Southern California CSU DNP Consortium

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DEVELOPMENT OF A CLINICAL REFERENCE FOR SCREENING AND PERIOPERATIVE MANAGEMENT OF PATIENTS WITH OSA

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

For the degree of

DOCTOR OF NURSING PRACTICE

By

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December 2020

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DOI 10.5281/zenodo.5104919

ABSTRACT

Obstructive sleep apnea (OSA) is a sleep disorder that affects millions of people in the U.S. with the vast majority of people remaining undiagnosed. Undiagnosed OSA can lead to detrimental health outcomes and significant healthcare costs both in the intraoperative period and beyond. Kaiser Permanente Fontana Medical Center has discovered that intraoperative management of OSA is an area that needs improvement specifically relating to screening and diagnosis of OSA in the perioperative period. The purpose of this project was to develop a clinical reference (CR) based on current evidence and provide education to clinicians on its utilization in practice. The IOWA model was used to carry out this practice improvement project. Due to the COVID-19 pandemic, we were unable to implement and evaluate the project at Kaiser Fontana due to limited resources and the inability to carry out practice change during this time. The plan for implementation, data, analysis, and education pertaining to the OSA CR were established in order to prepare for implementation and evaluation.

Keywords: obstructive sleep apnea, screening, perioperative, clinical reference, algorithm, evidence-based practice

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ACKNOWLEDGEMENTS

Our team would like to thank our Team Leader Dr. Hannah Fraley for her continuous support and help in refining this project. We could not have accomplished this project without her. We would also like to thank our Team Member Dr. Jeremy Heiner for his guidance and expertise in the clinical application of our project. Additionally, we would like to thank Kaiser Permanente, Fontana for their willingness to work with us on this project prior to the COVID-19 pandemic. We hope to revisit the remainder of the project when appropriate. Lastly, we would like to thank our friends and families who have supported us through this endeavor. Their support and encouragement were greatly appreciated.

Background

Obstructive sleep apnea (OSA) is a sleep disorder associated with detrimental health outcomes affecting 22 million people in the United States (U.S.); however, 80% of cases remain undiagnosed (Seet et al., 2015). Individuals who suffer from OSA can experience repetitive pauses in breathing caused by a partial or complete collapse of the upper airway and can last up to 10 seconds. The increased prevalence of OSA is attributed to the aging population and rising obesity rates (Lakdawala et al., 2018). If undiagnosed and untreated, OSA increases the risk of cardiovascular disease (CVD) (e.g. chronic heart failure, arrhythmias, ischemia, and hypertension), endocrine disorders (e.g. obesity, metabolic syndrome), and cerebrovascular diseases (e.g. stroke, transient ischemic attack) (Davies et al., 2016; Knauert et al., 2015; Seet et al., 2015). Furthermore, patients with undiagnosed OSA have an increased length of in-hospital stay, increased risk for critical care admissions, and increased risk for motor vehicle accidents (Knauert et al., 2015). Ultimately, undiagnosed OSA can lead to significant healthcare costs, such as coronary artery disease, estimated as averaging $190 billion per year and acute myocardial infarctions estimated as costing upwards of $14,000 per patient (Knauert et al., 2015).

Significance

Kaiser Permanente (KP) is a well-known health maintenance organization healthcare organization in the U.S. serving 12.2 million members per year, with a large number of acute care hospitals and clinics located throughout eight states and the District of Columbia (Kaiser Permanente, 2019). In particular, KP serves a high volume of surgical patients in California alone. Anesthesia providers have identified that there are inconsistent presurgical care practices at KP acute care hospitals and currently lack standardized, evidence-based clinical references

(CRs) for the assessment, diagnosis, and management of OSA in the surgical patient population. A study by Williams et al. (2017) found that 60% of anesthesia providers and 92% of surgeons were unable to identify patients who were previously diagnosed or undiagnosed with OSA.

Anesthesia providers are responsible for a thorough airway assessment including identification of OSA, as it influences anesthetic management in the perioperative period. When suspected OSA is identified through screening tools, appropriate measures can be taken in order to optimize a surgical patient prior to surgery. For example, there have been multiple studies that have proven the validity and efficacy when utilizing the STOP-Bang screening tool to determine patients with moderate to severe risk for OSA (Boynton et al., 2013; Chung et al., 2016; Davies et al., 2016). The acronym STOP-Bang measures eight independent components related to OSA with each component consisting of identified OSA symptoms (snoring, tiredness, and observed apnea), three physiological factors (high blood pressure, body mass index, and neck circumference), and two characteristics of the patient (age and gender) (Davies et al., 2016). It has been shown to have a sensitivity of 93% when detecting moderate to severe OSA and 100% when detecting severe OSA (Chung et al., 2016). In addition, further evaluation and diagnostic tests can be conducted during follow-up with a primary care physician in order to treat OSA and mitigate the associated comorbidities.

Purpose

Currently at KP there is no standardized approach regarding surgical patients who may be at risk for or who are undiagnosed with OSA. Therefore, the purpose of this project was to develop a Clinical Reference (CR) based on current evidence that addresses necessary screening assessment, management, and follow-up of patients with suspected OSA undergoing surgery at KP Fontana Medical Center (FMC). Our goal was to make this reference available to anesthesia

providers within KP so the reference can be used to improve care for patients with OSA leading to appropriate treatment and better patient outcomes. Additionally, the CR can serve as a basis for the development of OSA clinical practice guidelines (CPGs) and policies at other KP campuses across the country.

Review of Literature

Overview

An extensive literature search was completed (see Appendix B) in order to develop evidence-based CR for screening, diagnosis, and management of OSA patients presenting for surgery at KP. Electronic databases used included PubMed, CINAHL, Google Scholar, and EBSCO. The initial search terms included "obstructive sleep apnea," "perioperative," "anesthesia," "screening tools," "STOP-Bang," "anesthetic implications," "management," "barriers," and "risk factors." The search included studies written in the English language, peer reviewed, and published between 2009 and 2019. Studies were excluded if they are non-English language, not peer reviewed research studies, or articles published before 2009. A table of evidence (Appendix A) was created for the following subtopics: Screening and Risk Factors (Table A1) and OSA Anesthesia Management (Table A2). The additional search term, "guidelines," was added to include already published CPGs on the topic (Table B3). The formulation of a CR will be based on current evidence regarding the multidimensional management of patients with OSA undergoing surgery as well as already published CPGs from professional organizations.

Risk Factors and Screening Tools

Many factors place a patient at risk for OSA, some of these include excess weight, narrowed airway, high blood pressure, chronic nasal congestion, diabetes, gender, smoking, asthma, major depression and family history of sleep apnea (Arnold et al., 2017; Hein et al., 2017; Liu et al., 2016). It is crucial to determine risk factors in a systematic approach, this is possible with proven and effective screening tools.

Diagnosing OSA can be difficult and costly for a non-sleep specialist; therefore, numerous screening tools have been developed to identify patients at risk for OSA. An ideal OSA screening tool should be easy to use, while providing high sensitivity and specificity when compared to a polysomnogram (PSG), which is the current gold standard (Amra et al., 2018; Chung, et al., 2016; Pack, 2015). The OSA screening tools allow healthcare providers to assess patients quickly and effectively for further investigation for OSA diagnosis (Amra et al., 2018; Gamaldo et al., 2018; Kapur et al., 2017). The diagnostic tests and screening tools that are widely recognized and valid will be discussed below: PSG, Epworth Sleepiness Scale (ESS), Berlin Questionnaire (BQ), and STOP-BANG Questionnaire (SBQ).

Polysomnogram Diagnostic Tool

The PSG is a sleep study performed under observation and measures many sleep variables, but the primary variable for OSA diagnosis is the apnea-hypopnea index (AHI) (Gamaldo et al., 2018; Kapur et al., 2017; Mulgrew et al., 2007; Pack, 2015). The AHI is the sum of apneas and hypopneas per hour of sleep (Gamaldo et al., 2018; Kapur et al., 2017; Mulgrew, et al., 2007; Pack, 2015). The definition of apnea is the absence of airflow for greater than ten seconds, and hypopnea is a reduction in respiratory effort with greater than four percent desaturation (Gamaldo et al., 2018; Kapur et al., 2017; Nagappa 2015; Shrivastava et al., 2014**).** A patient with an AHI score from 5-15 is considered to have mild sleep apnea, 15-30 moderate, and greater than 30 is deemed to be severe (Gamaldo et al., 2018; Nagappa, 2015; Shrivastava et al., 2014). The sensitivity and specificity for PSG to detect an AHI >5 in one-night ranges from 75% and 88% (Gamaldo et al., 2018; Kapur et al., 2017; Pack, 2015; Mulgrew et al., 2007). PSG is the gold standard tool used to diagnose patients with OSA.

Epworth Sleepiness Scale Screening Tool

The ESS consists of eight questions that are self-reported and assess for daytime sleepiness or dozing (Gamaldo et al., 2018; Kapur et al., 2017). According to a systematic review, the ESS sensitivity and specificity were 72% and 76%, with a high number of false negatives (Kenzerska et al., 2014). Other studies concluded that the ESS score was significantly higher when scored by the partner compared to the subject (Amra, et al., 2018; Bonzelaar et al., 2017; Gamaldo et al., 2018). The difference in ESS scores suggests that the partner should be involved when filling out the ESS diagnostic form (Amra, et al., 2018; Bonzelaar et al., 2017; Gamaldo et al., 2018).

Berlin Questionnaire Screening Tool

The BQ is a tool that is comprised of 11 questions that classifies patients into two categories high or low risk for OSA. The BQ consists of three sections; in the first section, the participant is asked to score their snoring. The second section assesses the participants' daytime fatigue and sleepiness; the third section evaluates the participants' demographics, medical history, height and weight (Amra et al., 2018; Gamaldo et al., 2018; Senaratna et al., 2017). The participant is considered "high risk" for OSA if two or more sections score positive. In multiple sleep studies, the BQ revealed a sensitivity and specificity of 30.8% and 80% when detecting high risk OSA patients (Amra et al., 2018; Gamaldo et al., 2018; Senaratna et al., 2017). Overall, several studies found that the BQ is not an appropriate screening tool for identifying OSA in the surgical population (Amra et al., 2018; Gamaldo et al., 2018; Senaratna et al., 2017).

STOP-Bang Questionnaire Screening Tool

Lastly, the SBQ is the most widely utilized tool for OSA screening and consists of eight questions. The STOP portion is four yes/no questions, and the Bang questions provide clinically observed quantities that can be answered with yes/no options. Many studies have proven that the SBQ remains the best questionnaire when assessing for OSA due to the highest sensitivity and specificity of 93% and 85.2% reported in recent studies (Amra et al., 2018; Chung et al., 2016; Gamaldo et al., 2018; Nagappa, 2015). Traditionally, a SB score of three or greater has demonstrated a high sensitivity for detecting moderate and severe OSA in the surgical population (Amra et al., 2018; Chung et al., 2016; Gamaldo et al., 2018; Nagappa, 2015). However, the specificity is low (47% and 37% for moderate and severe OSA), which can result in high rates of false positives. Therefore, several studies have demonstrated that a higher SB score of five to eight can increase the probability, sensitivity and specificity of detecting patients with high-risk for moderate to severe OSA (Amra et al., 2018; Chung et al., 2016; Gamaldo et al., 2018; Nagappa, 2015). When searching for SBQ limitations (e.g., observational data), none were found during the literature review.

Barriers to Screening and Care

Organizational and Provider Barriers

Within an organization such as the healthcare industry, change can be challenging. This may be due to the belief that the individual can lose something of value or the fear of not being able to adapt to new ways (Foster, 2014). After patients are screened and considered high-risk for moderate to severe OSA, the following steps to be diagnosed with OSA can be burdensome to the patient. For instance, the diagnostic PSG overnight study is often time-consuming, labor-intensive, and costly, creating barriers for patients to complete (Amra et al., 2018; Chung et al.,

2016; Gamaldo et al., 2018). Additionally, patients with OSA may experience long waiting periods of up to 12 months before medical therapy can be initiated (CPAP) and 16 months before surgical treatment (Chung et al., 2016; Gamaldo et al., 2018; Nagappa, 2015). One consistent barrier noted in multiple studies is the variability in providers following recommended screening practices to include measuring patient neck circumference as well as lack of available resources, such as not having a measuring tape (Chung et al., 2016; Gamaldo et al., 2018; Nagappa, 2015). Additional barriers noted in the literature that facilitate barriers to optimal screening and identification of OSA include lack of provider motivation, education, lack of patient knowledge, and lack of financial resources, such as personnel to educate and update the electronic health record (EHR) (Boynton et al., 2013; Chung et al., 2016; Foster, 2014; Davies et al., 2016).

Patients with OSA tend to have similar features, such as a short thick neck, obesity, and are elderly males (Amra et al., 2018; Boynton et al., 2013; Chung et al., 2016; Gamaldo et al., 2018). Consequently, healthcare providers tend to stereotype patients who may or may not have these characteristics, which may lead to undiagnosed OSA (Boynton et al., 2013; Davies et al., 2016; Kapur et al., 2017). These stereotypes may have some truth, but multiple studies have shown up to 50% of individuals with OSA are not obese and women tend to underreport snoring, a symptom often associated with OSA, due to fear of social stigma associated with snoring among women (Gamaldo et al., 2018; Kapur, et al., 2017; Westerich, et al., 2019). Furthermore, a change in practice may take several years to become fully implemented. It is estimated that it takes 17 years to translate research into patient care and nine years to implement interventions recommended by evidence-based practice (EBP) (Gesme & Wiseman, 2010; Lehane et al., 2019). This barrier may be associated with the large number of undiagnosed OSA patients that are not appropriately screened with effective tools, such as the SBQ. Obstructive sleep apnea

screening of pre-operative patients at KP was believed to be inconsistent, and the problems were not well understood.

Clinical Practice Guidelines Driving Anesthesia Care in the Perioperative Period

Preoperative Optimization

Guidelines published by the American Society of Anesthesiologists (ASA) (2014) and the American Academy of Sleep Medicine (AASM) (2014) included results and recommendations from studies conducted on perioperative management of OSA patients scheduled for surgery. A review of these guidelines and their included studies revealed many evidence-based practices suggested for anesthetic management of OSA patients.

In the preoperative period, anesthesia providers should perform a detailed patient assessment and have equipment available to optimize the OSA patient prior to surgery. The detailed assessment should include an extensive medical record review, patient and family interview using appropriate screening tools, as well as a thorough physical examination (Chung et. al., 2016; Corso et. al., 2014). Studies have shown significant decreases in postoperative complications with the use of respiratory assist devices, such as CPAP and noninvasive positive pressure ventilation (NIPPV) in the preoperative setting (Corso et al., 2014; Mutter et al., 2015). Proper preparation and optimization of OSA patients greatly contributes to patient outcomes and should be considered well before the day of surgery (Chung et al., 2016; Corso et al., 2014).

Anesthesia Type

Intraoperative management of OSA patients differs among anesthesia providers due to varying opinions and learned practices (Chung et al., 2016; Corso et al., 2014). Despite these differences, potential postoperative respiratory complications in OSA patients should always be considered when selecting the appropriate intraoperative anesthetic management (Chung et al.,

2016; Corso et al., 2014). ASA recommends the use of local anesthetics or regional anesthesia over general anesthetics for patients with OSA due to increase in postoperative respiratory complications (Naqvi et al., 2017). When general anesthesia is required, the use of a secured airway and full monitoring are recommended (Chung et al., 2016; Corso et al., 2014). Additionally, OSA patients should be fully reversed from neuromuscular blockade and extubated awake with the head of the bed elevated to ensure adequate ventilation is achieved (Chung et al., 2016; Corso et al., 2014).

Pharmacological Management

The ASA and AASM guidelines and additional studies have emphasized limiting the use of narcotics and sedatives, such as barbiturates and benzodiazepines, in OSA patients due to increased risk of complications (Corso et al., 2014). A systematic review by Cozowicz et al. (2018) evaluated the perioperative risk of opioid-induced respiratory depression (OIRD) in OSA. It showed that patients with OSA were at a higher risk of OIRD. Therefore, Conzowics et al. (2018) recommend opioid-sparing techniques. Furthermore, Conzowics et al. (2018) caution use of muscle relaxants as they may cause airway compromise. Full reversal of muscle relaxants should be confirmed with nerve stimulation to ensure patient airway reflexes have returned. Full reversal of muscle relaxation involves the complete return of muscle strength to the patient's original status. With the new development of the reversal agent sugammadex, better reversal may be seen when utilizing this drug instead of neostigmine in OSA patients (Ünal et al., 2015). Limited studies have been conducted on its specific use in these patients. Yet, an RCT by Ünal et al. (2015) illustrated a reduction in respiratory complications and associated costs in OSA patients.

Post-Operative Management

In the post-operative setting vigilant monitoring of oxygen saturation and airway obstruction is vital. The ASA recommends that OSA patients are on continuous pulse oximetry monitoring and seated in the semi-upright position to facilitate ventilation (Corso et. al., 2014). Studies conclude that the semi-upright position is optimal for OSA patients in the postoperative period (Barnes et al., 2017; Corso et al., 2014; Seet & Chung, 2010). In addition, OSA patients should be provided supplemental oxygen after extubation, with the use of CPAP when necessary to maintain oxygenation and prevent obstruction and apnea (Chung et al.; Corso et al., 2014 Seet & Chung, 2010). Continuous patient-controlled analgesia therapy containing opioids should be avoided to prevent respiratory compromise (Corso et al., 2014). OSA patients may need to be monitored for a longer period of time in the post-anesthesia care unit (PACU) to ensure adequate ventilation prior to discharge home (Corso et al., 2014). Following these guidelines throughout the perioperative period will better optimize patients with OSA and improve intraoperative and postoperative outcomes in this patient population.

Summary of Findings

KP Southern California hospitals do not currently have a standard CR nor CPG in place for screening of OSA in the surgical patient population. The extensive review of literature support the need for a CR to be developed and implemented targeting patients with suspected OSA undergoing surgery at KP facilities. Through the investigation of published CPGs and current evidence, gaps in care were identified and addressed in this project. The ASA and AASM CPGs presented were developed based on the cumulation of other guidelines from reputable organizations invested in the optimization of care of those with OSA, in addition to the incorporation of other existing rigorous quality guidelines or literature on the subject. The

professional published guidelines were intended to provide basic recommendations to healthcare providers and patients during the clinical decision-making process. As such, they may be adopted as is or modified based on patient, provider, or procedure-specific needs. Post-screening treatment and care management practices may differ based on several patient and provider factors. Therefore, the developed CR from this project should not be the only consideration in determining the standard of care for the screening and management of OSA patients in the perioperative setting at KP. Additionally, ongoing revisions may be required based on new evidence and technology.

Implementation of a CR throughout KP hospitals for anesthesia providers to accurately identify OSA will likely improve patient outcomes and decrease the risk of detrimental and costly health problems related to undiagnosed OSA. The literature highlights evidence-based screening and anesthesia techniques that can be adopted by providers and adapted to the individual needs of the patient, provider, and procedure. Incorporating the latest evidence from the literature including evidence within available CPGs from the ASA and AASM will be key in addressing all aspects of the perioperative process relating to screening and accurate diagnosis of OSA in patients undergoing surgery at KP in order to prevent adverse events and optimize overall patient care.

COVID-19 Pandemic

Barriers and Limitations

Due to the COVID-19 pandemic, the project was unable to proceed within the original trajectory. Baseline and post-implementation data would be difficult to achieve with limited resources. Also, data would be skewed due to the cancelling of elective cases within the Kaiser Permanente hospital system. Workflow may have been altered, giving an inaccurate glimpse into the potential problems within the process our team hoped to correct. As a team, we felt it was an inappropriate time to introduce new knowledge and protocols during this trying and unprecedented time in healthcare and the world. Key stakeholders had to focus their efforts on managing major shifts in the intraoperative environment. Our hope is to be able to revisit this crucial project when the healthcare system has stabilized. We have included the evolution of the project steps up until the pandemic hindered our progress. In addition, the detailed plan for completion of the project is included, which discusses how data would have been collected and analyzed, as well as our education plan.

Supporting Framework

Background

The Iowa Model (IM) was selected to aid in the development and implementation of the obstructive sleep apnea (OSA) CR for Anesthesia providers at KP FMC (see Figure 1). The IM was created in 1994 by Marita Titler, a PhD graduate of the University of Iowa (Titler et al., 2001). The original IM has evolved from its inception of the Quality Assurance Model Using Research (Cullen et al., 2018). This model was chosen over other evidence-based practice (EBP) implementation models because of its intuitiveness and success in many healthcare and academic settings (Lloyd et al., 2016). The IM provided an organized stepwise framework that focuses on interdisciplinary collaboration and problem-solving in order to determine if implementation of new evidence will be beneficial to a specific care setting and how it can be best implemented (Lloyd et al., 2016). Additionally, the IM provides feedback for implementation of EBP changes and facilitates a team-based process of continuous evaluation in order to monitor a new practice change, or implementation of new evidence. Lastly, the IM was the selected organizational framework for practice changes at KP which is the setting of this project. Overall, the IM provided the best guidance for development and implementation of a CR and provides a path for sustainability at KP FMC.

Overview of IM Concepts

The IM served as a guide in the development of evidence-based practice change, consisting of seven key integrated steps including the concepts: 1) identifying a problem-focused trigger, 2) forming a team of stakeholders, 3) gathering, assembling, and appraising current evidence, 4) developing a plan for practice change, 5) integrating and sustaining practice change, 6) collecting and analyzing outcome data, 7) and disseminating the results (Cullen et al., 2017).

Triggering issues can be identified using data or through informal channels such as a clinician raising concerns regarding clinical practice issues (Cullen et al., 2018). Undiagnosed OSA is a priority at KP due to lack of instituted guidelines or policies on management of OSA in the perioperative period as well as poor provider education and involvement.

IM Steps

KP did not have a standardized CR for the screening and management of OSA in pre-surgical patients. Therefore, our project focused on developing the first five stages of the IM to develop an OSA CR based on current evidence as well as provider and patient needs.

Identify Triggering Issue. Identifying the problem and determining its precedence in practice is the first step of the IM. The problem focus trigger for this project was the prevalence of undiagnosed OSA in the perioperative period. KP had not adopted a CR on OSA, contributing to undiagnosed OSA patients at KP facilities. The development and implementation of an OSA CR was a priority for KP as it would lead to improved diagnosis and decreased adverse outcomes in those with OSA presenting for surgical procedures.

Form a team of stakeholders. Formulating a strong and engaged team of stakeholders is the second step of the IM and is essential to the success and impact of practice change projects. Each team member contributes a unique perspective and experience to the development of the CR. Improperly identifying members can cause severe gaps in process development and progression (Lehane et al., 2019). Our multidisciplinary team of stakeholders included the Chief of Anesthesia at KP, an invested Anesthesiologist, anesthesia managing director, anesthesia coordinator, KP Student Nurse Anesthetists, California State University Fullerton (CSUF) DNP faculty project team leader, and KP School of Anesthesia DNP faculty team member. A team was formed prior to the project implementation stage in January, 2020, during which current

literature and evidence were to be collected, critically appraised, and synthesized to determine the quality and validity of their findings (Cullen et al., 2017).

Gathering, assembling, and appraising evidence. Gathering evidence is the third step of the IM. Current management and practice recommendations were compiled from rigorous research studies as well as from existing CPGs written by professional organizations such as the American Association of Nurse Anesthetists (AANA), American Society of Anesthesiologists (ASA), and American Academy of Sleep Medicine (AACM).

Developing a plan for practice change. The fourth step of the IM includes developing a plan for practice change. After careful evaluation of existing evidence and methodical development of the OSA CR, the team planned to implement the reference in a KP hospital, following the third and fourth steps of the IM. Careful consideration would have been given to the recommendations included in the CR, with sufficient supporting evidence and stakeholder team approval.

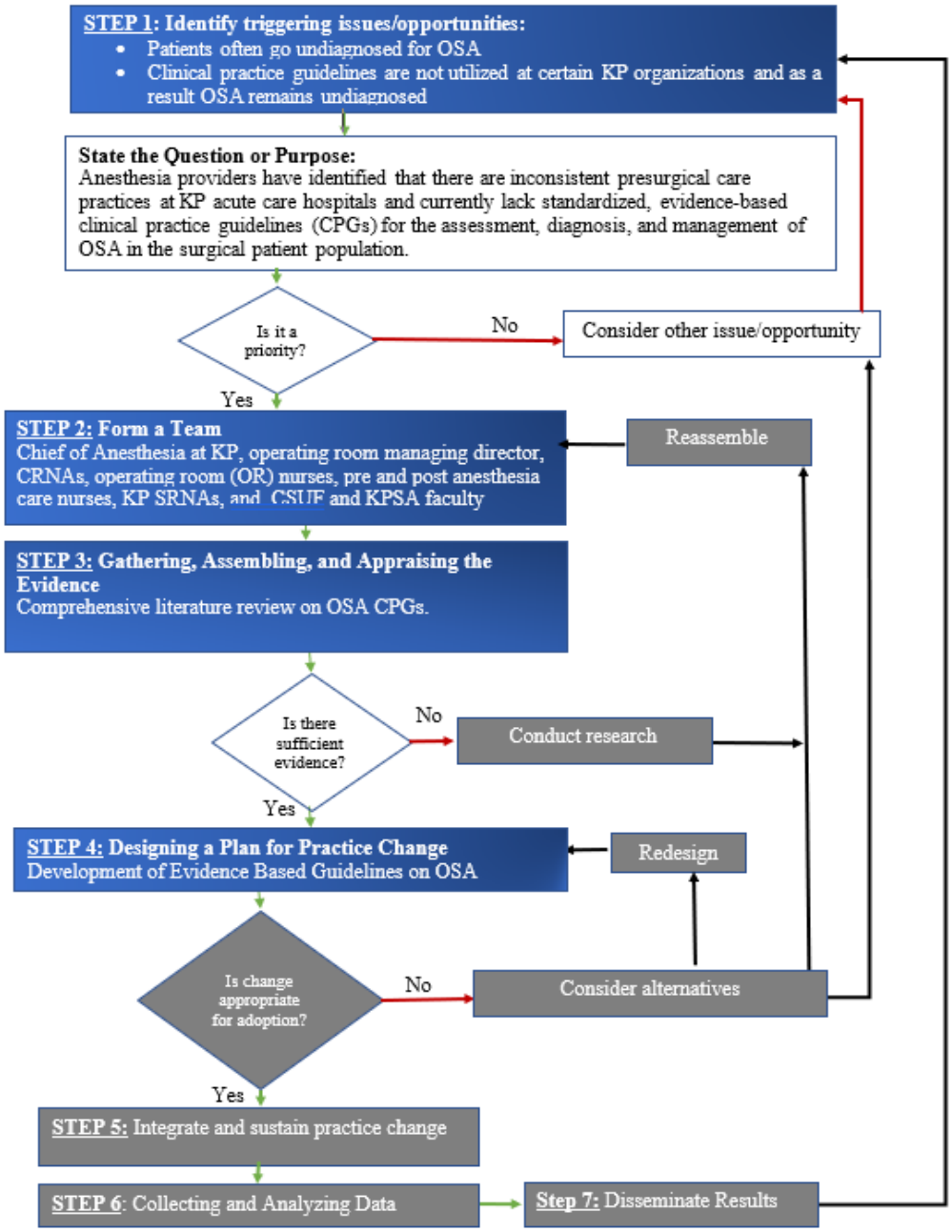
Post-Evaluation and Sustainability of Change

We recommend that the evaluation of this practice improvement project include a plan for sustainability. We advise the developed CR specific to KP be implemented and that education be given to the perioperative staff including perioperative nurses as well as anesthesia providers. After the development and implementation of the OSA CR has been completed, we endorse that the project be transitioned to a team of stakeholders at the specified KP facility to continue the project to fulfill the remaining stages of the IM. Over a three-month trial period, data from three key measures should be collected via the medical record. Through tailored measurement methods, it can be determined if the CR is appropriate for adoption into practice. Once approved by the organization, the CR can be instituted at KP and disseminated to other KP

facilities in Southern California. Continual monitoring and analysis of the use of the CR and OSA patient outcomes should be performed to ensure the sustainability of this EBP implementation.

Figure 1

Revised Iowa Model



Note. Cullen et al., 2018; White & Spruce, 2015

Methods

Overview

Undiagnosed OSA can be identified through proper screening tools and perioperative management in patients presenting for surgery. While KP FMC had developed a preliminary clinical reference document, the institution did not currently have an implemented CPG for the screening, management, and follow-up of patients with suspected OSA. Because of this, our team aimed to develop a CR based on current evidence and recommendations from professional organizations that address these gaps in care. These guidelines should be implemented and made available to anesthesia providers at FMC. After the initial implementation, the overarching goal is to tailor the CR to all KP campuses in order to help improve care and outcomes for patients with suspected OSA in the perioperative period at all KP facilities.

Preliminary Work

OSA management was deemed a practice issue in need of further evaluation by key stakeholders at KP. Initial work was conducted by KP and FMC Anesthesiologist Dr. Shawn Winnick. KP had made the STOP-Bang OSA screening tool available for clinicians to complete in its Electronic Health Record (EHR). This tool is accessible by anesthesia providers when completing the anesthesia patient evaluation either in the pre-operative clinic days before surgery or during the same-day anesthesia assessment. However, KP had identified inconsistencies in provider use of the STOP-Bang tool and did not have baseline data. In addition to the STOP-Bang tool, Dr. Winnick developed a CR for the peri-operative diagnosis and management of OSA for KP. This CR was not well adopted by the anesthesia staff at KP Fontana resulting in a need for a more condensed CR to be developed and implemented. It was also not reflective of the most current evidence. Besides this preliminary work on OSA done at KP, the development of

CPGs by the ASA and AASM are also on the forefront of OSA management during anesthesia care. The ASA guidelines were developed in 2006 and most recently updated in 2014 to reflect new evidence as a need was seen to improve perioperative anesthesia care for patients with OSA. On the other hand, the AASM guidelines were formed to specifically address preoperative considerations, screening, and optimization for OSA patients. With the enthusiasm and groundwork set by KP and the CPGs developed by invested national associations, this DNP project aimed to develop and provide a plan for implementation of an OSA CR (Appendix E*)* based on current evidence, professional organization recommendations, and the available KP clinical reference tailored to FMC's needs and practice culture.

Setting

KP FMC is a 314-bed teaching hospital located in Fontana, CA. FMC serves over 610,000 patients in the greater San Bernardino area and performs nearly 30,000 surgeries per year (Kaiser Permanente, 2019). According to Southern California Association of Governments (2019), the city of Fontana has an obesity rate of 39.1% which is higher than the rate in San Bernardino County (29.2%) and California (25.8%). Obesity is a key measurable demographic that is strongly linked to the development of OSA. In fact, a BMI >40 leads to a pop-up reminder for the STOP-Bang audit currently in the KP EHR. With such a high rate of obesity in San Bernardino and Fontana, emphasis should be placed on the diagnosis and optimization of obesity-linked disorders, such as OSA in order to improve health outcomes.

Participants

The recommended team to carry out the project should be the Chief of Anesthesia at KP, an invested Anesthesiologist, anesthesia managing director, anesthesia coordinator, KP Student

Nurse Anesthetists, CSUF DNP Faculty project team leader, and KP School of Anesthesia DNP faculty team member.

Design

This was a practice improvement project that utilized the Iowa Model to develop a CR for OSA and then formulated a plan for introduction into practice. Additionally, monitoring of the CRs utilization post-implementation should be conducted in the form of chart audits. It is also recommended that baseline chart audits are evaluated so that a baseline can be used to determine successful implementation or if modifications are needed.

CR Development

Purpose of Guidelines

As a preface to the OSA CR, the need for these guidelines was discussed along with the significance of the guidelines to OSA patient care and outcomes. The CR focused on adult surgical patients over the age of 18 years given KP FMC surgical unit includes a patient population of adults.

Preoperative evaluation. Screening for OSA is discussed and tools were recommended for use in perioperative surgical patients with suspected OSA. A figure mapping of the STOP-Bang screening tool is included in this section as it is the gold standard for identifying OSA in the clinical setting. Screening is important in the diagnosis and treatment of OSA. In addition to screening tools, a thorough preoperative assessment and medical record review is discussed as an essential component to the preoperative evaluation of the OSA patient. At risk patient comorbidities were included to help identify suspected OSA patients. Recommendations from the ASA and KP clinical reference were added including a screening algorithm developed by Dr. Winnick. The use of preoperative adjuncts such as continuous airway pressure (CPAP) and

noninvasive positive pressure ventilation (NIPPV) were described in this section of the CR to aid in the optimization of the OSA patient.

Intraoperative recommendations for the management of OSA. Recommendations for the intraoperative management of OSA were taken from the ASA CPGs as well as in several consultations with Dr. Winnick, and inclusion of his extensive clinical reference. These recommendations included the choice of anesthetic techniques, airway management, and intraoperative monitoring (Corso et al., 2014). Safety considerations related to intraoperative OSA management in regard to these anesthetic implications were explored as well as associated precautions. The advantages and disadvantages of various techniques for intraoperative management were included in this section as a guide for providers.

Postoperative management and analgesia. Recommendations including postoperative analgesia, patient monitoring, positioning, and oxygenation were taken from the ASA CPGs in addition to criteria for either discharge or hospital admission for OSA patients (Corso et al., 2014; Winnick et al., 2019). These recommendations were supported by evidence-based practices and current literature to provide safe postoperative care and outcomes for surgical patients with suspected OSA.

Figure 2

Pre- COVID-19 Implementation Timeline

Activity	**Dec 19**	**Jan 20**	**Feb 20**	**Mar 20**	**Apr 20**	**May 20**	**Sep 20**	**Oct 20**
Project proposal								
Submit to IRB								
IRB approval								
Form a team								

Baseline data								
Implement change								
Data collection								
Create/update charts								
Data analysis								
Write data analysis								
Write-up final paper								
Stakeholder result review								
Create poster								
Present project								

Sample

Appendix C includes the chart audit data collection tool that is recommended for use in future implementation and evaluation work. Due to the COVID 19 pandemic, our team was unable to collect data since it would have been inaccurate due to changes in hospital policy, cancelation of elective cases, and provider practice change. Regarding the continuation of the implementation of the CR on OSA our team recommends that a sample of charts from FMC should be evaluated every two weeks in the form of spot chart audits to determine the efficacy of the OSA CR following its implementation. The sample of charts should include the following patient types:

- Scheduled for outpatient surgery from February, 2020 through May, 2020
- Over the age of 18
- Receiving general anesthesia for surgical treatment at FMC

- American Society of Anesthesiologist (ASA) physical class I, II and III

Exclusion criteria should include the following patients:

- Scheduled for outpatient surgery outside the months of February through May
- Diagnosed with OSA
- Pending a sleep study
- Under the age of 18
- In-patient or emergent surgery
- Non-Operating Room Anesthesia
- ASA class IV, V, VI, due to these patients having higher operative risk

Measures

It is recommended that the project use outcome, process, and balancing measures to ensure sustainable improvement. During the data analysis period, consistent two-week chart reviews of the medical record should be completed to assess the overall project effectiveness. The chart reviews should include patients that fall within the inclusionary criteria from the months of February through May. The following measures should be assessed during the implementation stage to determine if the CR is being utilized: (a) the number of STOP-Bang questionnaires completed, (b) referrals to the sleep clinic, (c) the number of extended observations stays or inpatient admissions and lastly, (d) patients diagnosed with OSA after outpatient surgery. The compliance rate should focus on a STOP-Bang score of four or greater, classifying the patients as mild to moderate risk for OSA.

A retrospective chart spot audit should be completed every two weeks to determine the effectiveness of the CR implementation. The recommended outcome measure would include:

$$\frac{\text{The number of patients screened with the new CR}}{\text{The total number of patients having surgery}}$$

Compliance with the CR can be defined as 100% of the qualifying patients screened with the STOP-Bang questionnaire. By completing spot checks every two weeks the team can re-evaluate barriers during the implementation stage and make changes accordingly.

The process measure should reflect an increase in the appropriate use of the STOP-Bang questionnaire. Measuring the number of patients referred to the sleep clinic, with a STOP-Bang score of four or greater should reflect appropriate use of the questionnaire. The compliance rate can be measured by:

$$\frac{\text{The number of patients referred to the sleep clinic}}{\text{The total number of qualifying surgical patients}}$$

Success can be measured by 100% of the qualifying patients being referred to the sleep clinic. The outcome measure can be evaluated by the number of patients diagnosed with OSA after their outpatient surgery.

Data Collection Method

Due to the unforeseen limitations presented by the COVID-19 pandemic, data from the medical record was unable to be obtained. Due to this barrier, we have developed recommendations for how to proceed with the project. The current state and future state of the project is recommended to be monitored through retrospective chart audits made available by the KP research center in Pasadena, CA. Our team recommends that an initial baseline spot chart audit be collected once IRB approval is obtained using a data collection tool (see Appendix C) in which the current use of the STOP-Bang screening built within the EHR can be assessed. A data element and variables form has been created to clearly identify and define the data being extracted from health connect (Appendix D). In collecting this data, the team should identify patients who should be screened for OSA during the perioperative period. The data collected should exclude personal health information for the safety of patient data. The necessary data can

be extracted from the health record and placed in an excel document saved to a password protected flash drive for additional security. A more detailed list of inclusion and exclusion criteria can be referenced in the sample section of this paper. ICD codes and definitions should be given to the variables in an organized table for statisticians to easily pull the needed data from health connect (in Appendix D).

Following baseline data collection, it is recommended that the team implement the new OSA CR. The team can hold a provider educational session introducing the developed OSA CR, including the EHR STOP-Bang tool. In order to evaluate project effectiveness, the team can conduct spot chart audits every two weeks during the evaluation period. Additionally, the DNP project team leaders should hold project team meetings every two weeks during implementation in order to update the team on progress and assess barriers and/or make modifications. The data obtained from biweekly spot checks should be documented and collected with the same tool used for baseline audits displayed in Appendix C. We recommend that the data bee presented using Shewhart charts for STOP-BANG utilization compliance as well as the use of the newly developed OSA CR. Data trends are recommended to be monitored and shared with the team biweekly to discuss the findings and collaborate on appropriate steps to be taken.

Education

Research has shown that the implementation of evidence-based clinical practice is not enough to create change in the healthcare professional's behavior (Larsen et al., 2019). Healthcare professionals must understand and support the need for change to update their current practices (Larsen et al., 2019). Therefore, it is essential to provide effective education when introducing current evidence-based practice (EBP). Goals of this project include education

of key stakeholders at FMC on the importance of OSA screening and the STOP-BANG algorithm that has been developed.

There are many ways to provide education to healthcare professionals but utilizing the most effective method is crucial for implementing new practices successfully. Educational interventions consist of lecture-style learning presentations, web-based training modules, grand rounds, interactive clinical activities, classroom didactic using clinical and interactive activities, and stand-alone teaching (Horntvedt et al., 2018). The practice at FMC requires the anesthesia department to meet every Thursday from 0700 to 0800 in a large conference room. The meetings consist of PowerPoint presentations on current practice changes, case discussions, policy changes, and other topics presented by anesthesia professionals and administrators.

The weekly meetings at FMC are an ideal opportunity to educate the key stakeholders on the importance of the STOP-BANG questionnaire (SBQ) and algorithm. Due to staff scheduling, not all anesthesia professionals are present at one meeting. Therefore, developing a video recorded presentation may ensure that most of the anesthesia professionals receive the same education. The educational video may also provide the reliability of content across all anesthesia professionals who view the video (Lutz, 2018). During educational implementation, change requires champions that are committed to the goal and can lead others (Gesme & Wiseman, 2010). Dr. Winnick is an ideal champion at FMC; he is an excellent leader who is passionate about OSA screening and interventions, making him a great asset to this project.

A simple and common method to assess the effectiveness of the education provided to health care professionals is to conduct a pre- and posttest survey (Shivaraju et al., 2017). Shivaraju et al. (2017) reported that the majority of medical students felt that a pre- and post-test helped them improve their focus during lectures, causing them to become more

attentive and eager to listen. Prior to viewing the educational video, anesthesia professionals at FMC should be given a true-false pre-test survey to evaluate the level of knowledge of the SBQ. The pre-test survey should be developed by key stakeholders and tailored to organization specific goals. The survey should ask questions about where the SBQ is located within their EHR system and other questions about individuals who may be at risk for OSA. By the end of the video anesthesia professionals should be able to; understand the importance of properly screening patients for OSA with the SBQ, describe the location of the SBQ within the EHR system, properly identify patients who are at high risk for OSA using the SBQ, and understand the steps of the STOP-BANG algorithm. Lastly, the same survey should be used as a post-test survey in order to evaluate the anesthesia professionals' level of comprehension of the information presented in the video.

Results

Due to the unexpected COVID-19 pandemic, our team could not obtain accurate data from the electronic health records nor conduct important educational training. Therefore, the discussion of data collection, analysis, and steps to be taken by a future team will be reviewed in this section. We advise the team to utilize the OSA CR by educating the preoperative nurses as well as anesthesia providers. It is crucial to review the OSA CR (Appendix E) in a step-by-step manner to achieve appropriate staff education and measure compliance of the newly developed CR.

Clinical Reference Overview

The OSA CR is similar to other medical algorithms in which interventions are based on the patients presenting information that determines the recommended treatment course. The algorithm begins with a focused history and physical exam prior to the administration of anesthesia. The SB tool located in the KP EHR can be performed by the preoperative RN or anesthesia provider. Depending on the SB score, a patient with a low-risk score of ≤ 3 may proceed to surgery with the usual perioperative care. The anesthesia provider should consider scheduling a PSG or HST for a patient undergoing a high-risk surgery with an SB score of ≥ 4. Additionally, for patients with an SB score of ≥ 4, the anesthesia providers may proceed with the algorithm, which implements perioperative measures to enhance patient safety. For nonhigh risk surgeries, the initial step will be to provide the patient with a wrist band identifying them as a high risk for OSA. The wrist band will allow the anesthesia provider to acknowledge the patient's increased risk for OSA. In addition, intraoperative measures should be considered if possible, which include regional anesthesia with minimal sedation, preparation for a difficult airway, use of CPAP, raising the head of the bed to 25 degrees, use of short-acting drugs, use of

invasive monitoring, extubation when the patient is fully awake, and adequate reversal of neuromuscular blockade. Anesthesia recovery management may consider close observation of oxygen saturation and hemodynamic monitoring, placing the patient's head of bead to 30 degrees or in the lateral position for at least two hours if possible, consider opioid-sparing analgesia and use of early CPAP if desaturation occurs. Furthermore, in-hospital management should be capable of continuous oxygen monitoring and the use of CPAP if previously diagnosed with OSA or the use of CPAP preoperatively. Lastly, patient discharge management should consist of a follow-up appointment with a sleep expert for a PSG and possible diagnosis and treatment if appropriate.

Data Collection and Analysis Recommendations

We recommend that the team performs an initial baseline chart audit utilizing the data collection *tools (*Appendix C & Appendix D*).* When performing the baseline chart audit, one to two months of data can be extracted from the EHR, and the data can be presented using a Shewhart chart, providing the team with a reference point. Once the OSA CR has been presented to the FMC staff, the team can perform bi-weekly chart audits over three months using the chart audit tool in Appendix C. The retrospective bi-weekly chart audits will help govern the effectiveness of the CR implementation. The data collected should be presented to the key stakeholders bi-weekly using Shewhart charts, which will enable the team to evaluate barriers and the effectiveness of the OSA CR implementation and assess for barriers. We recommend the outcome measure to include the number of patients screened with the new CR divided by the total number of patients having surgery. Compliance of the CR can be defined as 100% of the patients that meet the inclusion criteria are screened with the SB questionnaire.

Furthermore, the process measure will reflect an increased use of the SB questionnaire. The compliance rate can be measured by the number of patients referred to the sleep clinic divided by the total number of qualifying surgical patients. Success can be measured by the qualifying patients being referred to the sleep clinic, with the outcome measure being the number of patients diagnosed with OSA after their outpatient surgery.

Discussion

This DNP project aimed to improve the screening, diagnosis, and treatment of patients with OSA in the perioperative area through the development and implementation of an OSA CR. Our team developed a n OSA CR algorithm based on current evidence to serve as a guideline for anesthesia providers caring for OSA patients to assist in clinical decision making. Due to unforeseen barriers from the COVID-19 pandemic, our team was unable to educate and implement the CR into practice at KP Fontana. However, we provided an in-depth recommended plan for implementation and evaluation theoretically informed by the IOWA Model. This discussion will explore the use of algorithms in translating evidence-based guidelines into practice, as well as shed light on the ways in which the COVID-19 pandemic has influenced clinical research and the care of OSA patients with COVID in the perioperative setting.

Algorithms as Clinical Tools

Medicine is rapidly evolving. With an expansion of evidence and knowledge that improves patient care, presenting and gaining utilization of this knowledge to clinicians in the healthcare setting may seem like a daunting task. Therefore, gathering and organizing evidence in a brief, organized manner, such as in the form of a CR or algorithm may help to concisely disseminate the evidence and hardwire into practice. Multiple studies have shown the benefits of implementing simplified CRs and algorithms into practice in order to improve patient care and outcomes.

Algorithms are used by both nurses and physicians to assist in clinical decision making by providing evidence-based recommendation in patient care and are generally favored among providers (Birrenbach, 2016). CPGs are used to provide evidenced-based quality care to patients with recommendations supported by current research and rigorous analysis. Although they are

highly regarded as a standard of practice, they can often be lengthy and time consuming to review. Because of this, many providers are not adequately able to interpret and apply the CPG to practice (McConnell et al., 2009). A succinct and easy to follow algorithm provides clinicians with a step-by-step approach to patient centered management of conditions such as OSA with the same level of rigor as a CPG that is user friendly and more easily accessible (Moayyedi et al., 2017). CPGs are often condensed into a reference tool or CR. The use of a flow-chart-like algorithm has been shown to improve learning and adherence to evidence-based practice (Helwig et al., 2998). Our team developed a CR algorithm from current evidence, rigorous research, and clinical recommendations to promote the adoption of best practice for patients with OSA in the perioperative area. We hope that after the education and implementation of our CR algorithm, there is improvement in the screening, diagnosis, and treatment of this patient population at KP Fontana.

COVID-19 and Clinical Research

The 2019 (COVID-19) pandemic caused by SARS–CoV-2 restricted our project extensively. Rapid urgency for studies related to COVID-19 took precedence and also required the full extent of resources needed to conduct studies, such as the IRB and statistical analysts. Many institutions, such as Rutgers University, implemented criteria that included performing noncritical research remotely and new projects that require in-person presence that are not related to COVID-19 were prohibited (Omary et al., 2020). Our initial meetings with key stakeholders were to take place at the start of the COVID-19 pandemic, and it was agreed to halt implementation and on-site components of the project until more resources were available and healthcare norms and standards were re-established. In addition to limited resources, some of the recommendations in the CR were contradictory to the recommendations regarding treating

patients undergoing anesthesia during the COVID-19 pandemic. For example, our recommendations include awake extubation and limiting narcotics and sedatives. However, recommendations by Kumar and Sharmaon (2020) on anesthetic management for COVID-19 focus on limiting aerosolizing events such as coughing. In order to limit these events, deep extubation and the use of narcotics and sedatives may be ideal. Additionally, the ASA recommends not using CPAP and BiPAP because of the possibility of aerosolization of patient secretions. Open airway cases, including monitored anesthesia care cases, that may require manipulation of the airway by the anesthesia provider because of obstruction are primary reasons for COVID-19 transmission during anesthesia (Kumar & Sharmaon, 2020; Asenjo, 2020).

While COVID-19 was a major barrier in completing our project, the team feels there is a critical need for this work to continue. A thorough step-by-step guide to how our project was to evolve is located in the results section of this paper. COVID-19 may have changed some of the ways in which we provide anesthesia. Yet, eventually COVID-19 will be minimized. Meanwhile, OSA and its associated comorbidities will not, at least not anytime soon. The obesity epidemic is still on the rise, and while a worldwide pandemic has been at the forefront of available research, critical research and the implementation of evidence-based practice has been neglected. Our goal is to have this project continued as soon as possible, so that critical work on a disease that affects millions of people per year is continued and not forgotten.

Conclusion

The successful intraoperative management of patients with OSA may benefit from the implementation of clear and concise clinical reference. This project developed an OSA CR based on the analysis of current literature in order to ensure best practice. Ultimately, collaboration with our team of key stakeholders at our initial site would have helped our team tailor these guidelines to the specific needs and environment of the institution. The Covid-19 pandemic deterred these plans along with the data collection, compliance analysis, and staff education. Those crucial elements were needed in order to make a practice change within the facility. However, the research we analyzed and constructed into a simple algorithm can be utilized in the future when the resources are available and there is openness to practice change.

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APPENDIX A

Literature Search

Screening Tools and Risk Factors for OSA

Terms	Limiters	Articles Found	Articles Reviewed	Articles Excluded	Articles Used
obstructive sleep apnea AND Screening; obstructive sleep apnea AND STOP-Bang; obstructive sleep apnea AND screening AND barriers	Peer Reviewed, English language, Publish Date: 2009-2019	PubMed: 7288; 331; 81 CINAHL: 6881; 254; 56 GS: 19,700; 4,090; 1,600 EBSCO: 5431; 248; 44	45	27	18

Note. Articles excluded were based on title or abstract and significance to project topic. CINAHL = Cumulative Index Nursing and Allied Health Literature (CINALH); GS = Google Scholar

OSA Anesthesia Management

Terms	Limiters	Articles found	Articles Reviewed	Articles Excluded	Articles Used
obstructive sleep apnea AND perioperative; obstructive sleep apnea AND anesthetic implications; obstructive sleep apnea AND anesthesia AND management	Peer Reviewed, English language, Publish Date: 2009-2019	PubMed: 594; 12; 280 CINAHL: 321; 7; 145 GS: 22,000; 17,200; 17,000 EBSCO: 620, 42; 320	41	26	16

Note. Articles excluded were based on title or abstract and significance to project topic. CINAHL = Cumulative Index Nursing and Allied Health Literature (CINALH); GS = Google Scholar

OSA Clinical Practice Guidelines

Terms	Limiters	Articles found	Articles Reviewed	Articles Excluded	Articles Used

obstructive sleep apnea AND guidelines; obstructive sleep apnea AND guidelines AND anesthesia	Peer Reviewed, English language, Publish Date: 2009-2019	PubMed: 585; 74 CINAHL: 465; 37 GS: 19,200; 17,200 EBSCO: 312; 27	8	5	3

Note. Articles excluded were based on title or abstract and significance to project topic. CINAHL = Cumulative Index Nursing and Allied Health Literature (CINALH); GS = Google Scholar

APPENDIX B

Data Collection Tools

Protection of Human Subjects (IRB requirement)

Patient MRN or Account Number	Subject ID

Chart Audit Tool

Patient ID	Age (round up)	Gender 0=Male 1=Female	BMI (number)	Surgical Procedure	CR used? 0=No 1=Yes	OSA diagnosed? 0=No 1=Yes	Comments

APPENDIX C

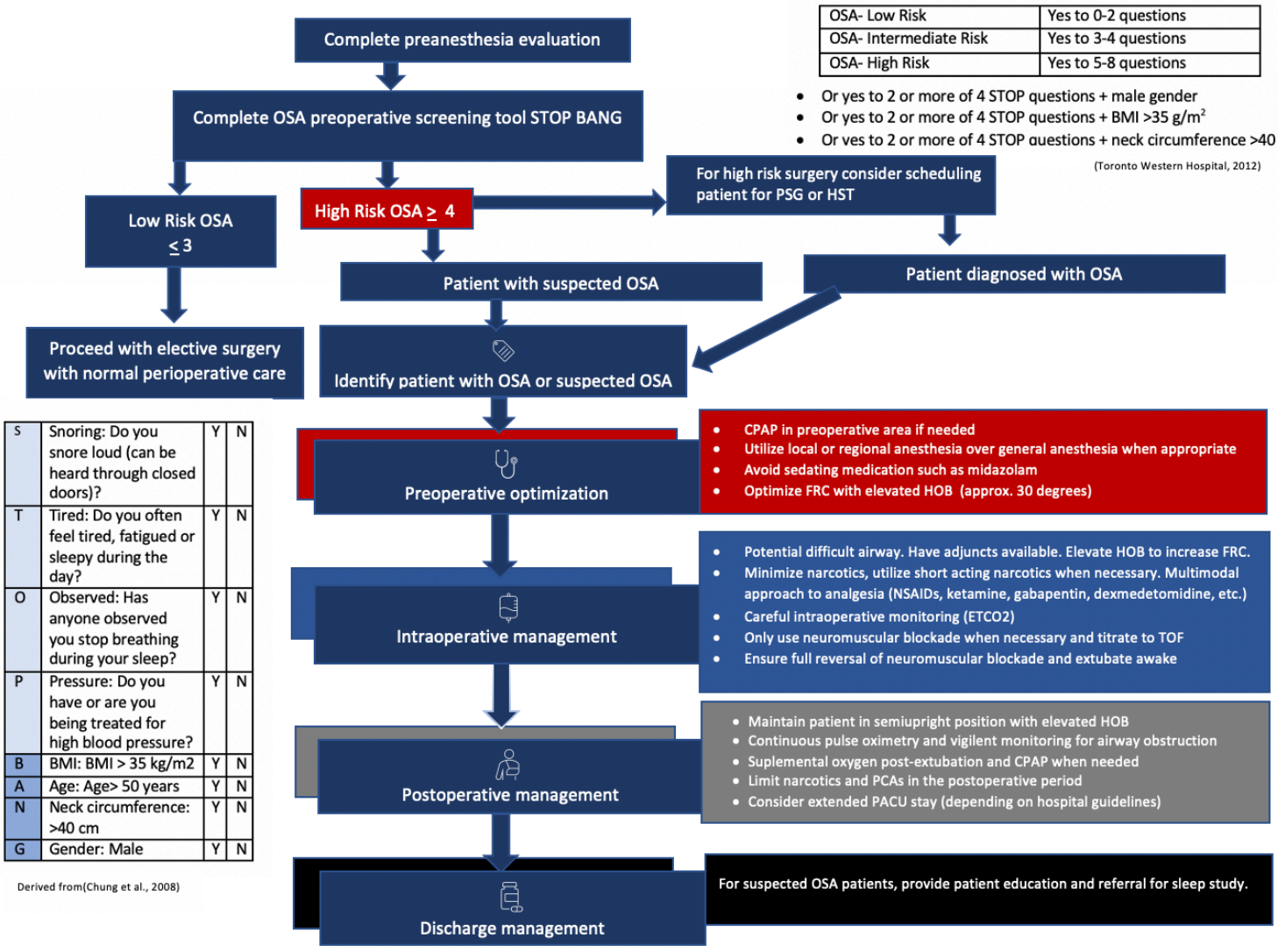
Data Element/ Variable Form

	Variable	ICD Code	Code Description	Definition	Inclusion/Exclusion
1	Demographics				Inclusion
1a	Age			Patients >18 years old	
1b	Sex			Male/Female	
1c	Height			Feet and Inches	
1d	Weight			Kilograms	
1e	Body Mass Index (BMI)	BMI- Z68			
2	Outpatient surgery at Kaiser Fontana			Patients presenting from surgery from home who are not being admitted following surgery	Inclusion
3	American Society of Anesthesiologists (ASA) I, II, III				Inclusion
4	Timeline Pre-Implementation (July 2019- December 2020)			Patients undergoing surgery before that meet inclusion criteria before implementation of clinical practice guideline	Inclusion
5	Timeline Post-Implementation (April 2020-September 2020)			Patients undergoing surgery before that meet inclusion criteria after implementation of clinical practice guideline	Inclusion
6	Diagnosed Obstructive Sleep Apnea	G47.3	Sleep apnea		Exclusion
7	Dependence on CPAP	Z99.89	Dependence on other enabling		Exclusion

			machines or devices (CPAP)		
8	Pregnant	Z33.1	Pregnant state		Exclusion
9	Polysomnography Completed				Exclusion
10	Age <18				Exclusion
11	Inpatient Surgery				Exclusion
12	Emergency Surgery				Exclusion
13	Non-Operating Room Anesthesia				Exclusion
14	ASA IV, V, VI				Exclusion

APPENDIX D

OSA Clinical Reference Tool



S	Snoring: Do you snore loud (can be heard through closed doors)?	Y	N
T	Tired: Do you often feel tired, fatigued or sleepy during the day?	Y	N
O	Observed: Has anyone observed you stop breathing during your sleep?	Y	N
P	Pressure: Do you have or are you being treated for high blood pressure?	Y	N
B	BMI: BMI > 35 kg/m2	Y	N
A	Age: Age> 50 years	Y	N
N	Neck circumference: >40 cm	Y	N
G	Gender: Male	Y	N

Derived from(Chung et al., 2008)

(Chung et. al., 2016; Corso et. al., 2014; Mutter et al., 2015; Naqvi et al., 2017; Cozowicz et al., 2018; Ünal et al., 2015; Barnes et al., 2017; Seet & Chung, 2010)