

SCREENING FOR OBSTRUCTIVE SLEEP APNEA IN PRIMARY CARE

by

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Abstract

Despite efforts to improve health and reduce morbidity and mortality rates, health screenings for significant conditions such as obstructive sleep apnea (OSA) are often missed. It is estimated that 80% of OSA cases remain undiagnosed and that early identification and treatment are vital for preventing health complications of OSA. Focusing screening efforts by primary care providers could be key in identifying and treating these patients. The purpose of this quality improvement project was to routinely screen all patients seen in a primary care clinic over a ten-week period using the STOP-Bang questionnaire to identify patients at risk for OSA. A total of 575 STOP-Bang questionnaires were completed, 256 (44.5%) of which identified patients at moderate to high risk leading to 19 sleep studies being ordered. Overall staff compliance rate was 77.1% with screening efforts, which was monitored weekly. Ultimate goals of the project were to improve patient care, outcomes, and overall health. Screening for OSA in primary care can be an effective way to identify at-risk individuals and improve health outcomes. Instilling a sense of significance and confidence in health care staff members is crucial to success of routine screening.

Key words: obstructive sleep apnea; standardized screening; staff education; STOP Bang questionnaire

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Chapter One: Overview of the Problem of Interest

Chronic diseases are responsible for the majority of illness, disability, death, and health care costs in the United States (US) annually (Bauer, Briss, Goodman, & Bowman, 2014).

Choosing healthy lifestyles and engaging in health promotion activities, such as routine health screenings, are key to prevention and proper management of disease (Downey, 2018).

Obstructive sleep apnea (OSA) is a multi-faceted disease with detrimental health effects if undiagnosed and untreated (Downey, 2018). Treatment for OSA begins with identification of at-risk individuals who require further evaluation; thus, screening efforts are necessary (Downey, 2018). To provide optimal care to at-risk individuals, health care providers must understand the importance of disease screening efforts (Downey, 2018). The purpose of this chapter is to define obstructive sleep apnea (OSA), establish the significance of the condition, and identify the clinical question that guided this DNP quality improvement (QI) project.

Background Information

Obstructive sleep apnea (OSA) is a sleep-breathing disorder that involves significantly decreased or completely blocked airflow due to partial or complete upper airway collapse during sleep (Bonsignore, 2017). This condition causes intermittent hypoxemia and arousal from sleep (Bonsignore, 2017; Chung, Abdullah, & Liao, 2016; Downey, 2018). OSA is diagnosed by overnight polysomnography (PSG), which is both time-consuming and expensive (Downey, 2018). Approximately 80% of OSA cases are undiagnosed (Bonsignore, 2017). Other obstacles to diagnosis include a shortage of sleep specialists and long wait times for appointments at sleep clinics (Boynton, Vahabzadeh, Hammoud, Ruzicka, & Chervin, 2013), hence making a reliable screening method crucial (Bonsignore, 2017). Early identification and treatment are vital for preventing health complications of OSA (Sunwoo et al., 2018).

The apnea-hypopnea index (AHI), used to grade OSA severity, describes the number of

apneas and hypopneas that occur in an hour (Schulman, 2018). Three levels of severity exist: mild (AHI 5-15), moderate (AHI 15-30), and severe (AHI>30). Treatment is recommended for anyone with 1) moderate or severe OSA (AHI>15) or 2) mild OSA who has symptoms of cardiovascular co-morbidities (Bakhai, Nigam, Saeed, Krishnan, & Reynolds, 2017). The American Academy of Sleep Medicine recommends continuous positive airway pressure (CPAP) during sleep as OSA first-line treatment (Bakhai et al., 2017).

Major OSA risk factors include obesity, age greater than 70 years, large neck circumference, abnormal or increased Mallampati score, enlarged tonsils, congestive heart failure (CHF), pulmonary hypertension, stroke, and metabolic syndrome (Downey, 2018; Sunwoo et al., 2018). Hypertension, diabetes mellitus type 2, hyperlipidemia, and anxiety are co-morbid conditions independently associated with high-risk OSA (Sunwoo et al., 2018). An estimated 20% of men and 25% of women in the US are obese (BMI >30) (Downey, 2018). Obesity is likely to cause OSA (Downey, 2018).

Muraki, Wada, and Tanigawa (2018) support the link between OSA and diabetes mellitus type 2 (DM2). Research indicates individuals with OSA are more likely to develop DM2 than those without OSA. Similarly, over half of type 2 diabetic patients also have OSA. Sleep disturbances and intermittent hypoxic episodes associated with OSA result in systemic inflammation and changes in hormone levels. These hormone changes include “activation of the hypothalamic-pituitary adrenal axis (HPA) and changes in adipokine profiles, both of which usually lead to fat accumulation and obesity” (Muraki et al., 2018, p. 4). Additionally, continued episodes of hypoxia result in worsening insulin resistance (Muraki et al., 2018).

OSA associated symptoms and untreated OSA complications include cognitive deficits, reduced cognitive performance, excessive daytime drowsiness (EDS) ---a major cause of driving accidents---, personality and mood changes, anxiety, depression, sexual dysfunction,

gastroesophageal reflux (GERD), cardiovascular diseases, and hypertension (Bonsignore, 2017; Downey, 2018). OSA has also been linked with other medical conditions such as ischemic stroke, increased mortality with atrial fibrillation, and worsening symptoms of carpal tunnel syndrome (Bilgin, Oruc, Sarac, Centintas, & Uluc, 2017; Marulanda-Londono, 2017).

Kim et al. (2018) argued that OSA is a predisposing risk factor for ischemic stroke and a triggering factor for wake-up stroke (WUS), a stroke that occurs during sleep. In a study of 260 patients with acute ischemic strokes, 25.8% were WUS. Patient examination detected pre-existing witnessed or self-recognized OSA as the only risk factor. (Kim et al., 2018)

Macey et al. (2018) found a higher degree of cortical thinning using magnetic resonance imaging (MRI) among OSA patients compared to a control group. This reduced cortical thickness is likely the result of tissue atrophy from repeated intermittent episodes of hypoxia during sleep. Ultimately, destruction of neurons and glia occurs, leading to autonomic dysregulation and impaired upper airway sensory-motor function. (Macey et al., 2018)

Significance of Clinical Problem

Although OSA prevalence varies based on measurement techniques, diagnostic criteria, and AHI score, it affects 20-30% of males and 10-15% of females in North America (Sunwoo et al., 2018; Strohl, 2018). Undiagnosed and untreated OSA leads to limited ability to perform activities of daily living (ADLs), worsened quality of life, compromised personal safety, decreased labor productivity, and increased health care expenditure (Duarte, Fonseca, Magalhaes-da-Silviera, Silviera, & Rabahi, 2017).

American Academy of Sleep Medicine (AASM) Task Force 2015. Quality measures were released about the care of adults with OSA. The challenge was “to improve detection and categorization of OSA symptoms and severity to promote assessment and diagnosis of the disorder” (Miller & Berger, 2015, p. 41). The AASM task force was developed to address

results from surveys about OSA conducted at primary care clinics. Surveys revealed that providers seldom addressed sleep disorders, patients rarely reported sleep disturbance issues, complaints of daytime drowsiness and insomnia were not recognized as OSA symptoms, and primary care providers (PCPs) did not routinely screen for OSA (Miller & Berger, 2015).

Healthy People 2020. The U. S. Department of Health and Human Services' Healthy People 2020 Initiative aims to have more people with OSA symptoms seek medical evaluation. Between 2005 and 2008, approximately 25.5% of individuals with OSA symptoms sought evaluation (USDHHS, 2018). Healthy People 2020 initiative set a target of 28% (USDHHS, 2018).

This project intended to identify at-risk individuals through routine screening so they could obtain evaluation when necessary. Patients who do not recognize OSA symptoms need information when they screen positive for OSA risk to have an opportunity for appropriate care.

Triple Aim. The Institute for Healthcare Improvement (IHI) is responsible for the Triple Aim pledge to better health care performance, which consists of three main goals. First, the initiative aims to improve patient experience including the quality and satisfaction of care. Second, population health improvement is sought. Lastly, the IHI calls for a per capita reduction in health care costs. (IHI, 2017) Early identification of disease risk factors and disease symptoms are important components of quality care, improvement of population health, and reduction in healthcare costs. Treatments for OSA complications are estimated to cost billions of dollars annually (Tierney, Gabarain, & Kominsky, 2017).

Problem Statement

The primary care clinic in Charlotte, North Carolina where this project was conducted serves a population of patients with many medical conditions identified as OSA risk factors. The practice's providers expressed concerns that they were not capturing all patients affected by

OSA. They agreed that routine screening using the STOP-Bang questionnaire would help identify these patients and direct them to further evaluation and treatment as necessary (Personal communication, January 31, 2018).

Purpose. The purpose of this project was to implement routine OSA screening for primary care patients. The STOP-Bang questionnaire was administered to all patients to identify moderate to severe OSA risks so that further diagnostics and potential treatment could be ordered. Staff was educated about OSA significance and use of the STOP-Bang questionnaire.

Clinical questions. Does providing staff education on the importance of OSA and screening increase staff compliance with routine screening? Does routinely screening all primary care patients using the STOP-Bang questionnaire help to increase identification of patients at moderate to high risk for OSA?

Question Guiding Inquiry (PICO)

The PICO model was used to develop the clinical question. The following components were identified.

Population. This project included all staff providing care to patients seen for routine annual physicals, chronic disease check-ups, and problem visits at a primary care clinic in the NC Piedmont region.

Intervention. Education was provided to staff about OSA and its screening importance. The STOP-Bang questionnaire was used for ten (10) weeks to screen for individuals at risk for sleep apnea.

Comparison. Post-education staff compliance with OSA screening was evaluated. The number of patients identified as at-risk for OSA by STOP-Bang questionnaire during a ten-week period was compared to previous estimated practice rates of patients identified as at-risk for OSA.

Outcome(s). The project goal was to improve the rate of OSA screening through staff education and compliance in use of the STOP-Bang screening tool so that at-risk individuals were able to get further evaluation and treatment when needed.

Summary

Identifying the need to improve routine OSA screenings in primary care and understanding of OSA's significance on individual and community health supported development of this QI project. An emphasis on the precise population, intervention, and outcomes provided the foundation. With identification of the clinical problem, an extensive review of the literature was then needed to determine an appropriate, evidence-based solution.

Chapter Two: Review of the Literature

Search Strategy

A literature review was conducted using PubMed and CINAHL to explore several topics including: obstructive sleep apnea (OSA), standardized screening, and STOP-Bang questionnaire. Key words used for a search in PubMed were “obstructive sleep apnea AND standardized screening OR STOP Bang,” which yielded a total of 433 articles. Filters were applied for free full text publications written in English within the last five years, yielding a narrowed collection of 115 articles. Another search in PubMed using mesh terms “staff education” and “health screenings” yielded 499 articles, which was further narrowed by using filters for free full text articles written in English in the last five years, yielding 40 articles. Yet an additional PubMed search for full text articles written in English in the last five years using mesh terms “health screenings” and “quality improvement” yielded 67 articles. Key words used for a search in CINAHL were “obstructive sleep apnea AND STOP Bang” with filters for full-text articles within the last five years written in English, which yielded a total of 40 articles. (See Appendix A and Appendix B)

Literature Review Findings

Standardized screenings. Various types of screening tests are used to help identify persons with active disease and persons at-risk for disease. Diagnostic tests are conducted when cause of exhibited symptoms must be identified. For example, a chest x-ray is obtained to diagnose pneumonia. Screening tests are used to diagnose disease in early stages before symptoms present, thus allowing early treatment and better health outcomes. Opportunistic screening tools, such as the STOP-Bang questionnaire, are different from other screening tests in that they are used to identify risk factors for disease. Further examination is needed to diagnose the presence of disease. At the same time, individuals who are identified as at-risk can choose

preventative measures and health promoting behaviors as to reduce their chance of developing the disease. (Institute for Quality and Efficacy in Health Care, 2016)

Evidence supports the use of standardized assessment tools as the best method to screen for medical conditions, such as drug and alcohol dependency, depression, heart failure, and OSA (Billioux, Verlander, Anthony, & Alley, 2017). Standardized screening tools can be used to quickly screen patients, thus reducing the chance of missing at-risk individuals when screenings are triggered by provider inclination only (Billioux et al., 2017; Suarez, Osorio, Torres, & Montserrat, 2016). Suarez et al. (2016) stressed the importance of beginning OSA diagnosis and management in primary care. They also suggest that home respiratory polygraphy (HRP) be used as a cheaper, more accessible diagnostic test when access to polysomnography (PSG) is limited. “HRP is a simplified portable monitor that includes sensors to measure airflow, respiratory efforts, pulse oximetry, and body position” (Suarez et al., 2016, p. 244).

Staff education, creating buy-in. Numerous studies and QI projects have emphasized the importance of adequate education for staff members to ensure improved quality of care for patients. For example, Velthuisen et al. (2018) educated staff about appropriate use of delirium screening tools and the need to recognize symptoms of delirium in order to increase nursing staff compliance with delirium screening on two inpatient hospital units. Their educational efforts were reported as useful and insightful per nursing staff. A 2.5-fold increase in delirium screening was observed (Velthuisen et al., 2018). Allen, van der Does, and Gunst (2016) used staff education to increase enthusiasm and confidence of diabetic foot screenings, yielding a 60% increase in staff compliance with screening. Through use of educational workshops and posters, McNulty et al. (2013) achieved a 76% increase in Chlamydia screening rates. Lastly, to improve OSA screening and diagnosis in patients with hypertension, Bakhai, Nigam, Saeed, Krishnan, and Reynolds (2017) conducted a QI project using PowerPoint presentations and small group

discussions to educate providers and staff on OSA significance and screening with the STOP-Bang questionnaire. They observed a 50% increase in post-educational screening, with providers citing time constraint as their biggest barrier. The project also noted providers reported they were more likely to give patients detailed education about OSA and hypertension (Bakhai et al., 2017). These studies strongly demonstrate that providing education to staff is feasible and beneficial to achieving improved patient care.

The importance of creating buy-in among health care employees is a crucial element of quality improvement success. For example, Lazenby et al. (2015) analyzed the effects of staff education on “the reach, effectiveness, adoption, implementation, and maintenance of psychosocial distress screening” (p. e413) for cancer patients. By educating staff about the evidence-based usefulness of screening to improve quality of patient care, they relieved workload concerns about screening and created buy-in among staff (Lazenby et al., 2015). Miller, McCaw, Humphreys, and Mitchell (2015) created buy-in among health professionals by presenting the detrimental effects of intimate partner violence (IPV) and emphasizing the need to help affected individuals. Staff education included evidence-based practice recommendations, interventions, and patient resources to improve IPV screening and counseling (Miller et al., 2015).

STOP-Bang questionnaire. The STOP-Bang questionnaire has been used for OSA screening since 2008 in many health care settings, including perioperative clinics, general practices, sleep clinics, and bariatric facilities (Nagappa et al., 2015). Its ease of use and promising ability to identify individuals at risk for OSA make it a good choice for primary care (Nagappa et al., 2015). The questionnaire consists of four subjective questions (STOP: Snoring, Tiredness, Observed apnea, high blood Pressure) and four demographic and physical examination items (Bang: BMI, age, neck circumference, gender) (Nagappa et al., 2015) (See

Appendix C). It is easily scored, with all yes/no answers (score 1/0) totaling a score of 0-8; low risk indicated by a score of 0-2, intermediate risk by 3-4, and high risk by 5-8 (Bakhai, Nigam, Saeed, Krishnan, & Reynolds, 2017).

A systematic review and meta-analysis of seventeen studies performed by Nagappa et al. (2015) revealed an overall sensitivity of 90%, 94%, and 96% to detect any OSA, moderate to severe OSA, and severe OSA with corresponding negative predictive values (NPVs) of 46%, 75%, and 90% in sleep clinic patients. Prasad et al. (2016) examined the effectiveness of nine different OSA screening tools. The STOP-Bang questionnaire was found to predict OSA with the following results: sensitivity 89%, specificity 43.5%, accuracy 79.1%, positive predictive value (PPV) 84.9%, and negative predictive value (NPV) 52.6% (Prasad et al., 2016).

Likelihood for a positive result (LR+) was 1.6, and likelihood for a negative result (LR-) was 0.2 for moderate to severe OSA and 0.1 for severe OSA (Prasad et al., 2016). With a sample of 456 Brazilian patients referred for sleep studies, Duarte et al. (2017) determined the STOP-Bang questionnaire's ability to predict any OSA with a sensitivity of 83.5%, specificity of 45.5%, PPV of 84.7%, NPV of 43.3%, and accuracy of 75.2%. Unlike other studies, Duarte et al. (2017) examined individual components of the STOP-Bang questionnaire. Researchers concluded that increased neck circumference was the single best predictor of moderate to severe OSA, followed by age and observed apnea (Duarte et al., 2017). Benefits to the STOP-Bang questionnaire include: reduction in peri- and post-operative complications due to otherwise undiagnosed OSA; reduction in co-morbidities and associated health care costs; and use of the questionnaire as a low-cost screening method in areas with limited resources and/or limited access to PSG (Nagappa et al., 2015; Prasad et al., 2016; Duarte et al., 2017).

Obesity, stroke, and asthma affect many individuals. Numerous studies examined use of the STOP-Bang questionnaire to predict OSA patients with these conditions. With roughly 60-

70% of obese individuals suspected to have OSA, Reed, Pengo, and Steier (2016) used the STOP-Bang questionnaire to screen obese patients undergoing bariatric surgery in a London facility. The researchers found that treatment was initiated for almost half of the patients screened. Further evaluation revealed that “systemic hypertension was prevalent in 40%, T2DM was present in 35%, and 25% of the patients had depression” (Reed et al., 2016, p. 270).

Approximately 40 to 80% of stroke patients develop sleep-related respiratory disorders such as OSA (Oliviera, Vago, Prado, & Santos-Coelho, 2017). Oliveira, Vago, Prado, and Santos-Coelho (2017) conducted a cross-sectional, observational study of 68 adult patients with history of stroke (< 1 year) to compare reported sleep quality with STOP-Bang OSA risk scores. Linear regression analysis indicated the STOP-Bang’s ability to predict poor-quality sleep at $p < 0.05$ with a relative risk of 1.6. Sensitivity for the STOP-Bang tool was found to be 83.6% in detecting OSA among patients with a history of stroke. This coefficient was congruent with sensitivity ratings found in other studies (Oliviera et al., 2017). Furthermore, Lu et al. (2017) found the STOP-Bang questionnaire more consistent and accurate for identifying OSA risk in 123 asthmatic patients than that of another questionnaire known as the Berlin questionnaire.

Limitations of Literature Review Process

One of the challenges to this literature review was that most of the studies conducted using the STOP-Bang questionnaire have been completed in sleep clinics or in perioperative sites. Generalizability for using STOP-Bang in primary care derives from patients with comorbidities who undergo surgery and are at risk for OSA complications if undiagnosed and untreated (Miller & Berger, 2015). These patients are seen in primary care clinics daily, thus making the STOP-Bang questionnaire valid for all patient populations.

Discussion

Conclusion of findings. After reviewing the literature regarding OSA, it was evident that identification of at-risk individuals led to further evaluation, proper treatment, and improved quality of care and health status for these individuals. Common emphasis on standardized screening was evident because OSA has varied symptoms not often recognized. For this reason, routine screening of all individuals with the STOP-Bang questionnaire is the best approach to identify at-risk individuals.

Use of the STOP-Bang questionnaire in various studies has shown it to have high sensitivity and negative predictive value (NPV) for severe OSA (AHI>30) specifically, making it a useful tool in primary care settings where OSA prevalence varies (Boynton, Vahabzadeh, Hammoud, Ruzicka, & Chervin, 2013). Providers can rely on this tool to identify patients who are affected and provide them with further evaluation and treatment so that symptoms are not ignored. At the same time, moderate to severe OSA can be confidently ruled out based on STOP-Bang scores (Boynton et al., 2013).

Advantages and disadvantages of findings. Many advantages exist to using the STOP-Bang questionnaire as a standard of care in primary care settings. First, it is a quick and easy tool that takes few minutes to complete. Second, it has clear instructions on scoring. Third, given the number of patients who require surgery at some point in their life for orthopedic, cardiac, or other conditions, it is important to know which patients have OSA and thus have higher risk for complications related to anesthesia, surgery, and postoperative recovery. Appropriately identifying these individuals before surgical procedures secures appropriate treatment, improved pre-operative health status, and lessens risk for surgical complications (Nagappa, Wong, Singh, Wong, & Chung, 2017).

One particular disadvantage has been identified with use of the STOP-Bang questionnaire. Its modest specificity has a concerning false-positive rate, which could result in unnecessary sleep studies and increased cost for perioperative patients with unnecessary monitoring (Nagappa et al., 2017). For this reason, provider assessment plays a crucial role in deciphering which patients may be more affected by other health conditions versus sleep apnea.

Utilization of findings in practice. The importance of standardized screening using the STOP-Bang questionnaire is evidenced in the literature and thus was implemented in this primary care clinic. Patients completed the STOP portion of the screening tool, while health care team members completed the BANG portion. Scores were totaled to identify those patients at risk for OSA and used to guide further patient management.

Summary

After completing an extensive literature review, compelling evidence supported using the STOP-Bang questionnaire to detect patients at moderate to severe risk for OSA due to its high sensitivity. Screening all primary care patients is justified due to the link between OSA and numerous other co-morbidities. Properly identifying patients at moderate to severe risk for OSA through routine screening gives them more prompt access to evaluation and treatment than waiting for them to present with symptoms and complications of OSA.

Chapter Three: Theory and Concept Model for Evidence-Based Practice

According to Fawcett (2012), a concept is "a label, expressed as a word or phrase, that summarizes the essence of a phenomenon" (p. 285) from which theories are derived. Conceptual models involve concepts that are abstract, grand theories serve as general explanations of phenomena, and middle-range theories are originated from more concrete concepts (Fawcett, 2012; Hoeck & Delmar, 2017). Nursing theories have guided research for years. A theory involves an assumption that can be tested and interpreted. (Hoeck & Delmar, 2017)

Concept Analysis

Obstructive sleep apnea (OSA). OSA is a sleep-breathing disorder that involves significantly decreased (hypopnea) or completely blocked (apnea) airflow due to partial or complete upper airway collapse during sleep, which causes intermittent hypoxemia and arousal from sleep (Bonsignore, 2017). Symptoms of OSA include loud snoring between periods of apnea, witnessed episodes of gasping for air, choking, and the complaint of daytime fatigue (Miller & Berger, 2015).

Standardized screenings. Screening tools are used to screen patients who report symptoms of disease as well as those who are asymptomatic and may be at-risk. Screening is "the act of doing a test on a person ... to look for evidence of a disease" (Miller & Berger, 2015, p. 42). Review of systems conducted by providers must address sleep disturbances, and at-risk individuals must be referred for further evaluation (Miller & Berger, 2015).

STOP-Bang questionnaire. A screening tool used to identify individuals at-risk for OSA (See Appendix C). It consists of four subjective questions (STOP: Snoring, Tiredness, Observed apnea, high blood Pressure) and four demographic and physical examination items (Bang: BMI, age, neck circumference, gender) (Nagappa et al., 2015). The tool is easily scored, with all yes/no answers (score 1/0) totaling a score of 0-8. A score of 0-2 indicates low risk, 3-4

intermediate risk, and 5-8 high risk (Bakhai, Nigam, Saeed, Krishnan, & Reynolds, 2017).

Theoretical Framework

The Integrated Theory of Health Behavior Change (ITHBC) is a midrange descriptive theory that emphasizes the importance of personal behaviors that impact health, as well as prevention behaviors, such as health screenings, that help to improve and maintain health status (Ryan, 2009). It was developed by Polly Ryan “to guide nurses and other healthcare professionals in the development of interventions, focus assessments, identify patient-sensitive outcomes, and provide the logic to design and evaluate the quality of intervention studies (Ryan, Weiss, Traxel, & Brondino, 2011, p. 2049). Ryan (2009) explained that individuals must understand the importance of recognizing risky behaviors, such as inactivity, smoking, consuming alcohol, and bad nutrition. Similarly, prevention behaviors, such as screening and immunizations, have equal importance to obtaining optimal health (Ryan, 2009).

The ITHBC proclaims the importance of social facilitation, influence, and support in one’s ability to choose behaviors that improve health (Ryan, 2009). Social facilitation “includes the concepts of social influence, social support, and negotiated collaboration between individuals and families and healthcare professionals” (Ryan, 2009, p. 164). Ryan (2009) concludes that healthcare providers play a critical role by knowing how to encourage patients to maintain healthy behaviors and lifestyles, with screenings being a large component.

Application to practice change. Application of the ITHBC supports the need for conducting routine OSA screenings as a means of promoting healthy behaviors (Ryan, 2009) (See Appendix D). Should a patient screen positive for OSA risk, he or she could focus more on behaviors and health conditions that could be causing this condition. At the same time, if diagnosed with OSA, a patient could then use CPAP as ordered to improve sleep, lessen symptoms, and reduce OSA complications. Adopting other health-promoting behaviors, such as

weight reduction and control of co-morbidities affecting OSA, could further improve long-term health status.

Evidence-Based Practice (EBP) Change Theory

This QI project was conducted following the Institute for Healthcare Improvement's (IHI) Model for Improvement, which consists of three main questions: 1) What are we trying to accomplish? 2) How will we know that a change is an improvement? 3) What changes can we make that will result in improvement? (Moran, Burson, & Conrad, 2017). The model's theme includes "goal definition, data acquisition and analysis, implementation of process change, and review of results" (Lee & Larson, 2014, p. 1131). Through use of the Plan-Do-Study-Act (PDSA) cycle, which is similar to the scientific method, a hypothesis is formed (plan), the hypothesis is tested (do), the data is analyzed (study), and conclusions are drawn (act). In all QI efforts, changes are adopted, abandoned, or modified and re-enacted (Lee & Larson, 2014).

The PDSA cycle was employed in this project with weekly analysis of compliance rates and identification of barriers or reasons for non-compliance. In the event of non-compliance, staff was asked about barriers and changes were made accordingly. This was a continuous process of evaluation and change as needed throughout the ten-week implementation phase.

Application to practice change. In this QI project, the Model for Improvement and PDSA cycle was employed as a method of reviewing the proposed OSA screening initiative. Logistics and education were altered as needed to fit the culture of the clinic. Brainstorming with practice providers and staff members aided in making needed adjustments to the proposed implementation. Once the final plan was developed and initiated, ongoing evaluation of performance was conducted throughout the implementation phase. Identified strengths, limitations, and barriers of the practice initiative were recorded and analyzed for significance to future clinical practice.

Summary

Both the Integrated Theory of Human Behavior Change (ITHBC) and the IHI's Model for Improvement guided this QI project with a goal of developing ideal, evidence-based improvement for OSA screenings at this primary care clinic. As improvements or needed changes were identified, the PDSA cycle was continued until an acceptable implementation plan was determined.

Chapter Four: Pre-Implementation Planning

Prior to implementation of this project, various aspects needed to be planned to ensure appropriateness of the project's aims as well as to guarantee success and minimize barriers. These aspects included the project's purpose, current status of organizational readiness for change, a cost analysis, the Institutional Review Board (IRB) review process, and a plan for project evaluation. This chapter will explore these project management aspects.

Project Purpose

The purpose of this project was to implement routine OSA screening for primary care patients. The STOP-Bang questionnaire was completed for all patients to identify at-risk individuals so that further diagnostics and treatments could be ordered. Staff was educated about OSA significance and use of the STOP-Bang questionnaire.

Project Management

Organizational readiness for change. Organizational readiness refers to “the extent to which organizational members are psychosocially and behaviorally prepared to implement organizational change” (Shea, Jacobs, Esserman, Bruce, & Weiner, 2014, p. 2). It is instrumental in QI success and implementation of new policies and procedures aimed to better patient care delivery. Staff members at this clinic were receptive to practice guideline changes and quality improvements that ultimately help improve patient care, workflow, and access and allocation of resources. By providing staff with education about OSA and STOP-Bang use, the goal was for staff to have a better understanding of OSA significance and assist patients in identifying their potential risk so as to receive treatments and improve health outcomes.

Inter-professional collaboration. When professionals of different educations and disciplines collaborate, positive impacts on patient care delivery and health outcomes are realized (Reeves, Pelone, Harrison, Goldman, & Zwarenstein, 2017). To ensure success of OSA

screenings, all project team members must be responsible and accountable for their roles in the initiative. In this project, the interprofessional team members consisted of: clinic providers, clinic staff members, a DNP student, and a DNP faculty member. Three providers were practicing at this clinic during the implementation phase, including two physicians and a physician's assistant (PA), who reviewed STOP-Bang questionnaires and ordered sleep study referrals as needed. One of the physicians served as the site champion and assisted with project planning, staff encouragement, and implementation. The office staff included two secretaries and a medical office assistant (MOA). The secretaries were responsible for scheduling appointments, checking patients in, submitting insurance claims and pre-authorizations, requesting referrals, and other miscellaneous clerical tasks. They were originally expected to help provide STOP-Bang questionnaires to patients at check-in. However, the MOA, who takes patients to exam rooms, takes vitals, performs medication reconciliation, and confirms medication allergies, was ultimately the one who completed this task. This individual was expected to complete remaining aspects of the STOP-Bang questionnaire, including BMI and neck circumference measurement. The DNP student, serving as the project lead, was responsible for conducting weekly site visits to address any issues or barriers identified, collecting and interpreting data, and presenting project outcomes. The DNP faculty member served as a resource for the project lead and provided guidance on the IRB process as well as specifics about QI project implementation. Collaboration among all of these team members was crucial to project success and improvement in patient care.

Risk management assessment. In order to identify issues or barriers that could possibly impede the success of this QI project, a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis was completed (See Appendix E). Internal and external variables posing both positive and negative potential impacts on project success were identified. Strengths, including small

clinic size, provider and staff commitment, minimal staff turnover, ease of STOP-Bang use, and patient receptiveness, were identified as potential positive influences on project success. Limited available resources, restricted insurance coverage, and cultural considerations were noted as possible threats.

Organizational approval process. To gain approval and support for this project, a meeting was held with the practice providers. Several care gaps needed to be addressed in order to improve patient care. Routine health screenings were the biggest concern voiced by both physicians, especially the need to evaluate patients for OSA. After an extensive literature review was conducted, a second meeting was held with the providers to discuss routine OSA screening using the STOP-Bang questionnaire. A unanimous agreement was reached to standardize routine OSA screening for all patients, eliminate provider interpretation on a case-to-case basis, and provide identified at-risk patients further evaluation and treatment. Organizational approval was granted to proceed with a QI project on screening for OSA.

Information technology. Technology aided in this project completion, including Microsoft Word to create data collection tools, Microsoft Excel to create budget proposals, record project statistics, and perform statistical calculations, and Microsoft PowerPoint to create educational handouts. The internet was also used to conduct a literature review and to obtain educational information. Providers in the clinic charted in the electronic health record (EHR) when a patient was identified as at-risk for OSA according to the STOP-Bang questionnaire, as well as when a sleep study was ordered. No personal health information was collected, thus the electronic medical record at the clinic was not utilized for this project.

Cost Analysis of Materials Needed for Project

Cost of the project included the cost of printing STOP-Bang questionnaires, data collection tools, and staff education handouts. Additional cost included the lunch provided to

staff during educational session before implementation. The total estimated project budget was \$303.50 (See Appendix F).

Plans for Institutional Review Board Approval

Several steps were completed in preparation for the Institutional Review Board (IRB) review process. First, faculty approval was sought for the proposed project. Second, CITI training was completed as required for all research and QI projects conducted. Third, an ePirate account was established to submit details of the project should a formal IRB review be required. Fourth, the staff educational handout and data collection tool were developed and submitted with faculty-approved project proposal for preliminary IRB review. University IRB reviewed the materials and deemed the project non-human subject research (See Appendix G).

Plan for Project Evaluation

Demographics. There was no additional demographic information collected during the project aside from the information included on the STOP-Bang questionnaire. The goal of this QI project was not to show a difference between OSA risk for subsets of patients but rather to show the importance of identifying at-risk individuals through a routine, standardized screening process. There was also no demographic information collected about staff participants of this project.

Outcome measurement.

Evaluation tool. The evaluation tool used in this project evaluated staff compliance with STOP-Bang questionnaire completion (See Appendix H). It consisted of five questions regarding the number of patients seen in the clinic each day, the number of questionnaires completed, the number of questionnaires indicating moderate to severe OSA risk, and the number of sleep study referrals placed for positive screens. In addition, the tool addressed

patients who completed a questionnaire at a prior visit within the implementation phase so that these non-completed questionnaires were not interpreted as staff non-compliance.

Data analysis. Microsoft PowerPoint and Excel were used to analyze and depict project outcomes, and Microsoft Excel was used to combine daily and weekly evaluation tool components. Data collected was quantitative in nature, at nominal and ordinal levels. Data depicted how many patients were screened for OSA using the STOP-Bang questionnaire, how many patients were identified as being at moderate to severe risk for OSA, and for how many of these patients sleep studies were ordered. Percentages, frequencies, and central tendencies were calculated and displayed using charts and graphs as needed.

Data management. Data storage was simple during this project given that patient identifiers and personal health information was not collected. Paper questionnaires were used and stored in folders in a locked box at the clinic until review by the project lead. Data was entered into a password-protected excel spreadsheet for data analysis purposes. Paper questionnaires were shredded after completion of the project and final presentation of project outcomes occurred.

Summary

Project planning prior to the implementation phase consisted of many aspects. The organization's readiness for change, importance of inter-professional collaboration, estimated costs, potential barriers or unforeseen obstacles, and both organizational and IRB review/approval were considered. Statistical approach in evaluating expected project outcomes was identified. Using the PDSA cycle, project plans were evaluated and modified as needed throughout the implementation phase.

Chapter Five: Implementation Process

The project was implemented over a ten-week period. This chapter provides a description of the project setting, participants, recruitment process, implementation, and plan variations experienced.

Setting

While OSA affects a large portion of the general population, focus began in a primary care clinic in the Piedmont region of NC which cares for a large variety of patients. An estimated 125 patients are seen weekly at the clinic. Diabetes, hypertension, heart and kidney disease, asthma, COPD, substance abuse, dyslipidemia, and anemia are among the most common health conditions treated (Personal communication, January 31, 2018). This clinic typically serves patients with private health insurance or Medicare. Medicaid is not accepted.

Participants

All providers at the clinic were involved in screening patients and completing referrals for sleep studies as indicated. All staff members involved in direct patient care were responsible for having patients complete screening tools. Every patient seen at the clinic was eligible to be screened for OSA using the STOP-Bang questionnaire. However, for patients who were seen more than once during the ten-week implementation phase, a screen was only completed once. The only participants excluded from this QI project were those who refused to complete the questionnaire.

Recruitment

All staff members were made aware of the project through informal discussions around the clinic with providers and the project lead. The educational session was scheduled by phone and communicated to all staff members by the secretary. Each staff member working at the clinic was expected to participate in the implementation. All patients were asked to complete the

STOP-Bang questionnaire. Only questionnaires written in English were used, as all patients seen at this clinic speak and understand English.

Implementation Process

Following completion of pre-implementation planning, the ten-week implementation phase took place from September 4th to November 9th. Lunch was provided at a staff education session held on Thursday, August 30th, a week prior to initiation of screening. Project goals and staff responsibilities were discussed along with a brief overview of OSA (See Appendix I). Questions were answered regarding use of the STOP-Bang questionnaire and its implications.

Although the original plan was to have the secretary give questionnaires to patients at check-in to complete while in the waiting room, the responsibility fell on the MOA who would have patients complete the first four questions on the STOP section upon rooming them. The MOA would also complete the Bang section during the rooming process and score the questionnaire. The screening tool was then left with the patient for the provider to see and act upon as needed. Providers then placed orders for sleep studies when indicated and returned forms to the secretaries who completed referrals and scanned questionnaires into patients' electronic medical records (EMR).

Plan Variation

During the second implementation week, a decrease in staff compliance with screening patients was observed. Upon discussion with the MOA, it became evident that on busy days she became overwhelmed and unable to complete screens on all patients due to time constraints. Thus, following discussion, the solution was to have the secretary give patients the questionnaire to complete in the waiting room prior to being called back by the MOA, as originally planned.

During implementation week three, a short-falling was noticed with the weekly data collection tool. While the tool captured the number of positive screens and the number of sleep

studies ordered, it lacked the ability to reflect why a sleep study was not ordered for every positive screen. The MOA and providers reported that many patients with positive screens had already completed a sleep study, had already been diagnosed, were already being treated, and/or declined the recommendation for further evaluation. Thus, in order to capture this information, a new item was added to the data collection tool (See Appendix J).

In week three, the MOA was home sick from work one day and screening tools were not completed for any patients seen that day. At this time, it became apparent that the secretary had not taken responsibility for giving questionnaires to patients as they check in. A discussion was held with the MOA about who was appropriate to assume her responsibilities when she was out of the office. The importance of having a back-up plan for patient care components was discussed.

During week nine, a provider offered further feedback explaining that for a few patients he has used the Epworth Sleepiness Scale (ESS) in addition to the STOP-Bang questionnaire to help evaluate patients' risk for OSA. He stated that using the two screens together provided him more certainty about a patient's OSA risk, especially when a patient was initially hesitant for further evaluation and diagnosis. The provider also mentioned that he would like to have the STOP-Bang questionnaire electronically programmed into the EMR so that it can be used even more easily and efficiently. (Personal communication, October 30, 2018)

Summary

This chapter provided a brief overview of the setting, participants, recruitment process, and implementation steps involved in this project. Through weekly PDSA cycles and site visits, strengths and barriers were identified leading to several plan variations discussed above. Project findings will be discussed in the following chapter.

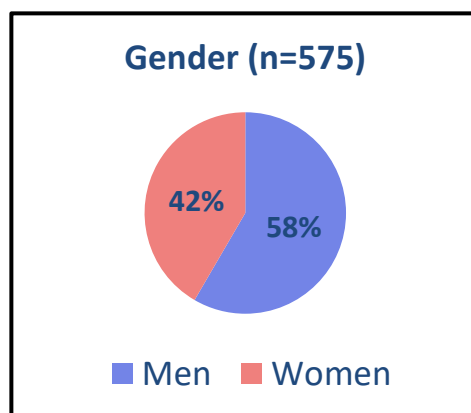
Chapter Six: Evaluation of the Practice Change Initiative

Following the implementation phase, data collected was analyzed to determine whether project goals and intended outcomes were met. The impact of using the STOP-Bang questionnaire to identify patients at risk for OSA was examined. Project findings will be discussed in this chapter.

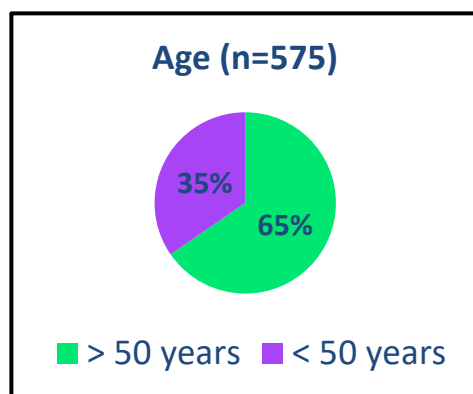
Participant Demographics

All staff members and providers in the clinic were included in the educational session prior to implementation. A total of six were present, including three providers, two secretaries, and one MOA. One other secretary, who was not working that day, was educated individually during the first week of implementation on the screening and sleep study referral process.

A total of 575 patients completed STOP-Bang questionnaires during the project's implementation period. Specific demographic information was not collected on these patients in order to keep their identities confidential; however, the following statistics were derived from information on the STOP-Bang questionnaires completed. Of the 575 patients, 336 (58.4%) were males, 239 (41.6%) were females, and 376 (65.4%) were over age 50 years (see Graph 1 and Graph 2).



Graph 1. Gender of patients who completed STOP-Bang questionnaire



Graph 2. Age of patients who completed STOP-Bang questionnaire

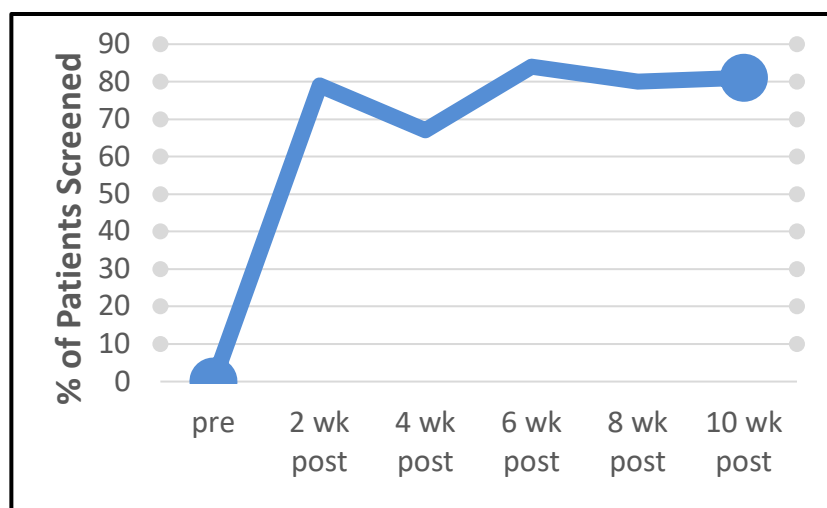
Intended Outcomes

Short-, intermediate-, and long-term outcomes were examined in hopes of increasing staff compliance with routine screening practices that improve patient care. Firstly, an educational session was provided during a catered lunch with both short- and long-term goals of properly educating staff on the importance of OSA screening and creating staff buy-in to support sustainability. Secondly, through initial education and weekly site visits, staff were provided information and opportunities to voice questions, concerns, and feedback so as to address the short-, intermediate-, and long-term goal of fostering an environment ideal for staff participation. Thirdly, involving staff in discussions about identified barriers and maintaining an open communication channel allowed them to feel a part of the improvement team, thus positively influencing staff compliance both during the ten-week initiative and long-term with future QI endeavors. Fourthly, the overall, long-term focus of the QI project was to increase identification of patients at-risk for OSA who need further evaluation. Lastly, by conducting weekly PDSA cycles and addressing barriers along the way, adjustments to the screening process were made in order to create a sustainable practice change that will continue to improve the quality of patient care provided at this clinic for the long-run.

Findings

A total of 912 patients were seen in the clinic during the ten-week implementation phase. Although not all visits included OSA screening, 575 STOP-Bang questionnaires were completed. Screening was not completed during 166 patient visits due to these patients having already completed a STOP-Bang questionnaire during a previous encounter in the ten-week period. Of the 746 patients eligible for screening, an overall staff compliance rate of 77.1% was noted. (See Appendix K)

The graph below depicts the improved screening rate at various intervals during the implementation phase compared to the pre-implementation rate of zero percent routine screening. Daily and weekly compliance rates were combined into biweekly rates that illustrate an upward trend in staff compliance. (See Graph 3)



Graph 3. Staff compliance with OSA screening

At some point in week three or four, there was a single day during which the MOA was not at work due to illness. Therefore, on this day there was not a single STOP-Bang questionnaire completed. Without an established back-up plan of having the other secretaries or the providers take responsibility to ensure screening was completed, it simply was not done on

that day. This contributed to the reason for the decrease in percentage of patients screened at week 4 (see Graph 3).

While 55.5% (319) of STOP-Bang questionnaires indicated low risk for OSA, 256 of 575 (44.5%) screens identified patients at moderate to high risk, leading to 19 sleep studies being ordered. Of these 256 screens, 76 (30%) were for patients already diagnosed with or treated for OSA.

In addition to previously diagnosed cases of OSA, numerous reasons were cited for why sleep studies were not ordered by providers when positive screens were obtained. First, many patients simply refused sleep study referrals explaining that they could not afford it, did not have time for it, and/or did not believe their risk was significant. Other patients expressed their desire to try weight reduction first to alleviate snoring and improve sleep health. Lastly, at least one patient was moving out of town and thus would not be returning to the practice for future care.

Summary

While the project yielded a 77.1% staff compliance rate with successfully implementing routine OSA screening, there were also several challenges encountered. The staff's ability to routinely screen patients and identify those at increased risk for having OSA is a valuable aspect in providing quality healthcare. The next chapter will discuss the implications of the project's findings to nursing practice regarding OSA screening.

Chapter Seven: Implications for Nursing Practice

Eight essentials that define DNP education have been established by the American Association of Colleges of Nursing (AACN, 2006). Each essential describes competencies that are core to the DNP role. This chapter will explore the eight essentials and the various implications to nursing practice that were realized as a result of this QI project and its findings.

Practice Implications

Essential I: Scientific underpinnings for practice. The first DNP essential speaks to the ability to perform a literature review to identify and analyze QI findings, translate knowledge into practice, and apply research and theory to practice in order to improve patient care and health outcomes (AACN, 2006). This QI project centered around translating current QI and research findings on OSA screening and implementing a practice change in the primary care setting to increase identification of individuals at risk for OSA. Through conducting a thorough literature review, evidence-based screening practices were examined and incorporated in this QI initiative. Translation of research into a practice initiative was guided by application of the Integrated Theory of Health Behavior Change (ITHBC) in support of the role healthcare providers play in encouraging patients to maintain healthy behaviors and lifestyles, particularly with screenings. Thus, future practice recommendations revolve around the ability of advanced practice nurses (APRNs) to incorporate evidence-based practice, such as health screenings, that promote prevention and improve quality of care and patient outcomes.

Essential II: Organizational and systems leadership for quality improvement and systems thinking. The second essential discusses the significance of organizational and systems leadership in the DNP's ability to improve patient outcomes, "to eliminate health disparities and to promote patient safety and excellence in practice" (AACN, 2006, p. 10). DNPs possess a unique ability to assess and implement quality improvement strategies that are sustainable and

provide a good balance of productivity and quality of care with main focus on improving patient and community health (AACN, 2006). As in this QI project, focus was placed on patients in primary care. By identifying OSA risk through screening, further evaluation is attainable thus providing patients with treatment necessary to reduce complications and effects on co-morbidities. In turn, the overall health of the population is improved through routine OSA screening.

Additionally, Essential II calls for the DNP's ability to weigh cost versus benefit and to realize opportunities for practice growth, particularly increased revenue (AACN, 2006). Using budgets to estimate costs of QI initiatives is recommended so as to identify any potential limitations prior to implementation. Contrasting estimated costs with anticipated cost savings or revenue potentials is crucial for gaining support and buy-in among practice stakeholders and provides further justification, in addition to improving patient outcomes, for the need for QI.

Essential III: Clinical scholarship and analytical methods for EBP. With scholarship and research being “the hallmarks of doctoral education,” (AACN, 2006, p. 11) Essential III discusses the DNP's ability to interpret the significance of research and QI, translate QI across many disciplines in order to strengthen the quality of patient care provided, and to use informatics to identify best practice (AACN, 2006). This QI project serves as an example of critically appraising previous study results and practice recommendations regarding OSA screening and applying them to a new clinical setting where screening efforts had been minimal. Collaboration between disciplines, for example nursing, medicine, and administration in this particular QI project, is vital for seamless patient care. Disseminating the findings of this project will further aid the development of evidence-based practice and research efforts so as to support continued improvement in healthcare outcomes (AACN, 2006). Presenting findings not only to the practice site but also to local sleep clinics and other primary care providers, is important for

furthering movements of screening efforts. Finally, completion of this project also revealed that additional research and QI is needed to further guide routine OSA screening practices, especially in the primary care arena.

Essential IV: Information systems/technology and patient care technology for the improvement and transformation of healthcare. The fourth essential pertains to the benefit gained from using information systems to strengthen the quality of health care delivered (AACN, 2006). During the implementation phase of this project, practice providers expressed their desire for having the STOP-Bang questionnaire, as well as other screening tools, formatted into the EMR for increased ease, convenience, and future reference. Such efforts would surely improve workflow and increase compliance by eliminating the burden of printing papers and scanning tools into patient's charts after completion. Messages within the EMR can be generated to remind health care team members to complete screenings. In addition, once screenings are completed, the EMR system would potentially be able to generate reports on certain metrics and statistics regarding screening, thus providing guidance for future QI and screening efforts.

Essential V: Healthcare policy for advocacy in healthcare. Essential V explains that "DNP graduates are prepared to design, influence, and implement health care policies that frame health care financing, practice regulation, access, safety, quality, and efficacy" (AACN, 2006, p. 13). In addressing issues of social justice and equity in health care, DNPs are able to understand the policy process and be proactively engaged in creating political change (AACN, 2006).

OSA has been cited in several policies regarding public safety and reduction in motor vehicle accidents. For instance, the Federal Motor Carrier Safety Administration, a division of the U. S. Department of Transportation, is responsible for regulating policies and procedures guiding medical examiners who approve and certify commercial drivers (Ancoli-Israel, Czeisler, George, Guilleminault, & Pack, 2008). The Rail Safety Improvement Act of 2008 required the

Federal Railroad Administration to enforce management of fatigue among railroad employees to reduce “train operator’s fatigue-induced performance degradation” leading to accidents, damages, and death (Frost & Sullivan, 2016, p. 10). In 2013, the American Thoracic Society (ATS) released a clinical practice guideline for sleep apnea and noncommercial drivers urging evaluation for OSA symptoms affecting driving abilities (Strohl et al., 2013).

Other organizations, including the American College of Physicians (ACP), American Academy of Sleep Medicine (AASM), and American Academy of Pediatric Dentistry (AAPD), have released policy statements, white papers, and clinical practice guidelines on OSA. They have warned about the detrimental effects of untreated OSA and have stressed the importance of adequate screening, early diagnosis, and appropriate treatment (Qaseem et al., 2014; Miller & Berger, 2015; AAPD, 2016). The Agency for Healthcare Research and Quality (AHRQ), a division of the USDHHS, supports many organizations that conduct healthcare research and make evidence-based clinical practice recommendations guiding patient care (AHRQ, 2011). For example, the United States Preventative Services Task Force (USPSTF, 2017) issued a statement deeming the screening of asymptomatic patients for OSA as insufficiently supported by evidence, yet without evidenced harm.

Therefore, given the impact that OSA clearly has on many aspects of public health, increased efforts and regulations are needed to ensure that more people with OSA symptoms are evaluated. This QI project supports the need for further research to compare screenings in various healthcare settings in order to determine which is best suited. The need for improved patient and public education on the significance of OSA and its detrimental impacts if undiagnosed and untreated was realized during this QI endeavor. Additionally, APRNs are urged to serve on committees directly involved in policymaking and political change, through which they can present the impact of OSA on patient and community health and the need for

access to evaluation and treatment.

Essential VI: Interprofessional collaboration for improving patient and population health outcomes. This essential iterates the DNP's mindset that an interprofessional, collaborative approach to patient care is most beneficial (AACN, 2006). DNPs are able to competently serve as central role in establishing interprofessional teams and assuming leadership when necessary through use of effective communication and collaborative skills (AACN, 2006). This project is a prime example of a DNP student taking the lead in brainstorming, planning, and implementing a QI initiative, which can be used to guide future QI efforts. The need to involve multiple disciplines, such as primary care providers, dentists, and sleep study clinicians, is evidenced in the screening, diagnosis, and treatment of OSA alone. Further collaboration between various fields and disciplines is needed to generate practice guidelines for OSA screening and treatment and to improve the quality of health care.

Essential VII: Clinical prevention and population health for improving the nation's health. With clinical prevention and population health efforts being "central to achieving the national goal of improving the health status" of Americans, the DNP's ability to analyze appropriate scientific data and formulate appropriate, effective interventions for health promotion is crucial (AACN, 2006, p. 16). Project findings included the general knowledge deficit about OSA and its significance. Therefore, future practice implications include improved patient education efforts not only on OSA but on all health promotion activities. Additionally, the positive role that health care providers can play in encouraging patients to take charge of their health and choose healthy lifestyles should not be underestimated. Future research and QI are needed to study specific prevention strategies for OSA, including nutrition, exercise, smoking, heart health, and sleep habits, and the most effective ways in which to educate patients on these concepts.

Essential VIII: Advanced nursing practice. This final essential details the preparation DNP graduates receive on broadened and specialized abilities to conduct comprehensive assessments; provide culturally sensitive care; develop and maintain respectful, therapeutic partnerships with patients, family members, and colleagues; employ advanced clinical judgment using evidence-based practices; educate, guide, and mentor other individuals to achieve excellence; and to blend issues of practice, organizational structure, population dynamics, fiscalism, and policy issues (AACN, 2006). This QI project was created, implemented, and evaluated in order to draw conclusions on its successes versus shortcomings so as to formulate practice recommendations. More emphasis should be placed on the health care team's investment in patient health through routine health screenings, which also promotes a respectful, reliable patient-provider relationship. Nurse educators should be challenged to use research and QI to assist APRNs in establishing appropriate policies and guidelines regarding OSA screening and developing an understanding of the importance of providing patient education, evidence-based diagnostics, and treatments when necessary. Furthermore, dissemination of QI findings allows others to improve their practices and achieve higher excellence. This is indeed the true groundwork for quality improvement and evidence-based care.

Summary

Through the DNP's ability to research, plan, implement, evaluate, and disseminate QI initiatives, recommendations can be made for evidence-based practice that can continue to provide improvement in patient health and reduction of healthcare costs. Further development of practice protocols and suggestions for future research and QI are discovered with each effort.

Chapter Eight: Final Conclusions

Implementation of routine OSA screening in primary care was successfully achieved using evidence-based practice and nursing theory, followed by repeated PDSA cycles giving way to needed adjustments in order to ensure improvement. The significance and practice implications realized through using the STOP-Bang questionnaire to screen for OSA risk will be explored. Strengths and limitations of this project will also be discussed in this chapter.

Significance of Findings

This project demonstrated the importance of adequate planning, staff education, and creating buy-in to ensure success of quality improvement initiatives. Many potential barriers were evaded by thorough brainstorming and planning. The general ability to avoid unnecessary time constraints and waste of resources is crucial for abiding by the Triple Aim and saving healthcare dollars, not only for the primary care practice but also for insurance companies and the patients themselves. Adherence to a weekly PDSA cycle proved to be effective in gaining provider and clinical staff feedback along the way so that revisions were made in order to further increase compliance. With 19 sleep studies being ordered in only ten weeks, the potential impact this initiative could have for other primary care practices, and other disciplines including cardiology, bariatrics, and dentistry for that matter, is huge. Increasing OSA risk identification and access to further evaluation and treatment are the core of both the AASM Task Force 2015 challenge and the Healthy People 2020 initiative. Proper treatment of OSA will reduce long-term complications and improve patient and population health, thus saving millions of dollars annually.

Project Strengths and Limitations

Strengths of this QI project included the small number of employees at the clinic site, passion and commitment of office staff to improving patient care, simple implementation plan

design, and foundation on strong theoretical principles of health promotion and preventive care. Detailed planning conducted prior to implementation allowed for anticipation of threats and weaknesses and adequate planning to avoid these barriers to success. Adequate staff education on the significance of OSA and use of the STOP-Bang questionnaire created the basis for encouragement of staff and providers. Conducting weekly site visits and PDSA cycles during which staff were able to provide feedback and input was instrumental in maintaining staff commitment and encouraging compliance. Finally, interdisciplinary collaboration and stakeholders support proved to be crucial in successfully producing improvement in patient care.

Limitations to this project included the inability to compare pre- and post-screening rates due to lack of calculated pre-existing screening efforts. While the small practice site was beneficial in many ways, at the same time, the fewer number of staff members placed restrictions on completion of screening on busy days. Additionally, the short, ten-week implementation phase limits the amount of PDSA cycles that can be done to ideally perfect screening practices.

Project Benefits

Benefits of this QI project includes increased screening for OSA at the practice. Providers stated that they were having more discussions about OSA with patients than ever before. Increased patient and staff awareness are another benefit of this project with great impact on patient and community health due to the potential to drastically reduce complications of OSA through proper treatment. An appropriate implementation process for this QI initiative within a primary care clinic was achieved and can be easily reproduced and applied to other practice sites. Patient care was improved regarding screenings for clinically important problems and emphasis on the significance of OSA and its impact on health. Practice providers realized the potential for improvements of the clinic's EMR to incorporate more screening tools, such as the STOP-Bang questionnaire, to facilitate ease of use. Finally, improvements in health screenings foster a

culture of preventive healthcare, which has the potential for significant reductions in healthcare costs related to complications of untreated OSA as well as increased patient satisfaction and confidence in their healthcare providers.

Recommendations for Practice

QI efforts generally yield recommendations for future practice guidelines and insight on future efforts to create positive change. For instance, during the literature review conducted for this project, it became evident that more studies are needed regarding use of the STOP-Bang questionnaire to screen for OSA in the primary care setting. Second, the need for improved patient education on sleep apnea was realized in discussions between patients and providers throughout the ten-week implementation phase. The benefit of having screening tools incorporated into the EMR for convenience and ease of use became evident to providers during this initiative, which provides encouragement to other healthcare practices to use their EMR to its full potential.

Additionally, establishing specific practice protocols and plans of care delivery is crucial in avoiding lapses or missed screenings. In this project, it became evident that having a back-up plan for screening efforts, to be used in the event that a staff member is absent one day, is vital. Clearly defining staff and provider roles within the office setting is important for smooth delivery of care. It is also helpful in determining how to most efficiently and economically provide care to patients on a daily basis.

As a result of this project, recommendations are made for interprofessional collaboration in OSA screening efforts. Given the wide variety of risk factors and co-morbidities that play a factor in OSA, there are many disciplines who should be routinely screening patients for OSA. These include, but are not limited to, cardiology, bariatrics, dentistry, pediatrics, women's health, and peri-operative services. In an effort to identify risk and provide opportunity for evaluation

and treatment, patients should have multiple healthcare access points to address potential OSA risk.

Lastly, due to the lack of harm in routinely screening patients for OSA risk and the potentially huge cost savings and improvement in patient health that can be realized, practice protocols should require routine, standardized screenings for all patients seen. While the focus of this QI project was specifically on identifying OSA risk, the concept of routine screening efforts can be generalized to screening for all conditions, including depression, cancer, and substance abuse. The fundamentals of this QI initiative can be applied to other screening efforts in various practice sites.

Final Summary

The prevalence and significance of untreated OSA is a growing concern in today's healthcare arena. Given the long list of associated co-morbidities, efforts to identify individuals at risk for OSA should be increasing exponentially. With the majority of these health conditions being treated in primary care, it is super important for PCPs to screen all patients for OSA routinely. While the STOP-Bang questionnaire is specific to OSA, many other tools can be used to assess risk of other health conditions. Initiating routine screening efforts in various healthcare settings can drastically reduce risk through preventive patient care. Lowering risk by making lifestyle alterations not only improves patient health outcomes but also reduces waste of healthcare dollars.

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Appendix A

Literature Review Matrix

Bauer, U. E., Briss, P. A., Goodman, R. A., & Bowman, B. A. (2014). Prevention of chronic disease in the 21st century: Elimination of the leading preventable causes of premature death and disability in the USA. *The Lancet*, 384(9937), 45-52.
doi: 10.1016/S0140-6736(14)60648-6

Level of Evidence: I

- Chronic diseases are responsible for majority of illness, disability, death, and health care costs in U.S. annually

Bilgin, O., Oruc, O., Sarac, O., Centintas, G., & Uluc, K. (2017). Carpal tunnel syndrome in obstructive sleep apnea patients. *Noro-Psikiyatri Arsivi*, 54(4), 307-311.
doi: 10.5152/npa.2016.15907

Level of Evidence: III

- OSA linked to carpal tunnel, possibly due to intermittent hypoxemia & inflammation

Bonsignore, M. (2017). Sleep apnea and its role in transportation safety. *F1000 Research*, 6(2017), 1-7. doi: 10.12688/f1000research.12599.1

Level of Evidence: V

- OSA is undiagnosed in 80% of cases
- Prevalent sleep breathing disorder that involves significantly decreased or completely blocked airflow due to partial or complete upper airway collapse during sleep, which causes intermittent hypoxemia and arousal from sleep

Chung, F., Abdullah, H. R., & Liao, P. (2016). STOP-Bang questionnaire: A practical approach to screen for obstructive sleep apnea. *CHEST*, 149(3), 631-638.
doi: 10.1378/chest.15-0903

Level of Evidence: I

- OSA associated with hypertension, cerebrovascular disease, myocardial infarction, diabetes, long-term cognitive impairment, and increased all-cause mortality

- Approx 80% of cases are undiagnosed
- Diagnosed by overnight PSG

Downey, R. (2018). Obstructive sleep apnea. *Medscape*.

Level of Evidence: I

- Healthy lifestyles and health promotion activities such as routine health screenings are key to prevention and proper management of disease
- OSA is multi-faceted disease with potentially detrimental effects on health if undiagnosed and untreated
- Treatment begins with identification and further evaluation
- Health care providers must understand the importance of OSA and screening efforts
- Diagnosis by PSG
- 20% of men and 25% of women in U.S. are obese so obesity alone carries a major responsibility in OSA presence

Institute for Quality and Efficiency in Health Care [IQWiG]. (2016). Benefits and risks of screening tests. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0072602/>

Level of Evidence: IV

- Responsible for the Triple Aim pledge to better health care performance by 3 goals: 1) improve patient experience including quality and satisfaction of care, 2) improvement of health of overall population, and 3) reductive in per capita cost of health care

Kim, J. S., Kim, S., Lee, S. H., Lee, H. Y., Lee, S. Y., and Im, K. B. (2018). Increased risk of ischemic stroke during sleep in apneic patients. *Journal of Clinical Neurology*, 14(5), 1-5.

Level of Evidence: II

- OSA was identified as a risk factor for wake-up stroke (WUS)
- Suggests that OSA is a predisposing risk factor and a triggering factor for ischemic stroke. Therefore, treating OSA might be beneficial in preventing stroke, particularly that occurs during sleep.

Macey, P. M., Haris, N., Kumar, R., Thomas, M. A., Woo, M. A., & Harper, R. M. (2018). Obstructive sleep apnea and cortical thickness in females and males. *PLoS One*, 13(3), e0193854. doi: 10.1371/journal.pone.0193854

Level of Evidence: II

- Cortical thickness assessed by MRI in patients w/ OSA compared to control group w/o OSA. Reduced cortical thickness was found in more females than males w/ OSA.
- Cortical thinning likely represents tissue atrophy from long term injury including death of neurons & glia from repeated intermittent hypoxia d/t OSA. Disease co-morbidities could also affect thinning. Thinning may contribute to autonomic dysregulation & impaired upper airway sensori-motor function.

Marulanda-Londono, E. (2017). The interplay between obstructive sleep apnea and atrial fibrillation. *Frontiers in Neurology*, 8(2017), 668. doi: 10.3389/fneur.2017.00668

Level of Evidence: I

- OSA linked to ischemic stroke and increased mortality especially in patients with atrial fibrillation

Muraki, I., Wada, H., & Tanigawa, T. (2018). Sleep apnea and type 2 diabetes. *Journal of Diabetes Investigation*, 2018, 1-25. doi: 10.1111/jdi.12823

Level of Evidence: II

- Link between DM2 and OSA is significant and each should consider treatment/prevention of the others
- Those with OSA are more likely to develop DM2 than those without OSA
- Hormone changes including “the activation of the HPA and changes in adipokine profiles, both of which usually lead to fat accumulation and obesity” (p. 4)

Schulman, D. (2018). Polysomnography in the evaluation of sleep-disordered breathing in adults. *UpToDate*.

Level of Evidence: I

- AHI is used to grade severity of OSA and “is calculated by adding together the number of apneas and hypopneas and dividing the sum by the total sleep time in hours”

Strohl, K. P. (2018). Overview of obstructive sleep apnea in adults. *UpToDate*.

Level of Evidence: I

- Estimated that OSA affects 20-30% of males and 10-15% of females in North America

Sunwoo, J., Hwangbo, Y., Kim, W., Chu, M. K., Yun, C., Yang, K. I. (2018). Prevalence, sleep characteristics, and comorbidities in a population at high risk for obstructive sleep apnea: A nationwide questionnaire study in South Korea. *PLoS One*, 13(2), 1-14.
doi: 10.1371/journal.pone.0193549

Level of Evidence: III

- Early identification and treatment are key for preventing health complications
- Prevalence of OSA is 15.8% (95% CI 14.5-17.2%). Old age (<70) (OR=2.68) and BMI (OD=10.75) are significantly related to OSA risk and physical activity appears to have a protective effect. HTN, DM, hyperlipidemia, & anxiety were comorbid conditions independently associated w/ high-risk OSA.

Tierney, W. S., Gabarain, G., & Kominsky, A. H. (2017). Healthcare usage after uvulopalatopharyngoplasty: Impact of analgesic regimen. *American Journal of Otolaryngology*, 38(2), 193-197. doi: 10.1016/j.amjoto.2017.01.024

Level of Evidence: III

- Early identification of disease risk factors and signs/symptoms of disease is important component of quality care, improvement of population health, and reduction in healthcare costs as treatments for complications of OSA are estimated to cost billions of \$\$ a year

U.S. Department of Health & Human Services [USDHHS]. (2018). Sleep health. Retrieved from <https://www.healthypeople.gov/2020/topics-objectives/topic/sleep-health/objectives>

Level of Evidence: II

- Healthy People 2020 – aims to increase proportion of people with OSA symptoms who seek medical evaluation
- Between 2005 and 2008, approx 25.5% sought OSA evaluation
- Initiative target of 28% by 2020

STANDARDIZED SCREENING:

Billioux, A., Verlander, K., Anthony, S., & Alley, D. (2017). Standardized screening for health-related social needs in clinical settings: The accountable health communities screening tool. *National Academy of Medicine*, 2017, 1-9. Retrieved from <https://nam.edu/wp-content/uploads/2017/05/Standardized-Screening-for-Health-Related-Social-Needs-in-Clinical-Settings.pdf>

Level of Evidence: V

- Standardized assessment tools and protocols are best for screening various medical conditions including drug and alcohol dependency, depression, heart failure, and OSA
- Can be used to quickly and consistently identify individuals at risk for disease that warrant further evaluation
- Eliminates potential to miss some individuals when screening is only triggered by provider inclination

Suarez, M., Osorio, J., Torres, M., & Montserrat, J. M. (2016). Should the diagnosis and management of OSA move into general practice? *Breathe*, 12(3), 243-247. doi: 10.1183/20734735.011216

Level of Evidence: III

- OSA diagnosis and management should originate in primary care settings
- Routine, standardized screening should be conducted and include subjective and objective questions
- HRP is cheaper and more accessible to use when PSG access is limited
- “HRP is a simplified portable monitor that includes sensors to measure airflow, respiratory efforts, pulse oximetry, and body position” (p. 244)

STAFF EDUCATION:

Velthuisen, E. L., Zwakhalen, S. M. G., Warnier, R. M. J., Ambergen, T., Mulder, W. J., Verhey, F. R. J., & Kempen, G. I. J. M. (2018). Can education improve clinical practice concerning delirium in older hospitalized patients? Results of a pre-test post-test study on an educational intervention for nursing staff. *BME Medical Education*, 18(59), 1-9. doi: 10.1186/s12909-018-1177-3

Level of Evidence: QI project

- Designed an educational intervention and instituted it on 2 inpatient hospital unit
- Goal: to evaluate effects of educational intervention for nursing staff on the proportion of patients screened for delirium, the appropriate use of the screening, and proportion of patients being referred for geriatric consultation
- Educated nurses on recognition of delirium signs/symptoms
- Result: increased number of patients for whom delirium screening was completed correctly; patients were 2.5 times more likely to be screened after the education
- Education was considered to be useful and insightful per nursing staff

Allen, M. L., van der Does, A. M. B., & Gunst, C. (2016). Improving diabetic foot screening at a primary care clinic: A quality improvement project. *African Journal of Primary Health Care & Family Medicine*, 8(1), 1-9. doi: 10.4102/phcfm.v8i1.955

Level of Evidence: QI project

- QI project in primary care office to educate staff in order to increase diabetic foot screenings
- Compliance with diabetic foot exams increased from roughly 10% of patients before to roughly 70% after education was provided
- Increased staff enthusiasm and confidence in conducting diabetic foot screening

McNulty, C. A. M., Hogan, A. H., Ricketts, E. J., Wallace, L., Oliver, I., Campbell, R., Kalwij, S., O'Connell, E., & Charlett, A. (2013). Increasing Chlamydia screening tests in general practice: A modified Zelen prospective cluster randomized controlled trial evaluating a complex intervention based on the theory of planned behaviour. *Sexually Transmitted Infections*, 2014(90), 188-194. doi: 10.1136/sextrans-2013-051029

Level of Evidence: II

- Educational workshops, including posters, were conducted in order to increase staff knowledge of the importance of and their confidence with chlamydia screening
- Result: chlamydia screening increased by 76%
- The study showed that providing education and long-term support to staff is feasible and successful

Miller, E., McCaw, B., Humphreys, B. L., Mitchell, C. (2015). Integrating intimate partner violence assessment and intervention into healthcare in the United States: A systems approach. *Journal of Women's Health*, 24(1), 92-99. doi: 10.1089/jwh.2014.4870

Level of Evidence: III

- Systems approach to implementation of IPV screening and counseling including health professional education in order to increase the rate of identification and use of available interventions
- Buy-in needed from health professionals and patients
- Must provide clinicians with evidence-based practice guidelines

Lazenby, M., Ercolano, E., Grant, M., Holland, J. C., Jacobsen, P. B., & McCorkle, R. (2015). Supporting commission on cancer-mandated psychosocial distress screening with implementation strategies. *Journal of Oncology Practice*, 11(3), e413-e419. doi: 10.1200/JOP.2014.002816

Level of Evidence: III

- Cross-sectional, descriptive study to analyze the effect of education on the reach, effectiveness, adoption, implementation, and maintenance of psychosocial distress screening for patients with cancer
- Goals for implementation were reviewed, one of which was the strong suggestion for creating buy-in among all stakeholders, including administration and patient care professionals
- Importance of educating office staff for two reasons: 1) to ease fears of increased workload from screening and 2) to clearly present evidence of usefulness of screening in improving quality of care

Bakhai, S. Y., Nigam, M., Saeed, M., Krishnan, A., & Reynolds, J. L. (2017). Improving OSA screening and diagnosis in patients with hypertension in an academic safety net primary care clinic: Quality improvement project. *BMJ Open Quality*, 2017(6),1-7.
doi: 10.1136/bmjoc-2017-000105

Level of Evidence: QI project

- QI project aimed to increase percentage of OSA diagnosis in HTN patients
- Analyzed reported barriers to OSA screening and implemented strategies to combat these barriers
- Educated physicians and staff about relationship between OSA and HTN and proposed workflow changes to incorporate routine OSA screening through PowerPoint presentations and small group discussions
- Plan-Do-Study-Act QI model
- Results: 50% of patients completed STOP; variable increases in STOP Bang by physicians due to reported barriers such as time constraints; physicians provided more patient education on significance of OSA on hypertension

STOP BANG QUESTIONNAIRE:

Nagappa, M., Liao, P., Wong, J., Auckley, D., Ramachandran, S. K., Memtsoudis, S., Mokhlesi, B., & Chung, F. (2015). Validation of the STOP-Bang questionnaire as a screening tool for obstructive sleep apnea among different populations: A systematic review and meta-analysis. *PLoS ONE*, 10(12), 1-21. doi: 10.1371/journal.pone.0143697

Level of Evidence: I

- STOP Bang used since 2008 in periop clinics, general population, and many special populations due to ease of use and high sensitivity, 83.9% for any OSA (AHI>5), 92.9% for mod to severe OSA (AHI>15), and 100% for severe OSA (AHI>30)
- STOP: Snoring, Tiredness, Observed apnea, high blood Pressure
- Bang: BMI, age, neck circumference, gender
- Systematic review and meta-analysis to determine use of STOP Bang to assess risk of OSA and distinguish levels of severity

Duarte, R. L., Fonseca, L. B., Magalhaes-da-Silveira, F. J., Silveira, E. A., & Rabahi, M. F. (2017). Validation of the STOP-Bang questionnaire as a means of screening for obstructive sleep apnea in adults in Brazil. *Brazilian Journal of Pulmonology*, 43(6), 456-463. doi: 10.1590/S1806-37562017000000139

Level of Evidence: III

- Prospective study of 456 Brazilian sleep clinic patients referred for PSG; completed STOP Bang to determine its ability to predict OSA
- Best indicator of OSA is neck circumference followed by age and observed apnea
- Ability to predict any OSA: sensitivity of 83.5%, specificity of 45.5%, PPV of 84.7%, NPV of 43.3%, and accuracy of 75.2%
- 3 potential benefits of STOP Bang: reduction in peri-operative and post-operative complications in patients due to undiagnosed OSA; reduction in co-morbidities and subsequently health care costs associated with these conditions; and availability of the STOP-Bang questionnaire as a low-cost, easy-to-use diagnostic method in areas with limited resources and/or where PSG is not widely available..

Reed, K., Pengo, M. F., & Steier, J. (2016). Screening for sleep-disordered breathing in a bariatric population. *Journal of Thoracic Disease*, 8(2), 268-275. doi: 10.3978/j.issn.2072-1439.2015.11.58

Level of Evidence: III

- Studied 141 obese patients undergoing bariatric surgery in a London facility
- Need to study interplay between obesity and OSA as obesity rates continue to increase; 60-70% suspected to have OSA
- STOP Bang to screen for those at risk; score >4 referred for further evaluation
- “Systemic hypertension was prevalent in 40%, T2DM was present in 35%, and 25% of the patients had depression” (. 270)
- CPAP and mandibular devices initiated for almost 50% of these patients

Oliveira, G., Vago, E. R., Prado, G. F., Santos-Coelho, F. M. (2017). The critical influence of nocturnal breathing complaints on the quality of sleep after stroke: The Pittsburg sleep quality index and STOP-Bang. *Arq Neuropsiquiatr*, 75(11), 785-788.

Level of Evidence: III

- 40-80% of stroke patients develop sleep-related respiratory disorders ie OSA
- Need to determine reliable screening tool for identify OSA risk
- Cross-sectional, observational study of 68 adults (18+) with history of stroke within the last year in order to compare sleep quality with OSA risk
- STOP Bang scores were higher in patients with poor quality sleep
- Linear regression analysis showed STOP Bang able to predict poor quality sleep at $p < 0.05$ with relative risk of 1.6
- Sensitivity of STOP Bang to predict OSA risk was 83.6% in post-stroke patients

Lu, H., Fu, C., Li, W., Jiang, H., Wu, X., & Li, S. (2017). Screening for obstructive sleep apnea syndrome in asthma patients: A prospective study based on Berlin and STOP-Bang questionnaires. *Journal of Thoracic Disease*, 9(7), 1945-1958.
doi: 10.21037/jtd.2017.06.03

Level of Evidence: III

- Rate of OSA in patients with asthma between 38% and 70% depending on source
- Prospective study to compare the ability of BQ and SBQ to identify asthmatic patients at risk for OSA
- Total of 123 patients at asthma clinic in Shanghai, China asked to complete both questionnaires, a series of lung function tests, and PSG studies
- Results: higher consistency and accuracy of SBQ in determining OSA risk than BQ

Prasad, K. T., Sehgal, I. S., Agarwal, R., Aggarwal, A. N., Behera, D., & Dhooria, S. (2016). Assessing the likelihood of obstructive sleep apnea: A comparison of nine screening questionnaires. *Sleep Breathing Physiology and Disorders*, 2017(21), 909-917.
doi: 10.1007/s11325-017-1495-4

Level of Evidence: III

- Retrospective analysis of 210 PSG subjects who completed all 9 different screening tools including STOP Bang.
- Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), likelihood ratio for a positive result (LR+) and likelihood for a negative result (LR-) were calculated for all 9 screening tools
- STOP Bang for prediction of OSA (AHI ≥ 5): sensitivity 89%, specificity 43.5%,

accuracy 79.1%, PPV 84.9%, NPV 52.6%, LR+ 1.6, LR- 0.2 for moderate to severe OSA and 0.1 for severe OSA

Miller, J. N. & Berger, A. M. (2015). Screening and assessment for obstructive sleep apnea in primary care. *Sleep Medicine Reviews*, 29(2016), 41-51. doi: 10.1016.j.smr.2015.09.005

Level of Evidence: II

- Generalizability is assumed from the fact that patients with many different co-morbidities undergo surgery and are at risk for OSA complications especially if undiagnosed and untreated
- There are also many patients with asthma, diabetes, and stroke history seen in primary care making STOP Bang valid for all of these patients
- American Academy of Sleep Medicine task force 2015 – came about after surveys of primary care clinics showed that sleep disorders are rarely addressed by providers, sleep disturbance issues are often not reported by patients, and complaints of daytime drowsiness and insomnia are often not recognized as OSA symptoms, and PCP's do not routinely screen for OSA. Challenge is “to improve detection and categorization of OSA symptoms and severity to promote assessment and diagnosis of the disorder” (p. 41)

Boynton, G., Vahabzadeh, A., Hammoud, S., Ruzicka, D. L., & Chervin, R. D. (2013). Validation of the STOP-BANG questionnaire among patients referred for suspected obstructive sleep apnea. *Journal of Sleep Disorders Treatment and Care*, 2(4), 1-20. doi: 10.4172/2325-9639.1000121.

Level of Evidence: III

- STOP Bang has shown in many studies to have high sensitivity and NPV for severe OSA specifically, making it a useful tool in primary care settings where OSA prevalence can vary
- Moderate to severe OSA can be confidently ruled out based on STOP Bang scores

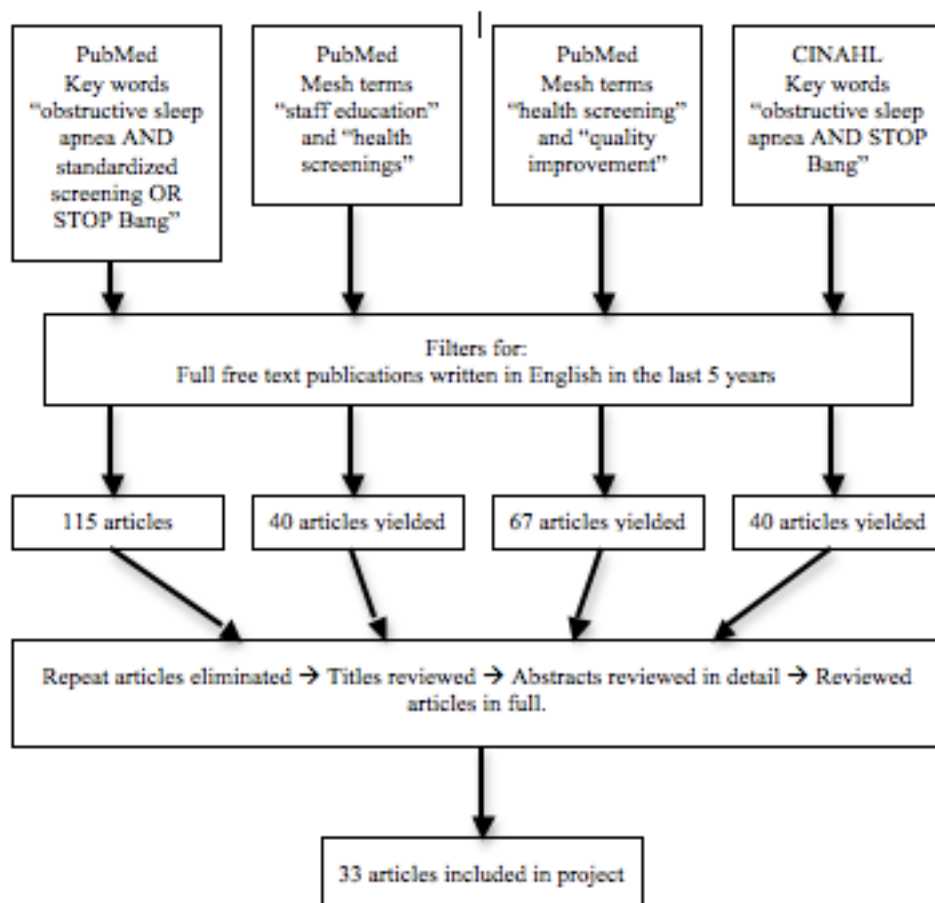
Nagappa, M., Wong, J., Singh, M., Wong, D. T., & Chung, F. (2017). An update on the various practical applications of the STOP-Bang questionnaire in anesthesia, surgery, and perioperative medicine. *Current Opinion – Anesthesiology*, 30(1), 118-125. doi: 10.1097/ACO.0000000000000426

Level of Evidence: V

- STOP Bang is quick and easy tool; easily and clearly scored
- Amount of patients who require surgery at some point in their life is high so OSA status should be known so as to prevent complications related to anesthesia, surgery, and postop recovery
- Allows for proper treatment and improved health status prior to surgery, placing them at lower risk for adverse complications

Appendix B

Literature Review Search Strategy Matrix



Appendix C

STOP-Bang Questionnaire

STOP Bang Questionnaire

Screening for Obstructive Sleep Apnea

Please circle YES or NO for the following four (4) questions.

Snoring?**Yes****No**

Do you snore loudly (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night?

Tired?**Yes****No**

Do you feel tired, fatigued, or sleepy during the daytime (such as falling asleep during driving or talking to someone)?

Observed?**Yes****No**

Has anyone observed you stop breathing or choking / gasping during your sleep?

Pressure?**Yes****No**

Do you have or are you being treated for high blood pressure?

For Staff Completion...

Body Mass Index	Yes	No
Greater than 35 kg/m ² ?		

Age	Yes	No
Older than 50?		

Neck size	Yes	No
Males – 17 inches / 43 cm or larger?		
Females – 16 inches / 41 cm or larger?		

Gender	Yes	No
Male?		

SCORING:

STOP - _____ out of 4

Bang - _____ out of 4

Total - _____ out of 8

CIRCLE ONE:

LOW RISK

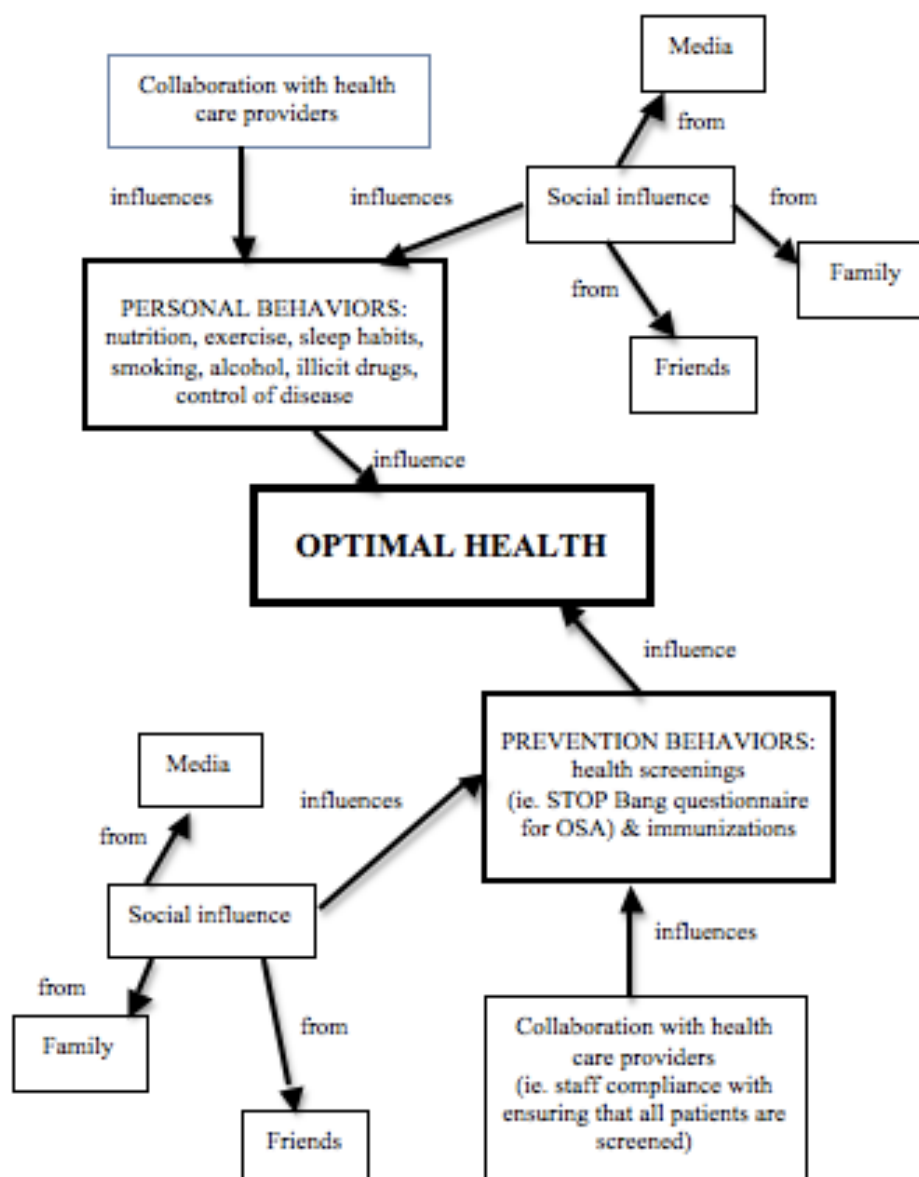
MODERATE RISK

HIGH RISK

* Modified from Chung et al. (2008). *Anesthesiology*, 108, 812-821;
 Chung F. et al. (2012). *Anesthesiology*, 108, 768-775;
 Chung F et al. (2014), *Journal of Sleep Medicine*, 10, 951-958."

Appendix D

Application of ITHBC



Appendix E

SWOT Analysis

	HELPFUL (Positive Impact)	HARMFUL (Negative Impact)
Internal	<p>Strengths may include:</p> <ul style="list-style-type: none"> - Small number of clinical staff - Commitment of providers and staff to offer optimal patient care - Minimal staff turnover - Office schedule of appointment times (usually every 30 minutes) - Ease of use of STOP Bang 	<p>Weaknesses may include:</p>
External	<p>Opportunities may include:</p> <ul style="list-style-type: none"> - Patients are receptive to identifying ways to optimize their health 	<p>Threats may include:</p> <ul style="list-style-type: none"> - Many patients have limited resources - Insurance coverage of sleep studies - Cultural aspects affecting patient views on health and disease

Appendix F

Proposed Budget Analysis

Miscellaneous Cost	Cost per unit	Amount needed	Budgeted cost
<i>Educational Lunch</i>			
Lunch provided on day of educational session	\$15 / lunch	10 employees	\$150.00
<i>Printing</i>			
STOP-Bang Questionnaire	\$0.05 / page x 1 page = \$0.05	1,200 patients	\$60.00
Data Collection Tool	\$0.05 / page x 1 page = \$0.05	1,200 patients	\$60.00
Educational Handout	\$0.05 x 5 pages = \$0.25	10 employees	\$2.50
<i>Supplies, Miscellaneous</i>			
File Folders	\$11 / box	1 box	\$11.00
Locked Box	\$20 / box	1 box	\$20.00
Total budgeted cost			\$303.50

Appendix G

Signed IRB Waiver



Projects Requiring IRB Review vs. Quality Improvement, Quality Assessment, or Quality Assurance: A Worksheet to Assist in Determining When IRB Review is Required

Use this worksheet to help determine whether a proposed activity or project involving humans or their individually identifiable information is considered research needing IRB review or a quality related activity that would not require IRB approval.

	True	False
The PRIMARY purpose of the proposed activity or project is to learn about or learn from existing care to IMPROVE what is done here at the local institution with regard to patient outcomes, efficiency, cost, patient/staff satisfaction, etc.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The activity or project would be carried out even if there was <u>no</u> possibility of publication in a journal or presentation at an academic meeting. (**Please note that answering "True" to this statement does not preclude publication of a quality activity.)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The activity or project falls under well-accepted care practices/guidelines.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The activity or project involves no more than minimal risk procedures meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.	<input checked="" type="checkbox"/>	<input type="checkbox"/>

If **any** of the above answers is "False", a submission for IRB approval is most likely needed. If all the above answers are "True", then it is very likely that IRB approval is not required. Please contact the Office of Research Integrity and Compliance (ORIC) with any questions at 252-744-2914 or umcirtb@ecu.edu. If you would like the ORIC to verify that an activity or project is not human subject research, please provide this form along with a summary of your activity to the ORIC at umcirtb@ecu.edu and the following page will be completed and returned to you for your records.

Project title: OSA Screening in Primary Care

Summary of activity including information about project aims/objectives, methods for carrying out the project and information about data to be collected (you may instead attach documentation describing your proposal):

Please see attached faculty-approved proposal

*** The ORIC will contact you if any further information is needed to make this determination. Please note that if the ORIC determines the activity is not human subject research, then any presentation, publication, etc. should not refer to the activity as "human subject research", "exempt research" or "expedited research".

ORIC Determination:

☒ Not Human Research: The ORIC has determined that based on the description of the project, approval by the IRB is not necessary. Any changes or modifications to this project may be discussed with the ORIC at that time to ensure those changes do not elevate the project to human research that would need IRB approval.

☐ Human Research: This project requires review by the IRB prior to initiation. An application in the electronic IRB submission system should be submitted.

ORIC Staff Signature:

Date: 6-19-18

Appendix H

Daily and Weekly Evaluation Tools

Figure 1.

Daily Compliance of Staff w/ STOP Bang Questionnaire Completion

Date: _____

	Number
How many patients were seen today?	
For how many patients was the STOP Bang questionnaire completed?	
How many patients had already completed a questionnaire at a previous visit thus did not complete one today?	
How many questionnaires screened positive for moderate to severe risk for OSA?	
For how many positive screens was a sleep study ordered?	

Figure 2.

Weekly Compliance of Staff w/ STOP Bang Questionnaire Completion

Dates: _____

	Number
How many patients were seen this week?	
For how many patients was the STOP Bang questionnaire completed?	
How many patients had already completed a questionnaire at a previous visit thus did not complete another one?	
How many questionnaires screened positive for moderate to severe risk for OSA?	
For how many positive screens was a sleep study ordered?	

Appendix I

Staff Educational Handout

Screening for Obstructive Sleep Apnea in Primary Care Using the STOP Bang Questionnaire

What is OSA?

- Most prevalent sleep-breathing disorder
- Involves significantly decreased or completely blocked airflow due to partial or complete upper airway collapse during sleep, which causes intermittent hypoxemia and arousal from sleep
- Diagnosed by overnight sleep study / polysomnography
- Apnea-hypopnea index (AHI) is used to grade severity of OSA by counting the number of apneas (complete cessation of breathing) and hypopneas (marked reduction in airflow) that occur in one hour
 - Mild OSA = AHI 5-15
 - Moderate OSA = AHI 15-30
 - Severe OSA = AHI >30
- Treatment with CPAP is recommended for anyone w/ AHI >15 or anyone with mild OSA who has symptoms or cardiovascular co-morbidities

(Bonsignore, 2017; Chung, Abdullah, & Liao, 2016; Downey, 2018; Schulman, 2018; Bakhal, Nigam, Saeed, Krishnan, & Reynolds, 2017)

Risk Factors

- Obesity
- Age > 50 years
- Male gender
- Large neck circumference
- Abnormal or increased Mallampati score
- Enlarged tonsils
- Congestive heart failure (CHF)
- Pulmonary hypertension
- Stroke
- Metabolic syndrome

(Downey, 2018; Sunwoo et al., 2018)

Signs & Symptoms

Patients may complain of...

- | | |
|------------------------------|-------------------------|
| Excessive daytime drowsiness | Fatigue |
| Non-refreshing sleep | Sexual dysfunction |
| Poor concentration | Behavioral irritability |
| Poor memory | Depression |
| Arousals from sleep | Road traffic accident |
| Nocturia | Snoring |
| Waking up with a dry mouth | Nocturnal sweating |

(Bonsignore, 2017; Downey, 2018)

Associated Diseases

- | | |
|--|------------------------------|
| • Coronary artery disease (CAD) | • Arrhythmias (a fib) |
| • Hypertension (HTN) | • Myocardial infarction (MI) |
| • Congestive heart failure (CHF) | • Metabolic syndrome |
| • Stroke (CVA) | • Obesity |
| • Gastroesophageal reflux disease (GERD) | • Hypothyroidism |
| • Diabetes mellitus T2 | • Asthma |
| • Hyperlipidemia | • Anxiety |

(Sumwold et al., 2018; University Health Network, 2012)

So What?

Undiagnosed and untreated OSA leads to...

- Limited ability to perform ADLs
- Worsened quality of life
- Compromised personal safety
- Decreased labor productivity
- Increased health care expenditure

(Duarte, Fonseca, Magalhaes-da-Silveira, Silveira, & Rabahi, 2017)

Healthy People 2020

U.S. Department of Health & Human Services

Sleep Health Goal #1:

“To increase the proportion of persons with symptoms of obstructive sleep apnea who seek medical evaluation”

Between 2005 and 2008, ~25.5% of individuals with symptoms sought evaluation.

Initiative set target of 28% by 2020.

(USDHHS, 2018)

American Academy of Sleep Medicine Task Force 2015

- Challenge to “improve categorization of OSA symptoms and severity to promote assessment and diagnosis of the disorder”
- Surveys of primary care clinics showed that:
 - Sleep disorders are rarely addressed by providers
 - Sleep disturbance issues are often not reported by patients
 - Complaints of daytime drowsiness and insomnia are often not recognized as OSA symptoms
 - PCPs do not routinely screen for OSA

(Miller & Berger, 2015, p. 41)

Triple Aim

Institute for Healthcare Improvement (IHI)

Three main goals:

- 1) Improve patient experience, including quality and satisfaction of care
- 2) Improve health of overall population
- 3) Reduce per capita cost of health care

(IHI, 2017)

STOP Bang Questionnaire

STOP

- Do you **snore** loudly?
- Do you often feel **tired**, fatigued, or sleepy during the daytime?
- Has anyone **observed** you stop breathing or choking/gasping during your sleep?
- Do you have or are being treated for high blood **pressure**?

Bang

- BMI > 35?
- Age older than 50?
- Neck size greater than or equal to 17in/43cm for male, 16in/41cm for female?
- Gender = male?

(University Health Network, 2012)

STOP Bang Scoring

- **Low risk for OSA**
 - Yes to 0-2 questions
- **Moderate risk for OSA**
 - Yes to 3-4 questions
- **High/severe risk for OSA**
 - Yes to 5-8 questions **OR**
 - Yes to 2+ STOP questions + male gender **OR**
 - Yes to 2+ STOP questions + BMI > 35 **OR**
 - Yes to 2+ STOP questions + neck size large

(University Health Network, 2012)

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Appendix J

Revised Daily Data Collection Tool

Figure 1.

Daily Compliance of Staff w/ STOP Bang Questionnaire Completion

Date: _____

	Number
How many patients were seen today?	
For how many patients was the STOP Bang questionnaire completed?	
How many patients had already completed a questionnaire at a previous visit thus did not complete one today?	
How many questionnaires screened positive for moderate to severe risk for OSA?	
For how many positive screens was a sleep study ordered?	
How many sleep studies were not ordered due to patient having previous sleep study/diagnosis of OSA?	

Reasons why sleep study was not ordered if STOP-Bang was positive:

Appendix K

Data Collection Spreadsheet

DATA COLLECTION								
Date	# of patients seen	# of questionnaires completed	# of questionnaires not completed due to previous completion	# of questionnaires positive for moderate to severe risk	# of sleep studies ordered	# of positives screens already diagnosed w/ OSA	Daily Staff Compliance	Weekly Staff Compliance
9/4/18	13	13	0	6	1	x	100.00%	
9/5/18	15	14	0	9	0	x	93.33%	
9/6/18	16	12	0	7	0	x	75.00%	
9/7/18	17	12	0	8	0	x	70.59%	84.73%
9/10/18	24	17	0	11	1	x	70.83%	
9/11/18	22	12	0	5	1	x	54.55%	
9/12/18	21	7	0	2	0	x	33.33%	
9/13/18	13	7	0	2	0	x	53.85%	
9/14/18	15	12	0	8	1	x	80.00%	73.14%
9/17/18	25	16	0	7	0	5	64.00%	
9/18/18	16	16	0	7	0	6	100.00%	
9/19/18	15	8	0	3	0	1	53.33%	
9/20/18	16	11	0	6	1	5	68.75%	
9/21/18	MOA out sick - screening was not done						0.00%	57.22%
9/24/18	26	18	1	8	0	2	72.00%	
9/25/18	19	15	1	7	0	2	83.33%	
9/26/18	23	18	0	12	1	5	78.26%	
9/27/18	15	12	1	5	1	1	85.71%	
9/28/18	18	11	2	7	1	1	68.75%	77.61%
10/1/18	17	11	3	5	1	2	78.57%	
10/2/18	21	15	4	9	0	7	88.24%	
10/3/18	13	9	4	3	0	3	100.00%	
10/4/18	16	13	3	8	1	3	100.00%	
10/5/18	18	10	5	7	0	2	76.92%	88.75%
10/8/18	24	18	3	5	0	1	85.71%	
10/9/18	22	10	8	7	2	3	71.43%	
10/10/18	14	7	5	1	0	1	77.78%	
10/11/18	14	8	4	6	0	4	80.00%	
10/12/18	22	10	10	5	0	3	83.33%	79.65%
10/15/18	21	15	6	8	1	3	100.00%	
10/16/18	15	9	3	3	1	1	75.00%	
10/17/18	21	8	11	1	0	1	80.00%	
10/18/18	17	11	3	1	0	1	78.57%	
10/19/18	22	10	10	3	0	3	83.33%	83.38%
10/22/18	25	14	5	2	1	1	70.00%	
10/23/18	21	15	3	7	1	0	83.33%	
10/24/18	16	8	5	4	2	1	72.73%	
10/25/18	20	12	4	1	0	0	75.00%	
10/26/18	22	13	6	5	0	1	81.25%	76.46%
10/29/18	22	13	5	4	0	1	76.47%	
10/30/18	16	7	7	1	0	0	77.78%	
10/31/18	15	8	4	6	0	3	72.73%	
11/1/18	15	13	1	2	0	0	92.86%	
11/2/18	22	13	8	7	1	0	92.86%	82.54%
11/5/18	26	12	9	6	0	0	70.59%	
11/6/18	23	15	1	8	0	1	68.18%	
11/7/18	19	16	3	1	0	1	100.00%	
11/8/18	20	14	3	7	0	1	82.35%	
11/9/18	24	7	15	3	0	0	77.78%	79.78%
TOTALS:	912	575	166	256	19	76		77.10%