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Effects of an Obstructive Sleep Apnea Screening Program on Providers' Adherence

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EFFECTS OF AN OBSTRUCTIVE SLEEP APNEA SCREENING PROGRAM ON PROVIDERS' ADHERENCE

by

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ABSTRACT

Obstructive sleep apnea (OSA) is a widely prevalent chronic disease estimated to affect 22 million Americans, with 80 percent of moderate to severe cases undiagnosed (American Sleep Apnea Association [ASAA], 2017). Unmanaged OSA has been associated with numerous detrimental health outcomes including hypertension, chronic heart failure, atrial fibrillation, stroke, and other cardiovascular conditions (ASAA, 2017). The purpose of this evidence-based practice project was to determine if the implementation of a screening protocol would affect providers' adherence to screening for OSA. The Theory of Planned Change was used as a guide to optimize providers' adherence to the protocol at a family medicine clinic in Northwest Indiana. Following an extensive review of the literature, the screening protocol was designed instructing providers' which patients needed to be screened for OSA and the preferred method. To determine if the screening protocol had an effect on providers' adherence to screening, a two-group comparison design was utilized. Pre-intervention group data were manually collected from medical records of *at-risk* patients at the clinic prior to protocol implementation. Post-intervention group data were collected from medical records of patients managed after protocol implementation. In the pre-intervention group, 1 (0.7%) patient *at-risk* for OSA were screened compared to the post-intervention group 44 (34.9%). Using chi-square test, a significant association was found between providers' adherence to screening *at-risk* patients between the groups ($X^2(1)=56.67$, $p<0.001$). A significant association was found between providers' adherence to using the STOP-Bang Questionnaire between the two groups ($X^2(1)=60.61$, $p<0.001$). No significant relationship was found between the number of patients referred for OSA diagnostic testing between the two groups ($X^2(1)=.488$, $p=.485$). Although the intervention significantly improved providers' adherence to screening for OSA, clinical significance is limited since there was no significant relationship found in the number of patients referred for diagnostic testing or incidence of patients with a new diagnosis of OSA.

CHAPTER 1

INTRODUCTION

Background

Obstructive sleep apnea (OSA) is a widely prevalent chronic disease often requiring lifelong treatment and evaluation. Among sleep-related breathing disorders, OSA is the most common (Strohl, 2018). OSA places patients at higher risk of numerous adverse health outcomes with severe OSA associated with increased all-cause mortality (Strohl, 2018). Despite the severity of health detriments attributed to OSA, the disease is largely undetected and undervalued. It has been estimated that 22 million Americans are affected with OSA, with 80 percent of moderate to severe cases undiagnosed (American Sleep Apnea Association [ASAA], 2017). It is estimated that 20-30% of males and 10-15% of females in North America have OSA (Strohl, 2018).

As detailed by Greenough and Judd (2017), OSA is a medical condition characterized by repetitive apneic episodes, which entails cessation of breathing for varying periods of time during the patient's sleep. Airway blockage is caused when the tongue mechanically collapses against the soft palate causing the soft palate to collapse against the throat. Evidence suggests that when a patient experiences an occlusive episode, it leads to a disturbance of blood gas exchanges such as decreased oxygen saturation and hypercapnia, prompting central nervous system (CNS) arousal (Javaheri et al., 2017; Strohl, 2018). This cycle of obstruction and CNS stimulation can occur numerous times throughout a patient's sleep. There are numerous detrimental health outcomes associated with OSA either as a consequence of the disorder or as a result of not receiving proper management. According to the American Sleep Apnea Association (2017), untreated moderate to severe cases of OSA have the potential to lead to high blood pressure, chronic heart failure, atrial fibrillation, stroke, and other cardiovascular conditions (American Sleep Apnea Association [ASAA], 2017). Considering the current

disproportionate state of OSA diagnosis and the potentially dangerous implications of not detecting OSA, this is a clinical problem that demands attention.

Statement of the Problem

Due to the many health detriments independently associated with OSA, a significant amount of research has been conducted focusing on identifying and managing OSA. An estimated 80% of moderate to severe OSA is undiagnosed and a majority of primary care providers are not regularly screening for OSA demonstrating a large undervaluing of the severity of the condition (ASAA, 2017). The Centers of Disease Control (CDC) asserts that despite major health contributions attributed to sleep problems, sleep disorders are rarely addressed or evaluated by providers during routine visits (Centers of Disease Control [CDC], 2017). It has been estimated that only 20% of patients with sleep-related symptoms regularly visiting a primary care physician spontaneously self-report their symptoms to their clinician (Jonas et al., 2017). With the insignificant number of patients disclosing sleep-related problems, it is the responsibility of the primary care provider to initiate screening for OSA to recommended patients.

Data from the Literature

Attributing to the significance of the project, unmanaged OSA is closely associated with numerous pervasive health detriments. Strohl (2018) described the strong associations between unmanaged OSA and metabolic syndrome, type 2 diabetes, depression, and traffic accidents. Although the association of type 2 diabetes and OSA can be attributed to the shared risk factor of obesity, their independent relationship has been supported in several large studies suggesting OSA's potential to exacerbate patients cardiometabolic risk. Postulations of the underlying mechanism of these relationships include the repeated apneic episodes and increased sympathetic arousal triggering an oxidative stress, vascular endothelial dysfunction, and increased platelet adhesiveness (Strohl, 2018). Daytime sleepiness is a common feature in patients with OSA and has been associated with impaired daily functioning, cognitive

dysfunction, decreased quality of life, and increased frequency of motor vehicle accidents. Furthermore, a two-fold increased prevalence of depression as well as sexual dysfunction has been demonstrated among patients with OSA (Strohl, 2018).

Strohl (2018) also addresses prominent risk factors of OSA including advanced age, male gender, obesity, and certain craniofacial structures that may occlude breathing. Strohl (2018) described that although OSA is present in pediatric populations, the prevalence increases in young adults and peaks in the seventh decade of life. Occurrence is also noted to be 2-3 times more common in males than females with the gap narrowing after the onset of menopause. African Americans younger than 35 years old have a higher incidence of OSA as compared to Caucasians of the same demographics. Tufik, Santos-Silvia, Taddei, and Bittencourt (2010) performed a study that demonstrated an increased risk for OSA with increasing BMI. The findings showed moderate to severe OSA was present in 11% of patients with normal weight, 21% in those overweight, and 63% of those that were obese. Additionally, findings from a four-year longitudinal study of nearly 700 adults by Peppard et al. (2000) reported a six-fold increase of OSA prevalence with a 10% weight increase. Craniofacial abnormalities such as short maxillary size, a wide craniofacial base, and tonsillar/adenoid hypertrophy increases the risk of OSA (Strohl, 2018).

There are numerous clinical signs and symptoms associated with OSA. Common patient reported symptoms include daytime sleepiness, morning headache, and snoring. Also, patients bed partner may complain of patient snoring, gasping, snorting, or interruptions of breathing during their sleep (Kline 2018; Strohl, 2018). Snoring has been associated with a sensitivity and specificity of 80-90% and less than 50% respectively (Kline, 2018). Strohl (2018) asserts that the most useful individual finding for OSA is report of nocturnal choking or gasping with a sensitivity of 52% and specificity of 84%. Common clinical exam signs indicating OSA include obesity (BMI >30 kg/m2), narrow oropharyngeal airway (classified as a modified Mallampati score of 3 or 4), large neck circumference (>17 in. in males and >16 inches in females) and

hypertension (Kline 2018; Strohl, 2018). Markedly, it is estimated that half of patients with OSA have coexisting hypertension (Kline, 2018). Patient symptoms should be evaluated in context with physical signs observed. For example, patients with report of snoring and a BMI of < 26 are less likely to have moderate to severe OSA (Kline, 2018).

Given the varying efficacy of independent patient signs and symptoms, several clinical screening tools have been developed to aid in OSA identification. Common screening tools include Epworth Sleepiness Scale (ESS), STOP questionnaire (SQ), STOP-BANG questionnaire (SBQ), Sleep Apnea Score (SACS), Berlin Questionnaire (BQ), and Multivariable Apnea Prediction instrument (MVAP) (Kline, 2018). These clinical tools often combine patient symptoms with common physical exam findings to generate a score that is correlated with the patient's risk of OSA. For example, the letters of STOP-Bang represent an acronym consisting of snoring, tiredness, observed apneas, blood pressure, BMI, age, neck circumference, and gender (Kline, 2018). Each positive finding associated with the acronym letter delineates a point with scores of greater than three of eight indicating possible OSA (Kline, 2018). Because many screening tools were developed using known high-risk patient population settings such as sleep clinics, they are often less useful in their ability to screen asymptomatic patients. While there is currently no established gold standard screening tool that is widely endorsed or recommended, several studies have compared the sensitivity and specificity of each tool allowing an informed clinical judgement to be made by the provider. As established by Kline (2018), the SBQ frequently demonstrates the highest sensitivity in detecting OSA when compared to other screening questionnaires in high-risk patients. This was further supported in a cross-sectional observational study by Miller et al. (2018) comparing multiple screenings tools sensitivity of predicting OSA. The study concluded the STOP-Bang questionnaire demonstrated the highest sensitivity of OSA among *at-risk* patients and was the desirable tool to use in screening (Miller et al., 2018).

The diagnosis of OSA is confirmed by either in-laboratory polysomnography or home sleep apnea testing (HSAT). In-laboratory polysomnography is considered the gold standard to diagnosis OSA and is preferred in patients with suspected complicated OSA such as those with comorbidities, those suspected to have other sleep disordered breathing conditions, and suspected mild OSA (Kline, 2018). HSAT is considered appropriate in patients suspected to have moderate to severe uncomplicated OSA (Kline, 2018). Patient preference and environmental factors should be taken into consideration regarding which method of diagnostic testing is selected. Although in-laboratory testing is the gold standard, many HSAT devices have been validated against standard polysomnography (Kline, 2018). Diagnosis is confirmed via in-laboratory testing or HSAT, observing the frequency of observed apneas, hypopnea, and respiratory effort-related arousals (Kline, 2018). At least five obstructive respiratory events per hour of sleep must be noted in addition to the presence of one or more of the following: sleepiness, nonrestorative sleep, fatigue, or insomnia symptoms; waking up with breath holding, gasping or choking; habitual snoring, breathing interruptions, or bother noted by partner or observer; hypertension, mood disorder, cognitive dysfunction, coronary artery disease, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus. Additionally, the occurrence of 15 or more obstructive respiratory events per hour of sleep regardless of associated symptoms confirms the diagnosis of OSA (Kline, 2018).

Kline (2018) explains that patients with OSA are classified in regard to severity of the disorder based on the frequency of respiratory events per hour referred to as the apnea-hypopnea index (AHI) detected by either in-laboratory polysomnography or HSAT. Respiratory events monitored include apneas from total occlusions, hypopneas from partial occlusions, mixed apneas, or respiratory related arousals. An AHI score is generated using the average number of apneas plus hypopneas per hour of sleep. Mild OSA encompasses those with an AHI between 5-14 events per hour, moderate 15-29, and severe greater than or equal to 30.

Once an OSA diagnosis is confirmed, management should be immediately initiated due to the chronic long-term nature of the condition. There are numerous treatment options available for OSA including positive airway pressure methods, oral appliances, and surgical treatment such as airway reconstruction as well as adjunct therapy options including weight loss and bariatric surgery (Epstein et al., 2009). The gold standard of treatment for mild, moderate, and severe OSA is continuous positive airway pressure (CPAP) and should be recommended to each patient (Epstein et al., 2009). A summary of the evidence concluded that the use of CPAP for treating OSA effectively reduced the patients AHI to normal ranges or near normal ranges (Bibbins-Domingo et al., 2017). Furthermore, studies have demonstrated a reduction of blood pressure and improved sleep quality associated with CPAP treatment (Jonas et al., 2017). Mandibular advancement devices (MADs) are oral appliances that are often utilized as an alternative treatment option for patients unable to tolerate CPAP. MADs were shown to be effective with decreasing AHI scores compared to placebo, but no significant blood pressure reduction was demonstrated (Jonas et al., 2017). Surgical options such as radiofrequency surgery of the soft palate, tissue ablation, uvulopalatopharyngoplasty, septoplasty, and bariatric surgery have limited evidence available demonstrating no significant reductions in AHI or blood pressure (Jonas et al., 2017). Although current research is sparse on weight loss, diet, and exercise as treatment options, the available data depicts an associated AHI reduction with these modalities (Jonas et al., 2017).

Data from the Clinical Agency Supporting Need for the Project

A local private family practice clinic was selected as the ideal setting to implement this project. This family practice clinic consists of a physician, a nurse practitioner, a nutritionist, a nurse, two medical assistants, and two front desk secretaries. The site serves a wide variety of patients with the majority of patients considered Caucasian and African American. Although the site offers services to all ages, the majority of patients are between 20-80 years old. The physician has additional training in obesity management and treatment thus complimenting the

services provided by the nutritionist. Due to the additional focus and services for obesity and weight loss, there is a higher prevalence of patients that are considered overweight and obese that utilize the clinic for routine care. Currently there are ambiguous clinic guidelines in regard to screening for OSA. The clinic has no established protocol for classifying patients as *at-risk* for OSA necessitating appropriate screening. Screening appears to be performed at random primarily by patients self-reporting a suspicion of OSA. Current practice at the clinic also demonstrates inconsistencies of which screening tool is used. While the providers report using the STOP-Bang questionnaire (SBQ) to screen patients, the clinical staff provides that they use the Epworth Sleepiness Scale (ESS) creating ambiguous procedures and inconsistent screening.

Purpose of the Evidence-Based Practice Project

The goal of evidence-based practice is to promote the use of best practice guidelines established by current evidence. The intent of this EBP project was to examine the best-practice recommendations of screening for OSA in the primary care setting by developing a policy based on current practice guidelines and best evidence. The aim of the project was to implement a protocol that broadened the base of patients that were being screened using established criteria while using the clinical tool that demonstrated the best sensitivity for detecting OSA. The underpinnings of implementing a screening protocol was an effort to attenuate the number of patients with undetected OSA that were potentially reaping the adverse effects of unmanaged OSA.

PICOT Question

The PICOT (patient population, intervention of interest, comparison intervention, outcome and timeframe) format was used to facilitate the structure of the EBP project. The PICOT question examined was, “In the internal medicine setting, how does implementation of a revised obstructive sleep apnea screening protocol affect providers’ adherence to screening over a one-month period as compared to current practice?”.

Significance of the Problem

Enhancing screening for OSA allows for earlier treatment and intervention with the goal of preventing adverse health outcomes associated with untreated OSA. Aurora and Quan (2016) support the impact of optimal screening stating, “since treatment of OSA has been shown to improve cardiovascular outcomes, screening for OSA in known high-risk populations has merit” (Aurora & Quan, 2016, p. 1186). As mentioned, OSA has been associated with several health consequences when left untreated such as hypertension, stroke, type 2 diabetes, and depression which are some of the leading causes of morbidity and mortality (Aurora & Quan, 2016; Strohl 2018). In addition to the improved patient outcomes, increased screening and treatment of OSA would signify a reduction in national health care cost. Individuals with untreated OSA are estimated to accumulate between 34 to 69 billion dollars in direct health care cost per year as a result of the associated significant chronic co-morbidities, decreased quality of life, decreased workplace productivity, motor vehicle and work-place accidents (American Academy of Sleep Medicine [AASM], 2016; Aurora & Quan, 2016). By enhancing providers’ adherence to screening for OSA, this would promote a shift in the delivery of care by emphasizing primary and secondary prevention potentially resulting in improved patient outcomes and reduction of national healthcare debt.

CHAPTER 2

THEORETICAL FRAMEWORK, EBP MODEL, AND REVIEW OF LITERATURE

Essential to evidence based-practice (EBP) is the utilization of current best-practice evidence to guide in the delivery of high-quality healthcare. A synthesis of varying levels of evidence is appraised leading to identification of major concepts as the basis of best-practice. Consequently, an exhaustive systematic literature review of best practice was conducted in generating a policy related to screening for obstructive sleep apnea (OSA) in the primary care setting. A theoretical framework and EBP model were used to guide in the development of this project. The purpose of this chapter will be to explore the theory and EBP model utilized to guide the established EBP project, as well as detail the literature search conducted.

Theoretical Framework

Overview of the Theoretical Framework

Concepts from Kurt Lewin's Theory of Planned Change were employed to guide project development. Lewin was a prominent social psychologist and sought to assess factors influencing behavior as a strategic means to guide change (Shirey, 2013). Lewin's theory is composed of several complimenting micro-theories including the force field analysis, quasi-stationary equilibria, and the individual-group relationships theory, and serves to explain how change occurs at the individual level of those that are involved in the change (Tiffany & Lutjens, 1998). To provide a brief overview, the force field analysis micro-theory is comprised of three stages including unfreezing, moving, and refreezing that provides instruction to guide the change process. The quasi-stationary equilibria micro-theory compliments the force-field analysis by explaining driving forces and restraining forces that promote or prevent the change (Tiffany & Lutjens, 1998). Driving forces are influences that motivate and strengthen the need for change while restraining forces hinder or prevent the change (Shirey, 2013). Within the theory these forces are depicted as opposing arrows facing each other across a straight line in

the middle which represents the equilibrium or state of functioning (Tiffany & Lutjens, 1998). Tiffany and Lutjens (1998) explain that the opposing arrows or forces either push the line towards the change or away depending on the cumulative strength of the forces. The individual-group relationships micro-theory concepts explains how the driving and restraining forces are developed or changed. Cognitive and affective experiences shape individual values and are strengthened during group interactions. These group interactions develop into power fields that exert pressure to maintain group standards. By influencing individual's value formation, this manipulates the strength of the forces to either promote or prevent change. Concepts from each of these micro-theories can be applied within the stages of change.

Unfreezing. Shirey (2013) explains the unfreezing stage is characterized by a change agent recognizing a problem and identifying the need to change the current equilibrium. Communication to key stakeholders regarding the need for change to help facilitate a better practice is essential in this stage. After the problem is recognized and changed is desired, preparations for the change are initiated by proposing solutions. Paramount to this stage and ultimately propelling a successful change is strengthening driving forces and weakening restraining forces. This can be accomplished through re-education aimed to alter individuals' values that conforms to the desired change (Tiffany & Lutjens, 1998).

Moving. Shirey (2013) describes that during this stage members are actively engaged in implementing the change. This stage is also known as transitioning and involves the inner movement that individuals make in reaction to the change. Inner movement incorporates implementation of the selected change.

Refreezing. In this last stage, the change is stabilized and becomes embedded into the new equilibrium (Shirey, 2013). This new equilibrium represents a system change reflected in the culture, policies, and practices and should ideally be of higher quality than the original. In a successful change, the driving forces accentuating the change continue to outweigh the

hindering forces. Often overlooked, refreezing or solidifying the change within the system determines the changes sustainability and permanency.

Application of Theoretical Framework to EBP Project

Sutherland (2013) demonstrated the applicability and success of employing Lewin's theory in the implementation of a bar-coded medication administration (BCMA) project. The unfreezing stage was initiated after identifying a problem with the current medication delivery system consisting of old medication carts in disrepair and relying on manual verification that the right medication is being correctly administered to each patient. This presented a problem to the facility due to the serious risks medication errors present to a patient's health and safety which may result in increased health care cost. This may also have the potential to negatively affect nursing morale. The key stakeholders that were most affected by the change were identified as staff nurses, managers, and administrators. With a driving force of avoiding risks of medication errors the need for change was accepted and solutions were hypothesized, namely a BCMA system. Essential to the success of the project was identification of driving and restraining forces in the unfreezing stage. Restraining forces included staff members aversion to using technology, lack of computer experience, and lack of trust in the organization. Key driving forces included staff's desire to ensure optimal patient safety, ease of use of the proposed medication administration system as compared to current medication administration system, and an increase satisfaction for staff in relation of better time management of patient care. After educating on the severe risks of medication errors, the driving forces were strengthened and ultimately outweighed the restraining forces, thus progressing the project to the moving stage. A designated project leader was appointed to oversee the implementation of the BCMA technology. Multiple disciplines were involved in the implementation of the change to bolster acceptance of the proposed change including information technology, pharmacy, and nursing staff in an effort to ensure all stakeholders were included in the change. During the final refreezing stage of the project, ongoing support with the fully operational new system deemed

the implementation a success. Implementation of the BCMA system signified a change in the equilibrium by creating a system change resulting in a new process of medication administration that sought to increase patient safety. Sutherland (2013) depicts Lewin's Theory of Planned Change as being instrumental in the successful implementation of a BCMA system and serves as a model to reference for future projects.

Concepts from Lewin's Theory of Planned Change applied to the goal of this EBP project of establishing a sustainable change of screening for OSA in *at-risk* patients. The three stages of change in Lewin's theory were essential in the development and implementation of the EBP project. The unfreezing stage started with discussion with clinical staff serving as key stakeholders about the practice's current process of screening for obstructive sleep apnea. It was openly accepted that the current method of screening for OSA was not consistent as evidence by some staff using the Epworth Sleepiness Scale and others using the STOP-Bang questionnaire. Furthermore, screening was done at random mainly as a result of patient's self-reported suspicion of OSA. The current practice presented a problem as unmanaged OSA has the potential to lead to numerous adverse health outcomes to patients. Potential solutions were discussed namely the implementation of a screening protocol. By creating an open dialogue, restraining forces were identified that could potentially prevent this adoption of the protocol. Restraining forces included staffs' belief that screening for OSA had minimal value, staffs' opinion that screening was time consuming, and that screening was a burden to the patients. However, there were several driving forces highlighted during discussed that supported a change in practice for screening OSA. Driving forces included staffs' desire to promote optimal patient outcomes while achieving compliance with best practice standards. By providing education to staff members on the adverse health outcomes associated with unmanaged OSA, this strengthened the driving forces of the staffs' desire to promote optimal patients' outcomes which outweighed the restraining forces. This symbolized a successful unfreezing stage and readiness for the project to enter into the moving stage.

The moving stage of the project began with the implementation of the screening protocol. Imperative to the long-term sustainability of the project, each stakeholder including physician, nurse practitioner, nurse, and medical assistants needed to be educated and actively engaged in the implementation. The moving stage consisted of the providers actively engaging the protocol into practice by identifying *at-risk* patients and screening those using the STOP-Bang questionnaire. This phase represented a shift in the equilibrium as the protocol created a change in the workflow process.

Once the protocol was implemented into current practice, this represented the refreezing stage. A new equilibrium is represented by a new way or process for screening OSA embedded into the practice of the clinic. Ultimately, follow-up with staff compliance with adhering to the protocol will determine if the change was successful in achieving permanency or if driving forces no longer continued to outweigh resisting forces.

Strengths and weaknesses of theoretical framework. Strengths of the theory include versatility and practicality. Although the theory was developed in the setting of psychology and group dynamics, it has applicability across numerous disciplines including nursing. Sutherland (2013) demonstrated the theory's use in the acute care setting, while others have applied to management settings. The theory is best applied in a top-down approach meaning one leader serves as a change champion driving the change throughout the organization (Shirey, 2013). This theory allows for stable change over time which aligned with the aims of this EBP project.

Weaknesses identified in the utilization of this theory included the potential for poor long-term sustainability of the change. The risk for continued adherence is of concern due to the change often starting with administration and propelled by a change champion rather than being generated by front-line staff implementing the change. The theory is criticized for being too linear and simple while change is seen as dynamic and unpredictable. It can be argued that change is too complex to be categorized into three stages.

Evidence-Based Practice Model

Overview of EBP Model

Complementing the Theory of Planned Change, the second edition of the John Hopkins Nursing Evidence-Based Practice (JHNEBP) model also served as a guide in the development and implementation process of this EBP project. The model was developed in response to clinical nurse's feedback expressing a desire for a process to help facilitate their evaluation and application of best evidence into bedside care (Dang et al., 2015). As a result, this model was developed as a means to promote the translation of new knowledge into current practice at John Hopkins Hospital after recognizing gaps between the standards of care and the actual care provided (Dang et al., 2015).

Unique to the JHNEBP model is the three phased process used to guide change implementation. This process is known as the PET process which represents the three phases of *practice question, evidence,* and *translation* (Dang et al., 2015). Dang et al. (2015) explains that within each of these three phases are multiple prescriptive steps with a total of 18 steps. The steps are relevant to each of the three phases and are designed to progress the implementation or translation of best evidence into current practice.

Practice question. Newhouse et al. (2007) explains that the first phase of the EBP process is comprised of 5 steps and begins with an interdisciplinary team developing an EBP question. The EBP question should be refined into a narrow and specific question using the PICOT format. The scope of the question should be defined and should guide identification of stakeholders. For example, if the project scope represents a departmental change, members of that department need to be informed and involved. An interdisciplinary team should be formed with leadership and responsibilities assigned. The first phase of the process is crucial, as the developed EBP question drives the remaining process.

Evidence. The second phase includes 5 steps and encompasses the literature search, appraisal, summary, and synthesis of best evidence (Newhouse et al., 2007). Newhouse et al.

(2007) explains that this phase begins with a comprehensive literature search incorporating a variety of evidence such as research studies, practice guidelines, quality improvement data, and opinions of experts. To ensure a thorough search is performed it is recommended to consult a health information specialist such as a library search specialist. After the search for evidence is complete, the level and quality of evidence should be appraised. The evidence should then be grouped together according to the appraised level and summarized. After summarizing the evidence, a synthesis of findings should be performed leading to the development of practice recommendations. Unique to this model are four pathways that determine how to proceed based on the strength of the current evidence (Dang et al., 2015). For example, the first pathway recommends that a practice change is implemented since there is consistent high-quality evidence yielded from the literature search (Dang et al., 2015). On the contrary, the fourth pathway suggests a revised literature search for new evidence or discontinuation of the project due to little or no available evidence supporting the proposal (Dang et al., 2015).

Translation. The last phase of the process entails eight steps that guide the implementation and evaluation of the EBP project change. Newhouse et al. (2007) explains that after evaluating the strength and recommendations from the literature search, the interdisciplinary team decides if the change is feasible and appropriate. Once the team agrees to proceed with project implementation, an action plan is created, and the change is implemented. After implementation, outcomes are evaluated including identification of any unexpected findings. The results should then be reported to the stakeholders and discussed if the change should be adopted internally depending on the outcomes. Regardless of outcome, it is urged that findings are to be disseminated.

Application of Evidence-Based Practice Model to Project

The JHNEBP model was instrumental in project development and assimilation of best evidence. During the developmental stage of the project, the model was fundamental to ensure high-quality evidence was utilized. This created a strong foundation for a successful

implementation. The dynamic nature of this model allowed for consideration of internal forces such as office culture and staff opinions that had the possibility of hindering the implementation. Recognizing these factors and promoting open communication have aided in the smooth application of the project.

The JHNEBP has been applied across numerous settings and initiatives as a tool to evaluate EBP. Mori (2015) provides a detailed systematic application of the model in the endeavor to decrease methicillin-resistant *Staphylococcus aureus* (MRSA) surgical site infections (SSI) in total knee and hip arthroplasty patients. Mori (2015) begins the JHNEBP process by developing the EBP question in PICOT format. Stakeholder support was achieved after interdisciplinary team members reached consensus that the current rate of surgical site infections posed a problem that needed attention. Roles within the team were delineated and the project advanced to the evidence phase of the model. During the second phase Mori (2015) provides detail of the literature search and appraisal process. Evidence was appraised and synthesized to develop recommendations including the procedure of screening for MRSA before surgery, use of chlorhexidine gluconate soap, and the procedure of decolonizing certain patients with intranasal antibiotics (Mori, 2015). After the recommendations were developed based on reviews of evidence, the translation phase sought to begin the project implementation. Feasibility of the implementation was explored including financial burden of the screening recommendations compared to the cost savings of reducing SSI's. Outcomes were evaluated 6 months after implementation demonstrating reduced SSI rates from 5.3% to 0 (Mori, 2015). These results were then disseminated and communicated with other institutions. Mori (2015) provides an exemplar application of the JHNEBP model framing the success of introducing best evidence into practice leading to positive patient health outcomes.

The JHNEBP benefitted the EBP development and application of this project. After establishing necessity in improving screening for obstructive sleep apnea (OSA) with front-line staff and key stakeholders, an exhaustive literature search allowed for the appraisal and

summary of the best-evidence. With no established universal recommendations for OSA screening, synthesis of multiple evidence findings and reviews guided the development of the project protocol recommendations. This project was comprised with clinical guidelines and quality measures from the American Sleep Apnea Association (ASAA) and American Academy of Sleep Medicine (AASM) as well as numerous other sources that were appraised for quality and strength.

Strengths and weaknesses of the JHNEBP model. Strengths of this model include the step-wise approach of best-practice utilization beginning with formulating a PICOT question to evaluating and disseminating findings. Distinct to this model is the incorporation of an evidence appraisal system and pathway that allows the strength of the literature to determine appropriate implementation. Important to this model is the evaluation of the project and dissemination of findings thus advancing future initiatives. The JHNEBP has versatility in its application in a variety of settings including clinical nursing, administrations, education, and advanced nursing practice. As demonstrated in EBP project initiatives, this model has assisted in improving patient health outcomes.

Weaknesses of the model may include the lengthy number of steps comprised in the model. With the model's heavy emphasis on best-evidence, this may diminish the patient preferences and provider opinion which are integral to the EBP process.

Literature Search

An extensive methodological literature search was performed to ensure the use and incorporation of best-practice evidence in screening for obstructive sleep apnea (OSA) in the primary care setting. Databases searched included (a) The Cochrane Library, (b) Joanna Briggs Institute (JBI), (c) National Guideline Clearinghouse (NGC), (d) Medline via EBSCO, (e) Medline via Pub-Med, and (f) Cumulative Index to Nursing and Allied Health Literature (CINAHL). Consistent throughout multiple database searches was the use of the medical subject heading terms (MeSH) of sleep apnea, obstructive. Uniform keywords across each database were used

included obstructive sleep apnea, screening, identify, detect, primary care, family practice and clinic. Utilization of truncation in the keywords was employed. Last, citation chasing was performed from appropriate sources.

Search results. Search results yielded for each database is displayed in Table 2.1. Majority of databases produced over 50 results with varying degrees of relevance and applicability.

Inclusion and exclusion criteria. Standardized inclusion criteria were utilized and included only scholarly peer-reviewed articles that were published within the last 10 years. Articles had to be in the English language and the main subject population of adults. Articles that were hand-picked from citation chasing were referenced within scholarly articles and included general themes of screening for OSA in the primary care setting. Articles were included for review if they included OSA screening methods in other settings, but patients in the primary care population must be included. Themes of articles that were reviewed included the effectiveness of clinical exam findings in detecting for OSA, accuracy of screening tools in identifying OSA, and recommendations of patients that should be screened for OSA.

Exclusion criteria included articles that were published more than 10 years ago. Also, articles that only focused on patients in the surgical setting, evidence that examined pediatric patients, or articles that focused on pregnant patient populations were not included.

Levels of evidence. After assessing the relevance of the evidence based on a review of the abstract, each article was graded utilizing the Schmidt and Brown (2019) evidence hierarchy. The Schmidt and Brown (2019) evidence hierarchy levels evidence from 1-7 with Level 1 being the highest quality and Level 7 being the lowest. The 7 levels of evidence are as follows: “1.) Evidence from meta-analysis, systematic reviews of RCTs, and current practice guidelines; 2.) Evidence from randomized controlled trails; 3.) Evidence from controlled trials without randomization (quasi-experimental); 4.) Evidence from cohort studies (epidemiologic) and case-controlled studies (epidemiologic); 5.) Evidence from systematic reviews of descriptive

studies, systematic reviews of qualitative studies (meta-analysis), and correlational studies; 6.) Evidence from single descriptive studies, single qualitative studies, case series studies (epidemiologic), case reports, or concept analysis; 7.) Evidence from the opinion of authorities, reports of expert committees, manufacturer's recommendations and traditional literature reviews" (Schmidt & Brown, 2019). Included in this project were 9 total articles. Of the nine studies one was level 1, six level 5, and two level 7. Evidence was also assigned a quality score based on the John Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal and Non-Research Evidence Appraisal tools. High quality research is assigned an A quality score, good quality research scores B, and low-quality research or major flaws receives a C (John Hopkins Nursing Evidence Based Practice, n.d.). Included articles with corresponding levels are depicted in Table 2.2.

Table 2.1

Studies Obtained from Database

Database	Initial Articles Yielded	Duplicates	Articles Reviewed	Article Accepted
JBI	38	0	2	0
Cochrane	14	0	1	0
CINAHL	78	2	2	0
MEDLINE	38	11	2	0
ProQuest	75	7	4	3
National Guideline Clearinghouse	32	2	3	2
Hand Search	-		7	4
Total	275	85	21	9

Table 2.2

Levels of Evidence

Evidence Level	Articles Included	Quality
Level 1	1	C (1)
Level 2	0	
Level 3	0	
Level 4	0	
Level 5	6	A (4), B (2)
Level 6	0	
Level 7	2	B (1) C (1)

Note. Adapted from Schmidt and Brown Evidence-based Practice for Nurses (2019)

Table 2.3

Appraisal of Evidence

Citation	Design/ Level	Sample/Setting	Measurement/ Outcomes	Recommendations/ Findings	Rating
Epstein, L., Kristo, D., Strollo, P., Friedman, N., Malhotra, A., Patil, S., . . . Adult Obstructive Sleep Apnea Task Force of the American Academy of Sleep Medicine. (2009). Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. Journal of Clinical Sleep Medicine, 5(3), 263-276.	Clinical Guideline/ Level 1	Included studies not stated	Issue of clinical recommendations concerning the evaluation, management, and long-term care of OSA in adults.	Expert consensus established patient populations that should be evaluated for OSA during routine health maintenance evaluations. Study findings showed evaluations should be completed on those who reported symptoms indicative of OSA, and those considered at high risk for OSA. Based on three established patient populations, those considered *at-risk* should receive a comprehensive sleep history and physical. Patients with positive findings should then be referred for sleep study.	C
Jonas, D. E., Amick, H. R., Feltner, C., Weber, R. P., Arvanitis, M., Stine, A., . . . Harris, R. P. (2017). Screening for obstructive sleep	Systematic Review/Meta-Analysis Level 5	110 studies (N=46188) RCTs and prospective cohort studies included	Eight key questions with evidence rationales addressing screening, test accuracy, and treatment of OSA.	Overall, study concluded that there was insufficient evidence in the clinical utility and accuracy in universal screening of patients. It was acknowledged that there are many adverse health outcomes associated with OSA. Authors discussed with multiple management options shown to	A

apnea in adults: Evidence report and systematic review for the US preventive services task force. *Jama, 317*(4), 415-433. doi:10.1001/jama.2016.19635				reduce apnea-hypopnea index scores as well as blood pressure. However, no treatment has been established proven to reduce mortality. Although universal screening is currently supported, there is utility in identifying and managing patients with OSA.	
Miller, J. N., & Berger, A. M. (2015). Screening and assessment for obstructive sleep apnea in primary care. Sleep Medicine Reviews, 29, 41-51. doi:10.1016/j.smrv.2015.09.005	Systematic Review/ Level 5	17 studies (14 nonexperimental, 3 experimental)	Study reviewed and evaluated current screening and assessment of OSA in the primary care setting	Findings showed that screening for OSA should occur in three patient categories: any adult reporting symptoms of OSA, every patient during annual health maintenance, and patients that are at *high-risk.* Signs and symptoms triggering further evaluation should include snoring, witnessed apneas, nocturnal gasping/choking, unexplained daytime sleepiness, large neck circumference (>17 inches in men, >16 inches in women), sleep fragmentation/insomnia, and non-refreshing sleep. *High-risk* patients necessitating screening were defined as those with obesity (BMI >35 kg/ m2), cardiac or metabolic comorbid conditions (congestive heart failure, atrial fibrillation, hypertension, type 2 diabetes, nocturnal cardiac dysrhythmias, stroke, and pulmonary hypertension), and patients that are pre-operative for bariatric surgery.	A

				Sensitivity and specificity of multiple clinical prediction tools for OSA was compared and concluded that the STOP-Bang and Berlin questionnaires are the current best methods in predicting moderate to severe OSA. Overall, more research is needed on screening for OSA	
Myers, K. A., Mrkobrada, M., & Simel, D. L. (2013). Does this patient have obstructive sleep apnea?: The rational clinical examination systematic review. Jama, 310(7), 731-741. doi:10.1001/jama.2013.276185	Systematic Review/ Level 5	42 studies Design and quality not provided	Comparison of patient symptoms, clinical signs, and screening tools accuracy in detecting OSA	Review sought to compare the accuracy of patient reported symptoms clinical sign's sensitivity and specificity in detecting OSA. Multiple signs and symptoms were compared and snoring was found to have highest sensitivity, but lowest specificity. Nocturnal choking or gasping was determined to be the most useful individual subjective finding in detecting OSA. Determined that there was no one sign or symptoms precise enough to rule in or out condition. Sensitivity and specificity of multiple screening questionnaires was compared and the STOP-Bang questionnaire demonstrated the highest sensitivity in detecting mild OSA and the Snoring Severity Scale had the highest sensitivity in detecting moderate OSA.	B

Abrishami, A., M.D., Khajehdehi, A., M.D., & Chung, F., M.D. (2010). A systematic review of screening questionnaires for obstructive sleep apnea. Canadian Journal of Anesthesia, 57(5), 423-38. doi:http://dx.doi.org.ezproxy.valpo.edu/10.1007/s12630-010-9280-x	Systematic Review/ Level 5	10 studies (n=1,484) Prospective and Retrospective design	To identify and evaluate current OSA screening questionnaires	Review consisted of 10 studies used to calculate pooled sensitivity and specificity of OSA screening questionnaires ability in detecting OSA. The Haraldsson questionnaire had highest pooled sensitivity in patients with a history of a sleep disorder. The Stop-Bang questionnaire had the highest sensitivity in screening for OSA in patients without a history of sleep disorders. The Berlin questionnaire had the highest pooled specificity in screening for OSA in patients without a history of sleep disorders. Considering tools feasibility, accuracy, and generalizability the authors recommend using either the STOP questionnaire or the STOP-Bang questionnaire.	A
Nagappa, M., Liao, P., Wong, J., Auckley, D., Ramachandran, S., Memtsoudis, S., . . . Chung, F. (2015). Validation of the STOP-bang questionnaire as a screening tool for obstructive sleep apnea among different	Systematic Review/ Level 5	17 studies (n=9,206) Prospective and retrospective design	To validate the accuracy of the STOP-Bang questionnaire as an OSA screening tool in sleep clinic and surgical patients. Meta-analysis performed to compare sensitivity and specificity	The purpose of the review was to evaluate the effectiveness of the STOP-Bang screening questionnaires diagnostic accuracy in patients suspected to have OSA in the sleep clinic and surgical populations. The SBQ was validated as an excellent screening tool in sleep clinic and surgical patients. Pooled sensitivity in the sleep clinic and surgical population were 94% and 91%; specificity was 34% and 32%. Probability of moderate	A

populations: A systematic review and meta-analysis. Plos One, 10(12), e0143697. doi:10.1371/journal.pone.0143697				and severe OSA steadily increased with increasing SBQ scores.	
Chiu, H., Chen, P., Chuang, L., Chen, N., Tu, Y., Hsieh, Y., . . . Guilleminault, C. (2016). Diagnostic accuracy of the berlin questionnaire, STOP-BANG, STOP, and epworth sleepiness scale in detecting obstructive sleep apnea: A bivariate meta-analysis. Sleep Medicine Reviews, 36, 57-70. doi:10.1016/j.smrv.2016.10.004	Systematic Review/Meta-analysis Level 5	73 studies (n=47,989) Varying design and quality of studies	Purpose was to analyze and compare diagnostic accuracy of several OSA screening tools.	Based on the meta-analysis calculations of pooled sensitivities and specificities, it was determined that the STOP-Bang Questionnaire had the highest sensitivity of detecting OSA compared to the other tools. The pooled sensitivities in detecting severe OSA using the SBQ compared to the ESS was 93% and 58% respectively. However, the ESS had higher specificity at 60% compared to the SBQ at 35%. The STOP-Bang questionnaire was endorsed as the superior and recommended tool in detecting mild, moderate, and severe OSA	A

Bibbins-Domingo, K., Grossman, D. C., Curry, S. J., Davidson, K. W., Epling, J. W., García, F. A. R., . . . US Preventive Services Task Force. (2017). Screening for obstructive sleep apnea in adults: US preventive services task force recommendation statement. Jama, 317(4), 407-414. doi:10.1001/jama.2016.20325	Recommendation statement/ Level 7	Studies used not clearly specified. Referencing USPSTF systematic review	Issue a recommendation statement of screening asymptomatic patients for OSA	Supported that there was insufficient evidence to provide a recommendation of screening for OSA in asymptomatic patients. However, was able to provide a definition determining which patients should be considered asymptomatic. Asymptomatic patients were defined as those with unrecognized symptoms or those that did not report their symptoms as a concern to their clinician. These excluded patients presenting with symptoms of OSA including snoring, witnessed apnea, excessive daytime sleepiness, impaired cognition, mood changes, or gasping or choking at night. Furthermore, this recommendation excluded children, adolescents, pregnant women, patients reporting concerns of OSA, those that have been referred for suspected OSA, and patients that have acute conditions that could trigger the onset of OSA such as stroke.	B

Aurora, R. N., Quan S. F. (2016). Quality measure for screening for adult obstructive sleep apnea by primary care physicians. *Journal Clinical Sleep Medicine. 12 (8).* P. 1185-1187	Quality Measure/ Level 7	Studies utilized not disclosed	Establish measure for primary care providers to appropriately screen for OSA in effort to reduce frequency of undiagnosed OSA.	Patients that are considered at *high-risk* for OSA should be screened every 12 months. *High-risk* patients were defined as patients with obesity (BMI 30kg/m2), congestive heart failure, atrial fibrillation, treatment resistant hypertension (blood pressure above goal despite adherence to antihypertensive regimen of 3 medications, or hypertension controlled by at least 4 medications), impaired glucose tolerance or type 2 diabetes, nocturnal dysrhythmias, stroke, pulmonary hypertension, preoperative for bariatric surgery, or coronary artery disease. Recommended using OSA-specific screening questionnaires over sleepiness scales.	C

Appraisal of Relevant Evidence

Level 1 evidence. The Adult OSA Task Force of the American Academy of Sleep Medicine (AASM) performed a review of current literature and practice guidelines to produce a clinical guideline for the evaluation, management, and long-term care of OSA in adults (Epstein et al., 2009). After appraising the current and relevant evidence, the committee delineated practice parameters consisting of standards, guidelines, and opinions based on the strength of the available evidence and expert consensus. Topics of practice parameters included screening, diagnostic testing, and treatment.

For the screening of OSA in the primary care setting, the task force produced a consensus statement detailing three patient population that should be screened including patients presenting for routine health maintenance evaluations, patients reporting symptoms suggestive of OSA, and patients that are high-risk for OSA. The recommendation suggested that as a part of routine health maintenance evaluations, questions inquiring of patient snoring and daytime sleepiness should be included to every patient. Also, patients that reported symptoms of witnessed apneas, snoring, gasping or choking at night, excessive sleepiness not explained by other factors, non-refreshing sleep, fragmented sleep, morning headaches, decreased concentration, memory loss, decreased libido, and irritability should trigger a further evaluation and screening. Along with patients reporting positive findings, those with retrognathia, hypertension, and obesity were all recommended to receive screening for OSA. The third patient population that should prompt additional screening for OSA includes patients that are considered *at-risk*. The guideline defines high risk patients as those that are obese (BMI ≥35 kg/m2), have congestive heart failure, atrial fibrillation, treatment refractory hypertension, type 2 diabetes, stroke, nocturnal dysrhythmias, pulmonary hypertension, high-risk driving populations (i.e. commercial truck drivers), and patients undergoing evaluation for bariatric surgery.

Patients that are considered *at-risk* for OSA within the three populations are recommended to be further evaluated with a comprehensive sleep history and physical examination to determine if a sleep study is warranted. A sleep history is suggested to evaluate snoring, witnessed apneas, gasping/choking episodes, excessive sleepiness not explained by other factors, severity of sleepiness defined by the Epworth Sleepiness Scale, total amount of sleep, nocturia, morning headaches, fragmented sleep, insomnia, and decreased concentration or memory. Physical examination focusing on risk factors for OSA should include presence of obesity, upper airway narrowing, increased neck circumference, retrognathia, lateral peritonsillar narrowing, macroglossia, tonsillar hypertrophy, elongated/enlarged uvula, high arched/narrow hard palate, and nasal abnormalities such as polyps, deviations, and turbinate hypertrophy. Patients with positive sleep history findings or physical exam findings suggestive of OSA are then recommended to be referred for a sleep study. Overall, these practice guidelines lend value by defining patients that are *at-risk* for OSA and necessitate screening. However, there is limited documentation of the search strategy or discussion on the quality of studies utilized in the practice recommendations making this guideline poor quality.

Level 5 evidence. Jonas et al., (2017) performed an extensive systematic review to analyze the current evidence of screening, test accuracy, and treatment of OSA to guide a USPSTF recommendation statement. The review consisted mainly of randomized clinical trials with some prospective cohort studies. Eight key clinical questions were addressed ranging from topics of screening to treating OSA with evidence rationales provided for each to support the recommendation.

The first key question sought to determine if there were any health benefits achieved from screening every adult for OSA. However, it was discovered that no eligible studies existed comparing health outcomes of universally screening compared to no screening. Due to the limited evidence, the review concluded that there was insufficient evidence to determine if screening every patient for OSA provided clinical utility. Despite the reviews limited findings, this

supported the decision not to universally screen asymptomatic patients as this is not yet supported by current evidence. Of note, other key questions addressed the effect of OSA treatment on immediate health outcomes. All relevant studies demonstrated a majority of patient's apnea-hypopnea index (AHI) scores returned to less than five which is considered normal, in patients treated with CPAP compared to those with placebo CPAP. Additionally, 29 trials identified a two-three-point reduction of diurnal systolic blood pressure associated with CPAP treatment in OSA patients. These findings demonstrate the positive health benefits associated with treatment therapies thus highlighting the importance of identifying undiagnosed patients to begin treatment. Overall, this systematic review is of high quality. The review provided an exceptional documentation of literature search strategy and quality of each study utilized for each key question recommendation.

Miller and Berger (2015) performed a systematic review with a focus on screening and assessing for OSA in the primary care setting utilizing 17 studies consisting of experimental study designs, descriptive, and mixed methods studies. The integrative review recognized that sleep disorders are common yet rarely assessed necessitating further education of primary care providers ability in detecting OSA and serves as the basis of this review.

The authors discussed patient populations that should be considered appropriate for screening. The findings highlighted three appropriate populations that should necessitate screening which included any adult patient complaining of symptoms suggestive of OSA, every patient during an annual well-visit, and in all patients that are considered *high-risk*. Signs and symptoms triggering further evaluation should include snoring, witnessed apneas, nocturnal gasping/choking, unexplained daytime sleepiness, large neck circumference (>17 inches in men, >16 inches in women), sleep fragmentation/insomnia, and non-refreshing sleep. Although snoring and daytime sleepiness is closely associated with OSA, these predictors lack reliability as effective independent predictors. The study also found that screening should take place as a part of the review of symptoms during routine health maintenance visits. Sleep health should be

discussed with each patient providing a time to recognize signs and symptoms prompting further evaluation for OSA. The study also found that *high-risk* patients necessitating screening were defined as those with obesity (BMI >35 kg/m2), cardiac or metabolic comorbid conditions (congestive heart failure, atrial fibrillation, hypertension, type 2 diabetes, nocturnal cardiac dysrhythmias, stroke, and pulmonary hypertension), and patients that are pre-operative for bariatric surgery.

Patients that were classified within these three groups were considered *at-risk* of OSA and were recommended to be screened for OSA. Screening tools were described as a quick and cost-effective method in predicting the presence of OSA and indicates the need to refer for a confirmative sleep study. The review focuses on analyzing the performance data of the most widely tested screening tools including the Berlin Questionnaire, Epworth Sleepiness Scale, STOP questionnaire, and the STOP-Bang questionnaire. By comparing the sensitivity and specificity of the psychometric tools across the studies, the Berlin Questionnaire and STOP-Bang questionnaire demonstrated the current best measure in screening for moderate to severe OSA. The integrative review offered valuable evidence supporting which patients should be screened and the best tools to screen those patients. Overall, the review is of high quality. Detailed documentation of the search strategy was provided with inclusion and exclusion criteria specified resulting in an identifiable number of studies included. A description of each study was included as well as design and quality of evidence. Findings were discussed in context of limitations such as flaws present in included studies to offer a balanced recommendation in screening for OSA.

Myers, Mrkobrade and Simel (2013) completed a systematic review to assess the accuracy of clinical assessment findings ability to diagnosis OSA. Included in the review were 42 studies of varying designs and quality. Central to the review was the comparison in the accuracy of patient reported symptoms and the clinical sign’s sensitivity and specificity in detecting OSA.

The reported patient symptoms that were compared included nocturnal choking/gasping, morning headache, excessive daytime sleepiness, reported apnea, and snoring. Among these symptoms, snoring was determined to have the highest sensitivity (90%) and lowest specificity (10%) in detecting moderate to severe OSA with a likelihood ratio (95% CI) for a positive test result of 1.1. Given the low specificity, it was determined that snoring should not be the exclusive symptom and must be evaluated in context of other patient specific information such as obesity. Despite snoring's high sensitivity, it was determined that nocturnal choking or gasping was the most useful individual finding with a positive likelihood ratio 3.3. Clinical signs or physical exam findings compared included oropharyngeal volume recorded as Mallampati class scores and pharyngeal narrowing. Each of these signs had comparable results with the Mallampati scores a sensitivity of 55% and specificity of 65% and pharyngeal narrowing scores 67% and 53% respectively. Given this information, the authors concluded that "individual symptoms and signs have limited utility in determining the likelihood of OSA, and no one sign is sufficiently precise to rule in or rule out this condition" (p.739).

Four clinical prediction tools used to screen for OSA were also compared including the STOP-Bang questionnaire, Snoring Severity Scale, Berlin Questionnaire, and the Names-2. Although a meta-analysis was not performed, sensitivity, specificity, likelihood ratios, and probability values from each study were compared for mild (AHI 5) and moderate OSA (AHI 15). For mild OSA, the STOP-Bang questionnaire (SBQ) had the highest sensitivity and specificity of 88% and 53% respectively. For moderate OSA the Snoring Severity Scale had the highest sensitivity and specificity of 97% and 38% respectively compared to SBQ scores of 93% and 35%. Findings are cautioned that studies were largely composed of patients that were sampled in settings highly prevalent of OSA, thus limiting the generalizability of the tool's clinical utility. This review was instrumental in determining whether to use a clinical prediction tool with combination findings to screen for OSA rather than using individual patient symptoms or signs. Overall this review is rated as good quality. A thorough search strategy and inclusion criteria

was discussed, but quality of studies utilized was not addressed limiting the strength of the findings.

Abrishami, Khajehdehi and Chung (2010) performed a systematic review evaluating existing OSA screening questionnaires. The review consisted of ten studies (n=1,484) including prospective and retrospective designs and calculated pooled sensitivity and specificity. The authors discussed that while polysomnography is the accepted gold standard in diagnosing OSA, the test is costly and not easily accessible. Therefore, screening tools are valuable in ascertaining patients *at-risk* before a sleep study referral.

The screening tools in the comparison were the Berlin Questionnaire, Wisconsin Sleep Questionnaire, STOP Questionnaire, STOP-Bang Questionnaire (SBQ), ASA checklist, Sleep Apnea scale of the Sleep Disorders Questionnaire, Haraldsson's, and Apnea Score. The review demonstrated that the STOP-Bang questionnaire had the highest pooled sensitivity and the Berlin Questionnaire had the highest pooled specificity in predicating moderate to severe OSA. The authors produced their final recommendation based on three criteria consisting of feasibility, accuracy, and generalizability. The authors determined that both the STOP and SBQ had fewer and more straightforward questions lending to increased feasibility. The accuracy of the SBQ was demonstrated to have the highest pooled sensitivity in detecting moderate to severe OSA as well as the authors judgement that the SBQ was of high methodological quality and validity. Generalizability of the screening tools were limited due to a majority of the tools being developed using high-risk patients, thus making them best suited for setting such as sleep clinics or surgery. Although the authors acknowledge the imperfections and limitations, the STOP and SBQ were the recommended screening tools. This review provides an insightful evaluation of the strengths and weakness in selecting the SBQ as the preferred screening tool. Although the sample of included studies was smaller, the authors provided an extensive search strategy documentation and specified inclusion criteria. The method and quality of each study

was detailed aiding the credibility of the results. A thorough review of findings in context of strengths and limitations allowed for logical recommendations making this review high-quality.

Nagappa et al. (2015) performed a systematic review and meta-analysis focusing on the STOP-Bang questionnaire in screening for OSA. The review was comprised of 17 studies (n=9,206) of varying designs and quality. The purpose of the review was to evaluate the effectiveness of the STOP-Bang screening questionnaires diagnostic accuracy in patients suspected to have OSA in the sleep clinic and surgical populations.

Pooled predictive parameters were formulated based on extracted data from each study that was included. Results demonstrated a 94% and 91% sensitivity in predicting moderate to severe OSA in sleep clinic and surgical patients respectively. Specificity was 34% in sleep clinic studies and 32% in surgical population studies. Inferences from the results demonstrated a direct positive relationship between STOP-Bang questionnaire scores and the presence of OSA. In other words, the higher the STOP-Bang score correlated with increased probability of an OSA diagnosis. To ensure consistency all included studies confirmed a diagnosis with a method of polysomnography. Using the analysis results, the authors concluded that the STOP-Bang questionnaire consistently demonstrated high sensitivity in detecting OSA in suspected patients and is recommended as a useful screening tool in *high-risk* patients. This review provided affirmation that the STOP-Bang questionnaire was an accurate tool for screening in *high-risk* patients. Although the review focused on patients in the sleep clinic and surgical population, these represent high-risk patient populations which is consistent with the project's target participants. Detailed search strategy documentation was provided as well as identifiable inclusion and exclusion criteria. The authors acknowledged limitations of the study including possible oversampling of *high-risk* patients threatening the findings generalizability. This was due to the study's' sample being obtained from sleep clinics and surgical patients which might not accurately represent the general population. However, logical conclusions were drawn using

the meta-analysis results that the SBQ offered an effective method providing an accurate quick screening for OSA across different settings and is a high-quality review.

Chiu et al. (2017) published a systematic review and meta-analysis analyzing the diagnostic accuracy of several OSA screening tools. The analysis was composed of 73 studies of differing designs with a combined sample size of 47,989 participants. The review was initiated after identifying the estimated high occurrence of undiagnosed patients and the substantial burden of the medical condition left untreated.

The clinical screening tools that were assessed and compared included the Berlin Questionnaire, STOP-Bang Questionnaire, STOP questionnaire, and Epworth Sleepiness Scale. Bivariate statistical analysis was performed with results including pooled sensitivity and specificity. Based on the meta-analysis calculations of pooled sensitivities and specificities, it was determined that the STOP-Bang Questionnaire had the highest sensitivity of detecting OSA compared to the other tools. The pooled sensitivities in detecting severe OSA using the SBQ compared to the ESS was 93% and 58% respectively. However, the ESS had higher specificity at 60% compared to the SBQ at 35%. A determination was made that a higher sensitivity had more value in clinical practice with the increased capability of early detection with more accurate findings. Therefore, given the superior sensitivity and overall feasibility, the STOP-Bang questionnaire was endorsed as the superior and recommended tool in detecting mild, moderate, and severe OSA. This review was instrumental in determining which screening tool was superior and preferred. The review demonstrated a methodological and exhaustive search strategy producing a robust sample size. Limitations were addressed including use of varying levels of methodological rigor among the studies. Studies were completed in different clinical settings which limited the ability to generalize results. Recommendations were provided with logical rationales and support from the evidence. Overall, the review is of high quality.

Level 7 evidence. Bibbins-Domingo et al. (2017) published a recommendation statement for the USPSTF primarily based on results from Jonas et al. (2017) systematic review

findings. The statement sought to provide a recommendation on screening for OSA in asymptomatic patients.

As previously discussed, this USPSTF review determined that there was insufficient evidence in assessing the benefits or utility of screening asymptomatic patients. Using these findings, the recommendation statement determined that they were unable to provide a recommendation supporting or advising against screening asymptomatic patients. Despite the inconclusive recommendation statement, the review was imperative by offering defining criteria to distinguish asymptomatic and *high-risk* patients. Asymptomatic patients were defined as those with unrecognized symptoms or those that did not report their symptoms as a concern to their clinician. These excluded patients presenting with symptoms of OSA including snoring, witnessed apnea, excessive daytime sleepiness, impaired cognition, mood changes, or gasping or choking at night. Furthermore, this recommendation excluded children, adolescents, pregnant women, patients reporting concerns of OSA, those that have been referred for suspected OSA, and patients that have acute conditions that could trigger the onset of OSA such as stroke. By establishing defined screening criteria, this ensures that this recommendation statement is applied to appropriate patients and those that warrant screening are not missed due to ambiguous guidelines. This review statement was influential in ensuring that the patient population being screened was based on current evidence. With no identifiable evidence supporting screening every patient, this serves as a foundation for screening *at-risk* populations. Overall, the recommendation statement is of good quality based on thoroughness and evaluation of recommendations provided. However, the recommendation did not make clear the evidence that was being utilized as the basis of the statement. Also, in defining the patient population the research was vague on which acute conditions are excluded in the recommendation aside from stroke. This is important as without clear delineation of acute conditions that should trigger screening, patient populations can be inappropriately missed and left undiagnosed.

Aurora and Quan (2016) describe a quality measure assisted by American Academy of Sleep Medicine staff and Workgroup members. The guideline was developed after a review of the literature limited to guidelines, meta-analyses, and systematic reviews. There were 364 studies retrieved with an unidentifiable number utilized in the final measure. The aim of the measure was to offer a recommendation of screening for OSA in the primary care setting in an effort to reduce the frequency of undiagnosed OSA.

One facet of OSA that was addressed was which patients should be screened. Rather than screening being universal to every patient, it was determined that screening should be limited to high-risk populations every 12 months. High-risk patients were defined as patients with obesity (BMI 30kg/m2), congestive heart failure, atrial fibrillation, treatment resistant hypertension (blood pressure above goal despite adherence to antihypertensive regimen of 3 medications, or hypertension controlled by at least 4 medications), impaired glucose tolerance or type 2 diabetes, nocturnal dysrhythmias, stroke, pulmonary hypertension, preoperative for bariatric surgery, or coronary artery disease. Due to the high prevalence of OSA in these conditions, early identification and treatment of OSA can potentially improve health outcomes associated with certain conditions. Next, the authors briefly discuss recommended screening tools as a means of early identification prompting diagnostic testing. While a specified screening tool was not endorsed, the recommendation asserts that a validated OSA-specific questionnaire is available and preferred. Additionally, it was recommended that sleepiness scales are to be avoided as they screen for sleepiness from any cause, thus not specific to OSA. Concepts from this quality measure were valuable in reinforcing the appropriate patient populations to screen for OSA along with the ideal methods of screening. Due to the limited discussion of studies included and their quality, this measure is of poor quality.

Construct EBP

Synthesis of literature. The best practice model of screening for obstructive sleep apnea (OSA) in the family practice setting is a protocol comprised of two concepts. Upon

critically appraising and synthesizing the current best-evidence, recommendations included (a) screening for OSA in patients that are considered *at-risk*, and (b) utilization of the STOP-Bang questionnaire to increase providers' adherence of effectively screening for OSA.

Screening in *at-risk* patients. Across the literature there is consensus that not every patient in the family practice setting should be screened for OSA. Bibbins-Domingo et al. (2017) determined that there is currently insufficient evidence to suggest screening for OSA in asymptomatic patients. Furthermore, the available screening tools were not designed to detect OSA in the general patient population, rendering them ineffective to screen asymptomatic patients (Bibbins-Domingo et al., 2017). However, evidence has shown that there is value in screening for OSA in patients that are considered *at-risk*. Undiagnosed and untreated patients have a higher association of type 2 diabetes, hypertension, and stroke which are leading causes of morbidity and mortality establishing credence of screening (American Sleep Apnea Association [ASAA], 2017). *At-risk* populations have been defined as patients with obesity (BMI ≥35kg/m2),congestive heart failure, atrial fibrillation, treatment resistant hypertension (blood pressure above goal despite adherence to antihypertensive regimen of 3 medications or hypertension controlled by at least 4 medications), impaired glucose tolerance or type 2 diabetes, nocturnal dysrhythmias, stroke, pulmonary hypertension, preoperative for bariatric surgery, and coronary artery disease (Aurora & Quan, 2016; Epstein et al., 2009). Given the higher occurrence of OSA among these patient populations, the patients are considered *at-risk* and should be screened annually.

STOP-Bang Screening Questionnaire. After reviewing and appraising the literature evaluating the recommended method for screening *at-risk* patients for OSA, the STOP-Bang questionnaire (SBQ) was selected as the optimal tool. While no screening tool is diagnostic, the SBQ has consistently demonstrated superior sensitivity in accurately detecting OSA in *at-risk* patients (Kline, 2018, Abrishami, Khajehdehi & Chung, 2010; Nagappa et al., Chiu et al., 2016). While some studies demonstrated comparable sensitivities of the SBQ and other screening

tools, the SBQ had more consistent results across numerous studies (Miller & Berger, 2015; Kline, 2018; Abrishami, Khajehdehi & Chung, 2010; Nagappa et al.; Chiu et al., 2016).The SBQ was designed with the intent of detecting OSA in *at-risk* patients which is preferred over sleepiness scales that aren't designed specifically for OSA (Aurora & Quan, 2016). SBQ scores of five or greater indicate high-risk of OSA and should then be referred for diagnostic testing (Kline, 2018).

Clinical Question

The goal of this EBP project was to enhance providers adherence to screening for OSA in the primary care setting with the use of a developed protocol using current best-evidence. The PICOT question developed was "In the internal medicine setting, how does implementation of a revised obstructive sleep apnea screening protocol affect providers' adherence to screening over a one-month period as compared to current practice?".

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

Implementation of this evidence-based practice (EBP) project was performed over several months and encompassed the utilization of the John Hopkins Nursing Evidence-Based Practice model as a guide. The primary goal during the implementation period was to improve providers' adherence of screening for obstructive sleep apnea (OSA) in adults as supported by current best-practice evidence in the family practice setting. Providers' adherence to protocol recommendations was measured by comparing adherence six weeks prior to protocol introduction to the six weeks after implementation. The steps of the John Hopkins Nursing Evidence-Based Practice model served as a guide to promote the successful translation of best evidence into practice.

Setting and Participants

The setting for the EBP project implementation was located at a privately-owned family medicine practice located in northwest Indiana. The practice provides medical services to all ages, with a majority of the patients over the age of 18 years old. Office staff consists of a physician, nurse practitioner, registered nurse, nutritionist, medical assistants, front-desk secretaries, and an office manager. Each provider sees an average of 20 patients per day. As the primary outcome of this project aimed to measure providers' adherence to a best practice OSA screening protocol, the physician and nurse practitioner were the target participants. Permission for project implementation was granted from the physician/owner of the practice as well as the nurse practitioner onsite following discussions and explanation of the current best evidence regarding screening for OSA.

As the project entailed implementing a protocol to increase providers adherence to screening (see appendix A), the effect was determined by comparing adherence between a pre- and post-intervention group. The pre-intervention group was comprised of patients that were

identified as *at-risk* and whether or not OSA screening was performed during 6 weeks prior to project implementation (Summer 2018). To gather this data, every patients' electronic medical record was audited during the specified timeframe. Data was manually extracted from the charts which included recording every patient considered *at-risk* and if screening was performed (see Appendix C). If screening was performed, the score from the screening questionnaire was then recorded and whether or not that patient was referred for a polysomnography. Data for the post-intervention group was collected in the same fashion by completing a records log of data obtained through manual chart audits of patients during the specified implementation time period. To determine the effect of the providers' adherence to the protocol, the pre-intervention group served as a baseline and was compared to the adherence of the post-intervention group.

Outcomes

The primary outcome examined for this EBP project was the measurement of providers' adherence to the utilization of the developed OSA screening protocol. The screening protocol consisted of two components which advised (a) identifying *at-risk* patients and (b) utilization of the STOP-Bang questionnaire in screening those patients identified as *at-risk* for OSA. Provider adherence was satisfied when both protocol criteria were fulfilled including screening patients with an *at-risk* diagnosis by using the STOP-Bang questionnaire. For example, if the provider screened a patient with a history of atrial fibrillation for OSA by using the STOP-Bang questionnaire this represented adherence to the protocol being that the provider screened a patient with an *at-risk* diagnosis using the recommended screening method. Adherence to the protocol components was evaluated for every *at-risk* patient visit during the implementation phase and was compared to the pre-intervention group.

Secondary outcomes that were examined measured the incidence of providers' referral for diagnostic testing as a result of the screening protocol. For patients that were screened for OSA, their charts were then further reviewed to evaluate if the provider ordered additional diagnostic testing such as home sleep apnea testing or polysomnography. Last, for patients

which OSA diagnostic testing was ordered, charts were further reviewed to record the occurrence of a confirmed OSA diagnosis.

Intervention

A systematic search across multiple databases was performed to gather current evidence supporting the intervention. All relevant evidence was appraised and synthesized to ensure best practice recommendations were obtained and utilized in developing the protocol. The project's proposed protocol served to replace the practice's current guidelines of screening for OSA. Prior to project implementation, the practice had a vague and rarely referenced OSA screening guideline. The guideline failed to specify which patients should be screened, but it was stated that the STOP-Bang questionnaire was the approved screening method. Despite the guideline recommendations, the document was rarely referenced, and medical staff reported using a different screening tool with patients. The protocol was designed in an easy-to-read standard format to help providers determine which patients the literature recommended to be screened and the best method to screen those identified as *at-risk.* The developed protocol included the addition of current best-evidence recommendations that included screening specified patients that were considered *at-risk* for OSA and supported the use of the STOP-Bang questionnaire.

Project implementation commenced by meeting with each provider individually in mid-October 2018 with a discussion regarding the plan for the implementation of the protocol in effort to promote a smooth transition period. The project coordinator supplied the providers and staff members with educational handouts related to the importance of identifying and treating OSA. The project coordinator was in contact with providers weekly to communicate identified patients that should be screened based on protocol guidelines and was available for questions. Results were reviewed with providers half-way through the implementation phase and at the end for continuity. The duration of the project was 6 weeks and implementation concluded at the end of November 2018.

Planning

Planning for the project was initiated by arranging a meeting with both of the project site providers in the summer of 2018. After explaining the prevalence and impact of undiagnosed OSA, the project was proposed, and interest was mutually expressed to develop an enhanced method of screening for OSA.

The protocol was designed following a thorough search and evaluation of the literature. By evaluating the current best-evidence related to screening for OSA, it was determined that the current screening policy did not reflect best-practice and supported the development of a new screening protocol. The new protocol developed was comprised of two main components that specified *at-risk* patients that should be screened and supported utilization of the STOP-Bang questionnaire in screening those patients identified as *at-risk* (see Appendix A).

The John Hopkins Nursing Evidence-Based Practice served as a guide for the project, with corresponding steps within the model being utilized during the planning and implementation stage. As recommended by *Step 11* of the model which suggests evaluating if the change is an appropriate match to the setting and timing. Accordingly, prior to project implementation the proposed protocol was presented to the project site providers to review for appropriateness and feasibility. *Step 12* which states to create an action, was essential in facilitating project implementation and included the development of an action plan by the project coordinator. Aspects of the action plan included a timeline for obtaining baseline data, and preparation of staff for implementation and evaluation. Securing support and resources needed for project implementation as directed by *Step 13* was beneficial in promoting project adherence by the staff members. Copies of the protocol were supplied to all staff members two weeks before project implementation to increase the staff's familiarity to the components of the protocol in an effort to promote adherence. Resources needed for the project were secured by printing copies of the protocol and screening questionnaires to supply the duration of the project.

Recruiting Participants

The primary aim of the project was to increase providers' adherence to screening for OSA. The participants consisted of the two providers at the practice, which included the physician and nurse practitioner. Performing individualized non-invasive screenings are within the scope of practice for every family practice provider to promote optimal patient outcomes. Given the purpose of the study corresponded with the roles and scope of practice of the providers they were the target participants recruited for project implementation.

Data

Measures and their reliability and validity. Data for the project were collected manually by the project coordinator using a self-developed data collection sheet and completed STOP-Bang questionnaire forms. External validity may be compromised due to the Hawthorne effect. The Hawthorne effect describes a phenomenon when subjects behaviors are influenced by participating in a study resulting in changes to the dependent variable rather than the changes being attributed to the intervention (Peters, 2015). In this project, providers' awareness that their compliance was being analyzed post-intervention represents a potential threat to validity.

Collection. Data collection began in June 2018 and was completed in October 2018 prior to the project initiation. Project implementation ran from October 2018 through the end of November 2018. Data collected reflected providers' adherence to the protocol including (a) identifying patients *at-risk* for OSA and (b) utilizing the STOP-Bang questionnaire to screen patients that were identified as *at-risk*. In order for the provider to be considered adherent to the protocol, both components needed to be fulfilled.

Providers' adherence to screening the correct patients outlined by the protocol was measured during weekly audits of patient's electronic medical records by the project coordinator. During the implementation phase, patients with established appointments had a

chart review completed weekly to determine if screening for OSA was indicated. Criteria that determined which patients necessitated screening was detailed in the protocol and accessible to each provider. Through manual chart audits, the project coordinator determined which patients met the criteria for screening and if screening was indeed performed by the provider or omitted. The data was organized in a self-constructed log that listed each patient that should have been screened, if OSA screening was performed, and if referral for diagnostic testing was ordered. Additional demographic information was also obtained including the age, gender, and significant medical history placing the patient *at-risk* for OSA.

Providers' adherence to using the STOP-Bang questionnaire was examined by quantifying the number of completed screening questionnaires of *at-risk* patients through a weekly chart audit. During weekly chart audits, the project coordinator identified patients that the providers should screen for OSA based on criteria detailed in the protocol. Completed STOP-Bang questionnaires were gathered each week with the date and patients confidential code. If there was a completed STOP-Bang questionnaire obtained for a patient that was identified as *at-risk*, it was determined that the providers were adherent to the protocol. Likewise, if a STOP-Bang questionnaire was not completed or if another screening tool was used by the provider for a patient identified *as at-risk* it was determined that the provider was non-adherent.

Management and Analysis. All data management and analysis were performed by the project coordinator with the primary objective of comparing providers' adherence of screening for OSA prior to the introduction of the protocol to the adherence post-intervention. Data that was collected represented nominal level data. Provider adherence was then compared using a chi-square test of independence to determine if any differences existed between the pre- and post-intervention groups. Statistical calculations were performed using SPSS software.

Protection of Human Subjects

Before project implementation, approval was granted from the Valparaiso University Institutional Review Board (IRB). Additionally, project approval was verified in writing by clinical

site facilitators. Patients were informed by the providers that screening could be refused to maintain patient autonomy and consent. Patient confidentiality was priority and included safeguards such as keeping all data in a locked drawer. After patient completion of the STOP-Bang questionnaire scores were logged and identifiable information was erased using a permanent marker.

CHAPTER 4

FINDINGS

This EBP project was developed to provide an evidence-based approach that aimed to improve providers' adherence to screening for obstructive sleep apnea (OSA) in the primary care setting. The PICOT question posed for this project was: "In the internal medicine setting, how does implementation of a revised obstructive sleep apnea screening protocol affect providers' adherence to screening over a one-month period as compared to current practice?". To evaluate and determine the effectiveness of the screening protocol, providers' adherence to screening were recorded before and after implementation and compared for statistical differences. Secondary outcomes that were analyzed assessed the effect of the project on the incidence of providers' referral for diagnostic testing for OSA and the incidence of subjects newly diagnosed with OSA. The following data analysis evaluates the impact of the project by comparing providers' adherence pre intervention to their adherence post intervention.

Sample

Pre intervention group characteristics. The pre intervention group was composed of 144 audits of electronic medical records. The charts comprising the sample included adults aged 18 years and older with an established *at-risk* diagnosis for OSA who had presented to the project-site clinic between July 9, 2018 and August 6, 2018. Of the pre intervention group, 64 (44.4%) were male and 80 (55.6%) were female. The age range most frequently encountered with an *at-risk* diagnosis was 60-69 (25.7%) years old. The most frequently occurring *at-risk* diagnosis in the pre intervention group was obesity 48 (33.3%) with diabetes mellitus 37 (25.7%) second (See table 4.1).

Post intervention group characteristics. One hundred and twenty-six audited medical records comprised the post intervention sample. The sample consisted of *at-risk* subjects aged 18 years and older with a scheduled appointment at the project-site between October 23, 2018

to November 26, 2018. In the post intervention group there were 67 (53.2%) males and 59 (46.8%) females. The most frequent age range of *at-risk* subjects were 50-59 (28.8%) years old. The most frequently occurring *at-risk* diagnosis among the post intervention subjects was obesity 44 (35.2%) with diabetes mellitus 25 (20.0%) second (See table 4.1).

Group comparison. Chi-square test of independence were analyzed comparing the participants characteristics including frequency of age ($X^2(5)=0.585$, $p>.05$), gender ($X^2(1)= 2.050$, $p>.05$), and *at-risk* diagnosis ($X^2(30)= 26.171$, $p>.05$) between the pre and post intervention groups. There were no significant differences between the groups on these demographic characteristics (See table 4.1).

Table 4.1

Characteristics of the Participants

	Pre Intervention n (%)	Post Intervention n (%)	Total N (%)	X^2	df	*p* value
Total # participants	144	126				
Age Range				5.585	5	.349
18-29 years	6 (4.2)	6 (4.8)	12 (4.4)			
30-39 years	29 (20.1)	17 (13.5)	46 (17.0)			
40-49 years	20 (13.9)	27 (21.4)	47 (17.4)			
50-59 years	35 (24.3)	37 (29.4)	72 (26.7)			
60-69 years	37 (25.7)	28 (22.2)	65 (24.1)			
70+ years	17 (11.8)	11 (8.7)	28 (10.4)			
Gender				2.050	1	.152
Male	64 (44.4)	67 (53.2)	131 (48.5)			
Female	80 (55.6)	59 (46.8)	139 (51.5)			
At-Risk Diagnosis				26.171	30	.666
Obesity	48 (33.3)	45 (35.7)	93 (34.4)			
Diabetes	37 (25.7)	25 (19.8)	62 (23.0)			
Obesity and Diabetes	21 (14.6)	20 (15.9)	41 (15.2)			
Uncontrolled Hypertension	4 (2.8)	5 (4.0)	9 (3.3)			

Changes in Outcomes

Statistical testing. Data analysis was performed using IBM SPSS Statistics software, version 25.0. To evaluate the primary outcomes chi-square test of independence was performed to test the dichotomous variables that examined if *at-risk* subjects were screened and if the STOP-Bang questionnaire was utilized in screening as a reflection of providers' adherence. Secondary outcomes comparing incidence of providers' referral of subjects for diagnostic testing and incidence of participants with a new OSA diagnosis was also evaluated using chi-square test of independence.

Significance. To answer the PICOT question multiple outcomes were measured in an attempt to evaluate the effect of the protocol on providers' adherence. The components of the protocol included first instructing providers' which subjects are considered *at-risk* for OSA and second directed the use of STOP-Bang Questionnaire for screening *at-risk* subjects. Providers' adherence to these variables were compared pre and post project implementation to evaluate effect.

Providers' adherence to screening *at-risk* subjects were recorded for both pre and post intervention groups. In the pre intervention group, providers screened 1 (0.7%) *at-risk* subject compared to 44 (34.9%) *at-risk* subjects in the post-intervention group (see Figure 4.1). A chi-square test of independence was calculated comparing providers' adherence to screening *at-risk* subjects for OSA between the two groups and a significant difference was demonstrated ($X^2(1)= 56.679$, $p<.001$). Results are displayed in Table 4.2.

Providers' adherence to using the STOP-Bang Questionnaire (SBQ) for screening *at-risk* subjects was recorded and compared between the pre and post intervention groups. In the pre intervention group, 0 (0%) subjects were screened using the SBQ compared to 44 (34.9%) subjects post intervention (see Figure 4.2). A chi-square test of independence was performed comparing providers' adherence to using the SBQ in screening for OSA in *at-risk* subjects

between the two groups and a significant difference was identified ($X^2(2)= 60.607$, $p<.001$) as shown in Table 4.2.

Secondary Outcomes

Secondary outcomes that were analyzed included the effect of the protocol on the incidence of providers' referral of diagnostic testing for OSA and the corresponding incidence of subjects with newly confirmed diagnoses of OSA. To determine if a relationship existed between the project protocol and number of diagnostic testing referrals completed by the providers, a chi-square test of independence was performed. Data demonstrated no significant relationship between the protocol and providers incidence of referring subjects for OSA diagnostic testing ($X^2(1)= 0.488$, $p=.485$).

To evaluate if there was an association between the project protocol and number of subjects newly diagnosed with OSA, a chi-square test of independence was performed comparing the incidence of subjects with a new diagnosis for OSA pre and post intervention. Data demonstrated no significant relationship between the protocol and number of subjects with a new diagnosis of OSA ($X^2(1)= 2.810$, $p=.245$). Results are displayed in Table 4.3.

Figure 4.1

Providers' Adherence to Screening *At-Risk* Patients

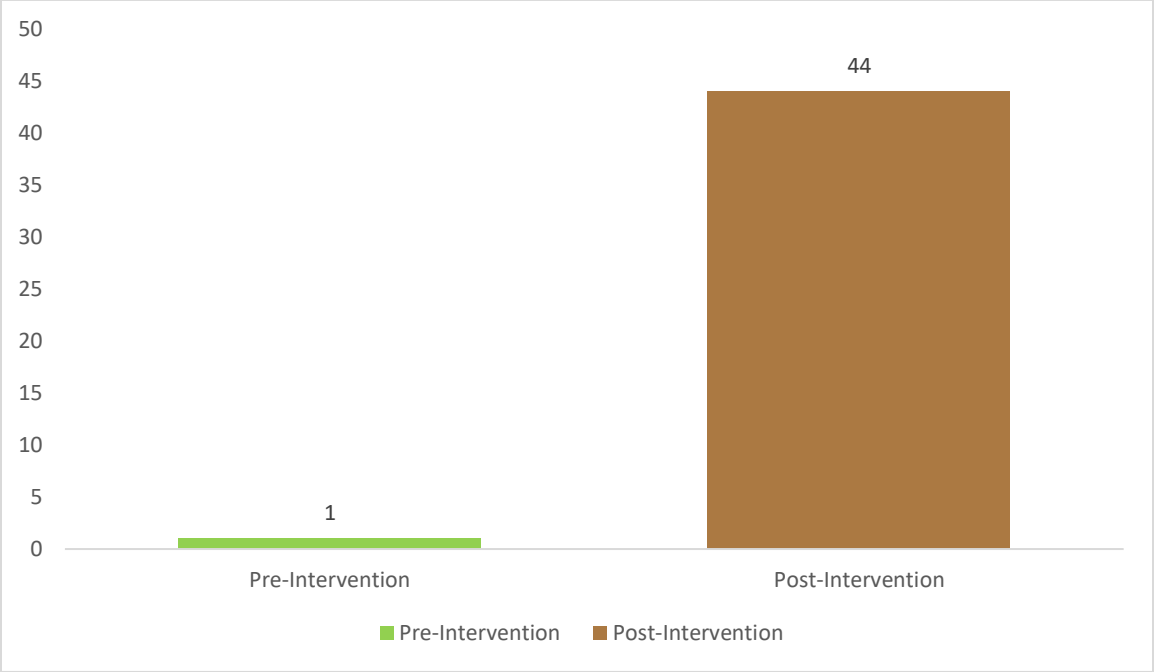

Figure 4.2

Providers' Adherence to STOP-Bang Questionnaire

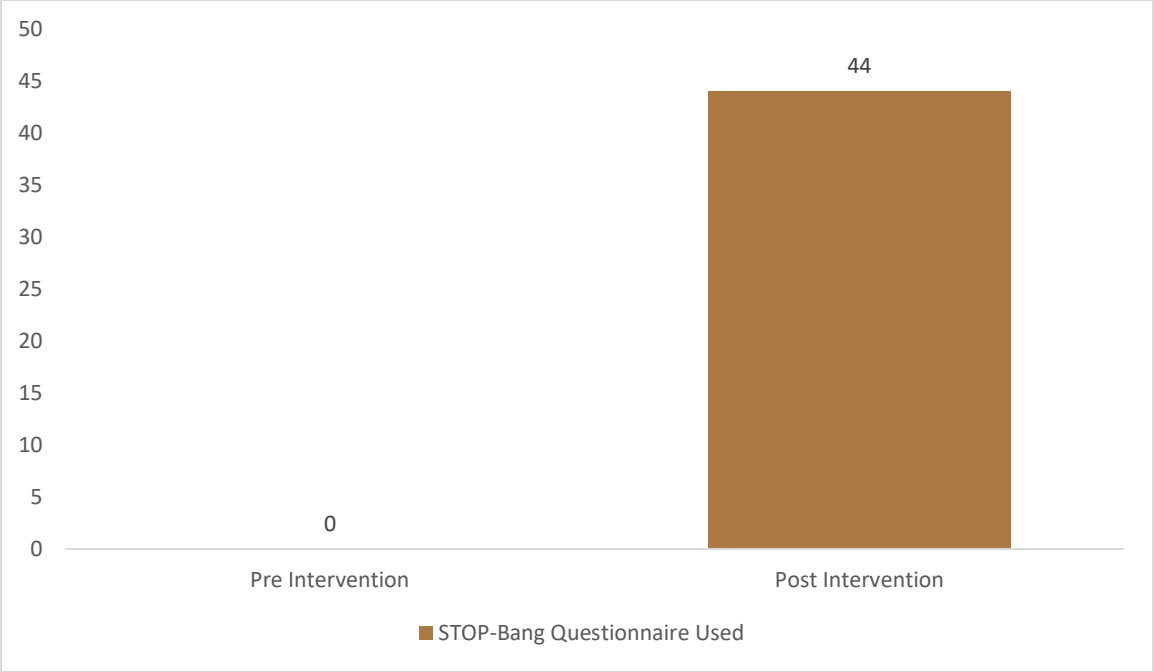

Table 4.2

Comparison of Providers' Adherence

	Pre Intervention n (%)	Post Intervention n (%)	X^2	df	*p* value
At-Risk Patients Screened			56.679	1	0.001*
Yes	1 (0.7)	44 (34.9)			
No	143 (99.3)	82 (65.1)			
STOP-Questionnaire Used			60.607	2	0.001*
Yes	0 (0)	44 (34.9)			
No	1 (0.7)	0 (0)			

* $p < .05$

Table 4.3

Secondary Outcomes

	Pre Intervention n (%)	Post Intervention n (%)	X^2	df	*p* value
Patients Referred	1 (0.7)	2 (1.6)	.488	1	.485
Diagnosed OSA	1 (0.7)	2 (1.6)	2.810	1	.245

CHAPTER 5

DISCUSSION

The purpose of this EBP project was to determine if the implementation of an obstructive sleep apnea (OSA) screening protocol in the family practice setting increased providers' adherence to screening for OSA compared to the clinics established method. Secondary outcomes that were examined included recording the incidence of diagnostic testing ordered by the provider and the confirmed incidence of a new OSA diagnosis as a result of providers' increased adherence to screening by utilizing the protocol.

Explanation of Findings

Primary outcomes. The pre intervention group had 1 *at-risk* patient that was screened for OSA as compared to the post intervention group that had 44 *at-risk* patients screened. Additionally, of the patients screened for OSA in the pre intervention group, 0 were screened using the STOP-Bang Questionnaire compared to the 44 patients that were screened using the STOP-Bang Questionnaire in the post intervention group. A chi-square test of independence comparing the providers' adherence to screening *at-risk* patients and the use of the STOP-Bang Questionnaire demonstrated a significant difference between the two groups. The implementation of the best-practice screening protocol resulted in a significant increase in providers' adherence to screening patients for OSA compared to the previous method.

Secondary outcomes. In the pre intervention group, 1 *at-risk* patient was referred for diagnostic testing compared to the post intervention group that had 2 *at-risk* patients that were referred. Furthermore, in the pre intervention group, 1 patient had a confirmed diagnosis of OSA while in the post intervention group 2 patients were newly diagnosed. A chi-square test of independence determined that there were no significant associations demonstrated when comparing the incidence of referral or incidence of participants newly diagnosed with OSA between the pre and post intervention group.

The PICOT question for this EBP project, “In the internal medicine setting, how does implementation of a revised obstructive sleep apnea screening protocol affect providers’ adherence to screening over a one-month period as compared to current practice?” was answered by the project results demonstrating a significant increase in providers’ adherence in screening *at-risk* patients using the STOP-Bang questionnaire. Although providers’ adherence to screening for OSA was increased, the frequency of patients referred for diagnostic testing resulting in an increased number of patients with a clinical diagnosis of OSA did not reflect a significant increase.

Evaluation of the Project: Theory of Planned Change

The theory of planned change was used as a guide to promote successful adoption of the projects protocol. Central to this theory is the concept that change occurs across three stages (a) *unfreezing*, (b) *moving*, and (c) *refreezing*. The theory hypothesizes that a successful change is promoted by driving forces outweighing restraining forces that hinder adoption of the change.

In an effort to promote providers’ adherence to the screening protocol, the three stages of change outlined by the theory were utilized as a guide throughout each step of the project. The theory facilitated identification of key driving forces that promoted providers’ adherence to the implemented protocol. For example, the providers’ expressed desire to uphold best-practice standards highlighted within the protocol. This desire, or driving force, was effective as evidence by the significant increase in providers’ adherence to utilizing the screening protocol. Additionally, as identification of driving forces was instrumental in the effectiveness of providers’ willingness to change, the identification of restraining forces was just as important. One pervasive restraining force observed during the course of the project was the perception that OSA was not a clinical diagnosis demanding foremost attention. Providers would occasionally remark that adherence was poor because they had limited time spent with patients that was reserved to discussing chronic conditions of greater importance. These observations correlate

with findings demonstrating no significant increase in the number of patients referred for diagnostic testing. The theory was instrumental during the planning phase of the project by identifying factors that either promote or prevent a successful adoption of change but offered little guidance during the implementation and evaluation stages.

Evaluation of the Project: Johns Hopkins Nursing Evidence-Based Practice Model

The Johns Hopkins Nursing Evidence-Based Practice Model (JHNEBP) was developed with the goal to foster the translation of evidence into each setting of nursing practice (Melnyk & Fineout-Overholt, 2015). As the model aims to promote the use of new best-evidence into current practice, the application of this model was apparent throughout the entire process of this EBP project. Implementation of this model is performed using the PET process which entails the three phases of (a) *practice question*, (b) *evidence*, and (c) *translation*. Within each of the three phases are multiple prescriptive steps serving to propel the process of evidence translation.

The first phase of the JHNEBP model created the foundation of the EBP project by developing the practice question. An interest in identifying and managing OSA served as the motivation and purpose of this project in the beginning. As detailed by the JHNEBP model, during this first phase a PICOT question is developed and refined based on the evidence yielded by the literature search. For example, the project PICOT question evolved over time based on current recommendations discovered by a thorough search of the literature. The original PICOT question sought to determine the effect of screening every patient for OSA and comparing the number of patients diagnosed before and after implementation. However, by analyzing the evidence it was clear that universal screening is not supported by research thus highlighting the need to modify the original PICOT questions. Ultimately the PICOT question was later refined to reflect best-evidence and promote a sustainable project. Once the final practice PICOT question was determined, key stakeholders were identified, and responsibilities were delegated.

After the practice question and implementation schedule was arranged, the project entered the second phase of searching the evidence. Aspects of this phase included conducting a search of the evidence, appraising the level and quality of each piece of evidence, summarizing, synthesizing the strength and quality, and developing recommendations based of the synthesis for each piece of evidence (Melnyk & Fineout-Overholt, 2015). Inclusion criteria and keywords were diligently reviewed and critiqued with the library liaison ensuring a methodological search strategy. Once articles of evidence were selected each were appraised for level and quality and then summarized. Concepts from each piece of evidence was synthesized and used in the development of the EBP protocol. As recommended by the JHNEBP model, a literature search yielding good and consistent evidence supports the initiation of a pilot project which propelled this project into the translation phase.

The third phase of the JHNEBP model provided a strategic outline to translate the evidence obtained into current practice. Following the steps within the phase, feasibility and fit were discussed with the project site coordinators. Once an agreement was reached an action plan was constructed and necessary resources such as copies of the screening tool and measuring tapes were secured. As outlined by the model, outcomes were evaluated and shared with stakeholders. Also, next steps and recommendations based on the outcomes were identified.

The JHNEBP model was effective in providing a general overview of the necessary steps of implementing evidence into practice. A strength of the model included dedicating time in developing a practice question that is rooted in the literature. The model is nonlinear, which allows previous steps to be revisited which was especially useful in refining the practice question based on findings from the evidence. Another strength was the explicit guidance of the evidence phase which directed the steps of the literature review and provide recommendations based on the strength of the evidence. A disadvantage of the model is that the emphasis was

on the development of the project offering limited guidance to promote a successful implementation.

Strengths of the EBP Project

Strengths of the project included the significant increase of *at-risk* patients that were screened for OSA using the STOP-Bang questionnaire. Although this didn't correlate with an increased number of patients referred for testing or new cases of OSA, it facilitated providers' communication with patients regarding their sleep health during the screening. Another strength included the large sample size available to the providers' to potentially screen. By having a large sample size this allowed for greater certainty that the results are associated with the intervention rather than a difference between the sample. Since the criteria defining an *at-risk* patient was broad there was a large base of patients that met the protocol inclusion criteria and the ability to detect a significant difference of providers' adherence to screening between the groups. The implementation of the project was completed at no direct cost to the clinic site.

Weaknesses of the EBP Project

One of the main weakness of this project was the lack of quality evidence. No studies were identified that directly examined the effect of a screening protocol in the family practice setting on providers frequency of screening or effect on diagnosing OSA. Inferences had to made by extracted concepts from a broad base of evidence to develop a screening protocol that reflected the best available evidence.

Another important weakness of the project design was not incorporating the effect of providers' beliefs and knowledge of OSA in relation to their adherence to screening. Reflecting on the project implementation, it became apparent that just as important as the providers' not being aware of best-practice screening guidelines, was their belief that OSA was not a clinically important diagnosis. The implications of the results would have been strengthened if providers beliefs and knowledge of OSA would have been measured both before and after implementation. Correlations examining if providers' adherence to screening for OSA was

affected by changes in providers' beliefs and knowledge of OSA may have provided more utility and insight. Another potential weakness of the project was the short implementation period. A longer pre and post implementation observation would provide more accurate adherence rates and inferences of overall sustainability of the project.

An additional weakness of the project was the structure of the project site. A frequently reported comment made by the providers' at the site was the issue of being short-staffed of medical assistants. During the course of the project, one medical assistant was terminated, and two new assistants were hired and were in the process of training. The providers' reported that as a result of the staffing issues they were having to assume more of the workload leaving less time to dedicate to adhering to the project.

Implications for the Future

Practice. Practice recommendations garnered from this EBP project outcomes are indifferent and don't provide straightforward clinical recommendations. Despite the significant increase of providers' adherence to screening, the clinical significance must be evaluated since the increase in screening didn't positively correlate with an increased diagnosis of OSA. In order for any screening protocol to be effective, its use must be justified by leading to a greater number of OSA diagnosis detected making it clinically significant. However, concepts from the policy are easily sustainable and can be readily referenced in the future during screening. Results from this practice site can be easily applied and generalized to other family practice settings.

To enhance sustainability at the project site a more streamlined process is recommended for greater adherence and clinical significance. Since providers' expressed a desire to be amenable to the protocol but experienced staffing issues that directed their time and resources to other tasks, the integration of the screening protocol into the electronic medical records (EMR) system would alleviate the burden of the protocol on providers' time. The possibility that the screening protocol would auto-populate patient specific information to

highlight *at-risk* patients would make screening patients more time-efficient for providers. Once the EMR extracts *at-risk* criteria of the patient, an integrated STOP-Bang questionnaire would allow providers' to conveniently screen patients with results documented in the electronic medical record. By having the results of the screening directly documented in the EMR this would support providers referral for overnight polysomnography and ensure reimbursement eliminating the extra time necessary to document results supporting coverage by screening patients using hard copies of the protocol. The integration of the protocol into the EMR may eliminate the extra time burden required with the project protocol possibly further improving providers' adherence to screening and ultimately leading to an increased number of patients referred for diagnostic testing and the number of confirmed OSA diagnosis.

Theory. The theory of planned change and JHNEBP model both facilitated the development and implementation of the project. The concepts of driving forces and restraining forces detailed by Lewin were displayed in providers desire to maintain compliance conflicting with the belief that unmanaged OSA was not a clinical priority and lack of time. The JHNEBP model provided a straightforward guide that navigated the project from creating a practice question, searching and appraising the evidence, to evaluating and disseminating the findings. Future projects aiming to increase detection of OSA and utilization of best-practice would be assisted with the use of these theories.

Research. Additional quality research related to the various concepts of screening for OSA in the primary care setting would prove invaluable. As highlighted through this project, nursing research exploring the correlation of providers' knowledge and beliefs of OSA and frequency of screening, referral, and confirmation would provide useful insight and guide future interventions aiming at promoting detection of OSA. The advance practice nurse (APN) is in a favorable position to pioneer future research or evidence-based practice projects regarding detection of OSA in the primary care setting.

Education. Principles from this EBP project and knowledge gained from project outcomes will have implications for nurse educators and advanced practice nurses (APN's). As attention to OSA heightens and unmanaged OSA is associated with numerous health risks to patients, being aware of screening recommendations and methods will be instrumental to APN's in primary care. Nurse educators and APN's are both in pivotal positions to be well-versed in the importance of diagnosing and managing OSA and to educate both patients and other health care providers.

Conclusion.

In summary, results from this EBP project support the use a of OSA screening protocol to promote providers' adherence to evidence-based screening recommendations. A screening protocol that detailed which patients were *at-risk* for OSA that necessitated screening along with recommending the STOP-Bang questionnaire was implemented at an active family practice clinic. The intervention was determined to have a significant association increasing providers' adherence to screening for OSA. Although the intervention demonstrated a significant difference, secondary outcomes revealed no significant difference in the number of patients referred for diagnostic testing or newly diagnosed with OSA as a result of the protocol limiting its clinical utility and significance. Despite insufficient clinical effects, the implementation of this EBP project replaced the project sites current manner of screening patients for OSA that did not reflect best-evidence. This project provides a method of increasing providers' adherence to screening and increasing awareness of undetected OSA.

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BIOGRAPHICAL MATERIAL

Kelsie A. Tokarczyk

Ms. Tokarczyk graduated from Valparaiso University with a Bachelor of Science degree in Nursing in 2015. Following graduation, she was employed as a registered nurse caring for patients on a general medical and pediatric unit. During employment she also received additional certifications including Pediatric Advanced Life Support and Emergency Nursing Pediatric Course. Ms. Tokarczyk returned to Valparaiso University in 2016 to pursue her graduate studies in the Doctor of Nursing Practice. During her doctoral preparation, she developed an interest in the recognition and management of obstructive sleep apnea in the primary care setting, which influenced her evidence-based practice project. Ms. Tokarczyk hopes that with obtaining a Doctor of Nursing Practice degree that she will be able to serve the needs of patients from across the lifespan with a focus on health promotion and disease prevention.

ACRONYM LIST

AASM: American Academy of Sleep Medicine

AHI: Apnea-Hypopnea Index

ASAA: American Sleep Apnea Association

APN: Advanced Practice Nurse

CINAHL: Cumulative Index to Nursing and Allied Health Literature

CPAP: Continuous Positive Airway Pressure

EBP: Evidence Based Practice

EMR: Electronic Medical Record

JBI: Joanna Briggs Institute

OSA: Obstructive Sleep Apnea

SBQ: STOP-Bang Questionnaire

Appendix A

Screening for Obstructive Sleep Apnea Policy

In effort to promote screening for Obstructive Sleep Apnea according to available best-practice evidence, the following protocol has been developed to serve as a guide to providers.

1. *At-risk patients:* The following diagnoses are acknowledged to place patients as *at-risk* for OSA. Patients with at least one of these established diagnoses should be screened for OSA. Universal screening of OSA in patients without one of these established diagnoses is not supported. Diagnoses include obesity, congestive heart failure, atrial fibrillation, treatment resistant hypertension (blood pressure above goal despite adherence to antihypertensive regimen of 3 medications, or hypertension controlled by at least 4 medications), coronary artery disease, impaired glucose tolerance or type 2 diabetes, nocturnal dysrhythmias, stroke, pulmonary hypertension, preoperative for bariatric surgery, or high-risk driving populations.
2. To screen for OSA in a patient that is *at-risk* the STOP-Bang questionnaire is the optimal method to detect OSA. The STOP-Bang questionnaire stratifies patients' risk for OSA into low, moderate, and high based on total scores. Patients that are classified as *high-risk* based on STOP-Bang questionnaire scores should be referred for definitive diagnostic testing for OSA.

Appendix B

STOP-Bang Questionnaire

	Yes	No
1. Snoring- Do you **snore loudly** (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?		
2. Tired- Do you often feel **Tired, Fatigued, or Sleepy** during the daytime (such as falling asleep during driving)?		
3. Observed- Has anyone **Observed** you **stop breathing or choking/gasping** during your sleep?		
4. Pressure- Do you have or are being treated for **high blood pressure?**		
5. Body Mass Index- more than **35kg/m^2**?		
6. Age- Are you older than **50 years**?		
7. Neck Size- Male is your shirt collar 17'' or larger? Female, is your shirt collar 16'' or larger?		
8. Gender- Are you **Male** gender?		
Total		

Scoring:

Low risk of OSA: Yes to 0-2 questions

Intermediate risk of OSA: Yes to 3-4 questions

High risk of OSA: Yes to 5-8 questions

Modified from:

Chung, F., Yegneswaran, B., Liao, P., Chung, S. A., Vairavanathan, S., Islam, S., . . . Shapiro, C. M. (2008). STOP questionnaire: A tool to screen patients for obstructive sleep apnea. *Anesthesiology, 108*(5), 812-821. doi:10.1097/ALN.0b013e31816d83e4

Appendix C
Providers' Adherence Records Log

Appt Date	Patient Code	Gender	At-Risk Diagnosis	Screening Performed? (yes/no)	SBQ tool used to screen? (yes/no)	SBQ score	Referred for diagnostic testing? (yes/no)	OSA diagnosis confirmed? (yes/no)	Weekly Adherence