▪ Completed time logs that reflect accountability and progress toward project goals
Essential III *Clinical Scholarship & Analytical Methods for Evidence-Based Practice*	**Competency** - Critically analyzes literature to determine best practices **Competency** - Implements evaluation processes to measure process and patient outcomes **Competency** - Designs and implements quality improvement strategies to promote safety, efficiency, and equitable quality care for patients **Competency** - Applies knowledge to develop practice guidelines **Competency** - Uses informatics to identify, analyze, and predict best practice and patient outcomes **Competency** - Collaborate in research and disseminate findings	▪ Followed PDSA framework throughout project implementation to evaluate successes and areas for improvement ▪ Literature searches to determine EBP for OSA screening and implement proven practices ▪ Used data collection tool to evaluate nurse compliance with screening and re-educate when necessary ▪ Collaborated with project mentor, partnering agency, and peers throughout development, implementation, dissemination of findings
Essential IV *Information Systems –*	**Competency** - Design/select and utilize software to analyze practice and consumer information systems that can improve the delivery & quality of care	▪ Used the agency EMR to collect patient data during implementation

Technology & Patient Care Technology for the Improvement & Transformation of Health Care	**Competency** - Analyze and operationalize patient care technologies **Competency** - Evaluate technology regarding ethics, efficiency and accuracy **Competency** - Evaluates systems of care using health information technologies	▪ Discussed recommendations for changes to EMR that would incorporate STOP-Bang questionnaire and electronic patient flag to improve screening and communication ▪ Evaluated efficacy of using paper copies of STOP-Bang questionnaire vs incorporating into EMR for ease of use ▪ Recommended ASA guidelines within order set of patients with OSA, high STOP-Bang scores
Essential V *Health Care Policy of Advocacy in Health Care*	**Competency**- Analyzes health policy from the perspective of patients, nursing and other stakeholders **Competency** – Provides leadership in developing and implementing health policy **Competency** –Influences policymakers, formally and informally, in local and global settings **Competency** – Educates stakeholders regarding policy **Competency** – Advocates for nursing within the policy arena **Competency**- Participates in policy agendas that assist with finance, regulation and health care delivery **Competency** – Advocates for equitable and ethical health care	▪ Literature search regarding increased risk of OSA among bariatric surgery patients ▪ Advocated for bariatric surgery population to undergo screening considering increased risk factors ▪ Evaluated stakeholder perspectives in 'Six Thinking Hats' assignment ▪ Educated preop and PACU nurses regarding project implementation, screening process, EBP ▪ Discussed cost-benefit concerning prolonged PACU length of stay vs. the overall cost of project implementation
Essential VI *Interprofessional Collaboration for Improving Patient & Population Health Outcomes*	**Competency**- Uses effective collaboration and communication to develop and implement practice, policy, standards of care, and scholarship **Competency** – Provide leadership to interprofessional care teams **Competency** – Consult intraprofessionally and interprofessionally to develop systems of care in complex settings	▪ Collaborated with project stakeholders, nurses, site-champion, physicians, and project faculty for development, implementation, evaluation ▪ Led preop and PACU nurses to implement evidence-based screening process for OSA patients and ASA guidelines to optimize patient outcomes
Essential VII *Clinical Prevention & Population Health for Improving the Nation's Health*	**Competency**- Integrates epidemiology, biostatistics, and data to facilitate individual and population health care delivery **Competency** – Synthesizes information & cultural competency to develop & use health promotion/disease prevention strategies to address gaps in care	▪ Evaluated data collected throughout implementation including history of disease and postoperative complications to determine correlation

	Competency – Evaluates and implements change strategies of models of health care delivery to improve quality and address diversity	▪ Offered use of an interpreter to non-English speaking patients undergoing screening
Essential VIII *Advanced Nursing Practice*	**Competency**- Melds diversity & cultural sensitivity to conduct systematic assessment of health parameters in varied settings **Competency** – Design, implement & evaluate nursing interventions to promote quality **Competency** – Develop & maintain patient relationships **Competency** –Demonstrate advanced clinical judgment and systematic thoughts to improve patient outcomes **Competency** – Mentor and support fellow nurses **Competency**- Provide support for individuals and systems experiencing change and transitions **Competency** –Use systems analysis to evaluate practice efficiency, care delivery, fiscal responsibility, ethical responsibility, and quality outcomes measures	▪ Created project goals that aligned with organizational need, Triple Aim, Healthy People 2030 ▪ Dissemination of project results to improve practice, create systems-level change, improve patient safety and outcomes, advocate for vulnerable populations ▪ Designed, implemented, and evaluated DNP Project