Increasing Screening Rates for Sleep Apnea in the Cardiac Population with the use of the STOP-BANG Assessment

by

Stephen Lombardi DNP-C, BSN

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Dr. Carolyn Hoskins, Project Team Lead

Dr. Wands Williams, DNP Program Director

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Abstract

Obstructive sleep apnea (OSA) is characterized by spontaneous cessation of breathing for greater than 10 seconds. OSA apnea has been correlated with cardiac diseases such as hypertension, cardiovascular disease, arrhythmia, and stroke. Despite these correlations, most OSA is undiagnosed due to the lack of screening in the cardiac population. It is estimated that approximately 80% of OSA worldwide is undiagnosed. The purpose of this project was to implement an OSA screening tool along with providing education in order to identify moderate to high-risk patients. The STOP-BANG Questionnaire has been shown to increase identifiable moderate to high-risk OSA when implemented compared to other standardized tools. Over the course of 6 weeks, CR staff screened a total of 48 patients. Of those 48 patients, a total of 32 patients were screened as either moderate to high risk for OSA. All patients that are screened moderate to high risk for OSA should be referred for a sleep study for proper diagnosis. All OSA patients should receive education on behavior modification, blood pressure reduction and weight loss to prevent further disease progression.

Background and Significance

The United States is in the middle of a sleep crisis, with an estimated 50 to 70 million Americans having a sleep disorder. One of the more prevalent of these sleep disorders is sleep OSA, thought to affect approximately 20 million Americans (American Academy of Sleep Medicine, 2018). OSA is the spontaneous cessation of breathing for greater than 10 seconds due to the relaxation of soft tissue, such as the tongue or the soft palate, during sleep (Tietjens et al., 2019). Recent research has suggested that obstructive sleep apnea has been correlated with diseases such as hypertension, cardiovascular disease, arrhythmia, stroke, and daytime sleepiness (Ononye et al., 2019; Tietjens et al., 2019). Despite these correlations, most sleep apnea goes

undiagnosed due to the lack of screening among the general population. It is estimated that approximately 80% of people with sleep apnea are currently undiagnosed (Ononye et al., 2019). The absence of recognition of OSA poses an economic and health threat to Americans. According to the American Academy of Sleep Medicine (2018), OSA costs the United States approximately $150 billion a year. The research also estimates that $100 billion can be saved every year if every patient in the United States is correctly diagnosed with OSA.

Risk factors for the development of sleep apnea are obesity, hypertension, snoring, neck circumference greater than 16 inches, and male gender. As the rates of obesity and hypertension have continued to rise in the United States over the past decade, it can only be inferred that the prevalence of sleep apnea will also rise (Ononye et al., 2019). It is imperative to start screening high-risk patients for sleep apnea to diagnose and prophylactically treat sleep apnea before other diseases develop. Implementing OSA screening tools for high-risk patients may reduce the amount of undiagnosed OSA and decrease the chance of correlated diseases.

To successfully diagnose sleep apnea, a patient must complete a polysomnography procedure (PSG), which usually consists of an overnight sleep study done at a sleep center where the patients are monitored by technicians looking to observe apneic sleep lasting for greater than 10 seconds (Barrows, 2020). With the rising research on OSA, more convenient polysomnography testing is being done with at-home tests. Before a patient is scheduled for a polysomnography procedure, the patient must have a positive screening. The STOP-BANG Questionnaire has clinically proven to have a 90% positive predicted value rate for successfully identifying the presence of OSA (Barrows, 2020; Chung et al., 2013).

Purpose

The purpose of this project was to implement an OSA screening tool along with providing education in order to identify moderate to high-risk patients. OSA is routinely not screened for in primary and tertiary cardiac care settings. This project focusd on implementing an effective screening tool for patients currently enrolled in Cardiac Rehab (CR) for OSA and providing education to patients about OSA.

The focus of the project was on the number of patients that screen moderate to high risk for the OSA Stop-Bang questionnaire. The patients screened moderate to high-risk will represent the number of people who would not have otherwise been evaluated for OSA without the implementation of this project.

Review of the Current Literature

A general literature review was conducted using the database MEDLINE (PubMed) and Cumulative Index to Nursing and Allied Health Literature (CINAHL Complete). Search terms entered into the database included: obstructive sleep apnea, cardiac rehab patients, cardiac disease, coronary artery disease, hypertension, atrial fibrillation, screening tool or assessment tool, sensitivity and specificity. The search yielded 95 results after articles published before 2017 and studies conducted outside the United States were excluded. Of the 129 articles 21 were chosen that reflected correlation between OSA and various cardiac diseases.

Cardiovascular Disease

Despite evidence that clinically links OSA to cardiovascular disease (CVD), OSA screening in the cardiac population is not part of the routine preventative care assessment. It is estimated that anywhere from 40-60% of patients with CVD have undiagnosed OSA (Chung et

al., 2018; Tietjens et al., 2019). Despite these statistics, the US Preventative Task Force does not have any current recommendations for screening in patients with known CVD. A study by Hudgel (2018) shows cardiac patients screened and diagnosed with OSA had decreased mortality rates and less chance of another cardiac event when adhering to treatment for OSA.

Myocardial Infarction

The majority of CR referrals are for patients that have suffered a myocardial infarction (MI). Clinical research has shown that approximately almost half of patients with cardiovascular disease have a diagnosis of OSA (Hupin et al., 2018). The majority of patients with cardiovascular disease also do not display the typical symptoms of OSA (Alonderis et al., 2020). A study by Zhang et al. (2020) demonstrated that OSA leads to increased inflammatory markers and causes hemodynamic instability. In addition, OSA was also shown to increase platelet aggregation, which increases the risk of developing an acute cardiac event. Increased triglyceride levels have been associated with prolonged untreated OSA (Talib et al., 2020). OSA has been also associated with other significant diseases that are the main perpetrators of CVD such as hypertension (Hupin et al., 2018.)

Hypertension

Prolonged hypertension is one of the leading causes of CVD. Research has shown that that approximately 30-50% of patients with HTN also have undiagnosed OSA (Bakhai et al., 2018; Mansukhani et al., 2019). Evidence would suggest that patients with concurrent HTN and possible undiagnosed OSA need screening. In addition, it is estimated that 70% of patients with resistant hypertension also have OSA (Tietjens et al., 2019). Prolonged hypertension leads to cardiac remodeling and hypertrophy of the myocardium, causing dysfunction of the heart (Jehan et al. 2020).

Congestive Heart Failure

OSA has been identified as a factor in the development of congestive heart failure (CHF) (Jehan et al. 2020). Research has shown that 50-80% of patients with CHF have an associated sleep disorder (Gullvåg et al., 2019). Many of these patients are unaware that they suffer from a sleep disorder such as OSA. OSA has been associated with an increased risk of adverse outcomes, including HTN, arrhythmia, and sudden cardiac death in patients with CHF (Tietjens et al., 2019; Ersoy & Mercan, 2021).

Cardiac Arrhythmias

Clinical evidence has shown a link between OSA and many cardiac arrhythmias. The most common cardiac arrhythmia in the United States is atrial fibrillation (A-fib). It is estimated that approximately 20% of patients with A-fib have a diagnosis of OSA (Tietjens et al., 2019). Studies have shown that 50% of patients with poorly controlled A-fib have associated OSA (Khan et al., 2019). Untreated or poorly controlled A-fib can lead to adverse outcomes such as cardiovascular accident, deep vein thrombosis, and demand ischemia (Khan et al., 2019; Tietjens et al., 2019.) Patients with A-fib should be screened for OSA to decrease the risks of adverse health events.

STOP-BANG Questionnaire

The primary OSA screening tools found during the literature review are the STOPBANG Questionnaire, Epworth Sleepiness Scale, and the Berlin Questionnaire. A study by Tietjens et al. (2019) demonstrated the STOP-BANG Questionnaire to have significantly more specificity (90%) compared to both the Berlin Questionnaire (77%) and Epworth Sleepiness Scale (74%). The STOP-BANG Questionnaire has been shown to increase identifiable moderate

to high-risk OSA when implemented compared to other standardized tools (Barrows., 2020). Based upon this evidence, the STOP-BANG Questionnaire was chosen as the screening tool to be implemented in this project based upon the its superior specificity compared to other OSA screening tools (See Appendix A).

Continuous Positive Airway Therapy

The overall goal of screening for OSA is to identify high-risk patients so proper diagnostic testing can be ordered. Clinical evidence shows that treatment options for OSA are effective in preventing the development of CVD (Mansukhani et al., 2019.) The main form of treatment of OSA is continuous positive airway pressure (CPAP) therapy delivered by a CPAP machine. CPAP therapy has been shown to reduce blood pressure, improve CV outcomes in patients with CVD, increase recovery time in stroke patients, and overall decrease mortality (Hudgel, 2019; Mansukhani et al., 2019).

Lifestyle Modifications

Literature shows there is a connection between OSA and weight. Lifestyle modifications that contribute to weight loss have been shown to reduce the risk for development of OSA. Weight loss primarily is influenced by two factors, physical activity, and diet. More active individuals are less likely to develop OSA compared to those who are sedentary (Sahni et al., 2021). In conjunction with increasing physical activity, patients should modify their food consumption to lean animal protein, raw nuts, and fruits and vegetables (Gala & Seaman, 2021).

In addition to these changes, patients should decrease nutrient dense calories such as grains, dairy products, and saturated fat (Gala & Seaman, 2021).

Conceptional Framework

Advanced nursing practice is founded upon the principles of combining medical science with social science in order to realistically improve patients' health. In the primary care setting, providers are asked to correctly diagnose diseases and evaluate patience ability to carry out treatment plans and care for themselves. Dorothea Orem was a nurse theorist who believed patients recovered quicker if allowed to care for themselves and acknowledged that some patients have deficiencies in their self-perseveration (Hartweg & Pickens, 2016). Orem formulated the Self-care Deficit Nursing Theory (SCDNT) to provide a framework for nurses to improve patients' care for themselves. SCDNT is founded upon practicing diagnostic, prescriptive, treatment, or regulatory principles and case management (YIP, 2021). These four practicing principles can be applied to our target population of cardiac patients with undiagnosed sleep apnea. Orem's SCDNT will be used during the screening process to evaluate the patient's capabilities to partake in treatment to reduce key risk factors of OSA. Evaluation of the patient's cognitive status, learning capacity, willingness for change, and social-economic status all play a vital role in self-care.

One of the core theories of SCDNT Is evaluating the patient's lifestyle and presenting symptoms to make an accurate diagnosis (Geden et al., 2001). The theory looks at the whole individual and considers the patient's ability to care for themselves and make healthy lifestyle changes. This theory is applicable in the targeted population because environmental factors play a large role in the development of cardiac disease (Talib et al., 2020). Screening for sleep undiagnosed OSA is the primary goal of this quality improvement project, but evaluating patients' readiness to make lifestyle changes to reduce causative factors will ultimately determine if treatment is effective.

Methods

The purpose of this project was to implement an OSA screening tool along with providing education in order to identify moderate to high-risk patients. The synthesis of the current literature illustrates a clear link between OSA and cardiac disease. With this information, a plan was formulated to create an in-service to implement the project. All patients that do not have a diagnosis of OSA will be screened. If a patient is screened moderate or high risk for OSA, education will be provided on how to decrease risk factors. The patient will be offered a copy of their STOP-BANG questionnaire results to present to their primary care provider or cardiologist to pursue diagnostic testing for OSA.

Population

The quality improvement project was implemented in an outpatient cardiac rehab (CR) at a hospital in central North Carolina. The cardiac rehab nurses agreed to participate and received an in-service on how to conduct the STOP-BANG questionnaire. The patient population had to be enrolled in cardiac rehab and not have a diagnosis of OSA.

Setting

CR is a multidisciplinary approach to treat the patient's cardiovascular disease and optimize physical, mental, and social functions (Ozemek et al., 2018). The disciplines in CR provide interventional treatments through exercises, behavior changes, and nutrition education. The main component of the CR program is supervised exercise by trained cardiac nurses and exercise physiologists. Physical activity has been proven to reduce cardiovascular associated events by 50% and along with reducing risk factors such as obesity, diabetes mellitus, hypertension, OSA and hyperlipidemia (Wang, Ai, & Zhang, 2017). CR programs are usually

12-week programs broken into 3 phases. This project will focus on Phase 2 of the CR program. Phase 2 of the program is in the outpatient setting and lasts 12-weeks. Exercise is prescribed by an exercise physiologist and the patient's heart rate, blood pressure, and respiratory status are closely monitored. During these 12-weeks patients are shown safe and effective ways to progress their physical activities and are given nutritional education. The goal of the phase to is to prepare the patient to continue their exercise regimen in order to reduce the risk of having another cardiovascular related hospitalization. Studies have shown that successful completion of phase 2 has led to a reduced risk in mortality of 20-30% along with improvements in quality of life and the ability to return to work quickly (Thomas et al., 2018).

Translational Framework

The Plan-Do-Study-Act (PDSA) methodology was utilized to implement the DNP project. The PDSA analyzes changes and their effect to determine if the intervention was successful or another action is required. First, approval from the IRB was obtained to conduct this quality improvement project. Prior to implementation of the DNP project, permission was obtained to use the STOP-BANG Questionnaire. Consent was obtained from the cardiac rehab manger to implement the quality improvement project. An in-service was held at an outpatient cardiac rehab at a hospital in central North Carolina to educate staff on how to conduct the STOP-BANG questionnaire.

At the beginning of the cardiac rehab class patients were given a brief overview of the projects purpose and were offered to voluntarily participate. Participants that verbally consented were given a copy of the STOP-BANG questionnaire and instructed to fill out the questionnaire. Staff made rounds with each participant to explain the questionaries as well as provide measurements of neck circumference and calculate BMI. The staff collected the questionnaires and placed the results into a dedicated folder for the primary investigator. The questionnaire did

not contain any personal or identifying information. Patients that were screened to be moderate or high risk were be given general education about OSA and how to reduce risk factors. Since there is not an onsite provider, patients were given the option to have a copy of their STOPBANG questionnaire to present to their primary care provider or cardiologist if they wish to pursue diagnostic testing. The information was collected at the end of the 6-week period and analyzed.

Data Analysis

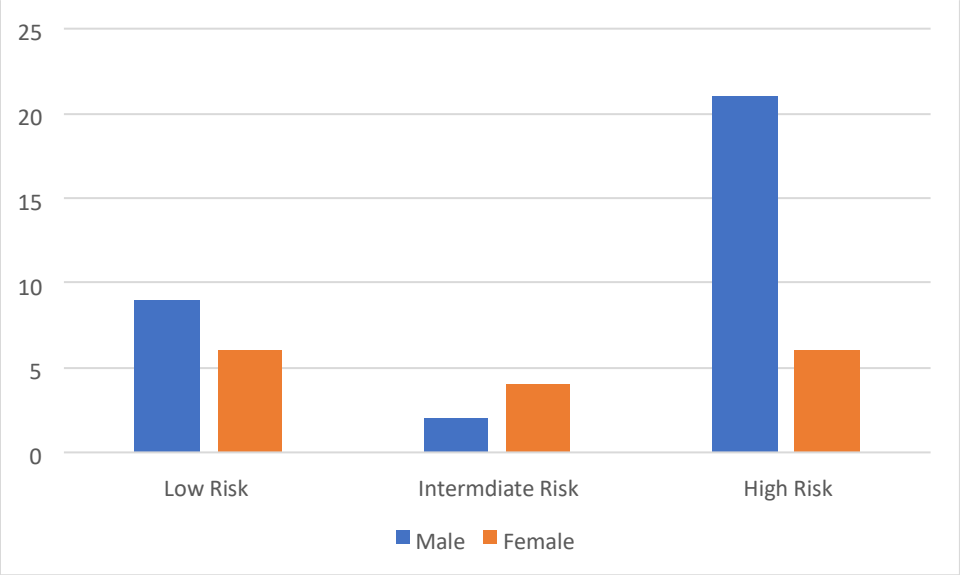
Over a 3-week period data was collected from completed STOP-BANG questionnaires by CR staff. The STOP-BANG questionnaires were tallied by score and classified as to low, moderate, or high risk for OSA. The data was analyzed using Microsoft Excel and placed into charts displaying the frequency of scores and risk class.

Results

Forty-eight CR patients underwent OSA screening using the STOP-BANG questionnaire. Of the forty-eight patients, 68% (33) were male and 32% (15) were female. Figure 1 displays the results of the STOP-BANG questionnaire in the selected population.

Figure 1

Prevalence of OSA in CR patients



A total of 33 patients (67%) screened either moderate or high risk for OSA. Males (33) were twice as likely have a positive screen than females (15).

Discussion

Obstructive sleep apnea has been associated with cardiac diseases such as hypertension, cardiovascular disease, arrhythmia, and stroke. Despite these correlations, most OSA is undiagnosed among the cardiac population. The purpose of this quality improvement project is to implement an OSA screening tool along with providing education from UpToDate in order to identify moderate to high-risk cardiac patients. (See appendix 2)

The PDSA methodology was used in this quality improvement project to evaluate the effectiveness of implementing a OSA screening tool and how the CR program can implement a screening protocol. The STOP-BANG questionnaire was implemented to measure the number of cardiac patients that screened moderate or high risk for OSA. The STOP-BANG questionnaire was the preferred OSA screening tool based on current evidence in relation to specificity and

sensitivity compared to similar screening tools. Over a six-week implementation period, data demonstrated that there is a need to screen cardiac patients for OSA. The data reflects that the majority of cardiac patients that were screened for OSA did have a positive screening result. Previous studies have demonstrated the correlation between OSA and cardiac disease so the results of the study were anticipated (Chung et al., 2018; Tietjens et al., 2019).

Patients that had a positive screening should be setup for polysomnography to make an accurate diagnosis of OSA. Utilizing the PDSA method, dissemination was done with the CR manager and staff. Staff reactions to the project was overall positive in that they clearly saw the benefit with the implementation of an OSA screening tool. Unfortunately, management and staff saw the limitations of the CR setting in extending the diagnosis process. The project will not be implemented into practice in the CR setting, but conversation has been started into implementing this practice into cardiac clinic. If left untreated these patients are at risk for further cardiac complications if their OSA is not treated. Patients that did have a positive screen were provided education from UpToDate in regards to reduction of risk factors for OSA. The education focused on weight loss and blood pressure control.

Limitations

A limitation to the project was the absence of an onsite medical provider that could order polysomnography for moderate to high-risk patients based on their STOP-BANG score. This could reduce the number of patients that may not follow-up with their primary provider or cardiologist to set-up an outpatient polysomnography test.

Conclusion

The purpose of this project was to implement an OSA screening tool along with providing education in order to identify moderate to high-risk patients. Based on previous evidence and data from the QI project there is clearly a need for OSA screening among cardiac patients. The rates of obesity and heart disease in the United States have been increasing yearly and one can logically conclude that the rate of OSA has been increasing as well. Clinical research provides evidence that OSA screening is needed in the cardiac population. The first step in this process is to acknowledge that OSA is an important disease to screen in cardiac patients. Clinical evidence suggests that OSA screening in the population is imperative to prevent future cardiovascular complications.

Recommendations for future studies

Follow-up studies should focus on increasing the screening rate for OSA along with polysomnography diagnostic testing to evaluate the percentage of patients with confirmed OSA. OSA screening would be more appropriate to be implemented in primary care and cardiac clinics rather than cardiac rehab due to limitations in follow-up diagnostic testing required to make proper diagnosis. Unfortunately, patients that screened positive in this study could only be provided education information in regards to risk factor reduction. Proper diagnosis would be required for additional treatment modalities such as CPAP therapy.

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Appendix A

Stop-Bang Questionnaire

Yes	No	
		Snoring?
○	○	Do you snore loudly (loud enough to be heard through closed doors or your bed partner elbows you for snoring at night)?
Yes	No	**Tired?**
○	○	Do you often feel tired, fatigued, or sleepy during the daytime (such as falling asleep during driving)?
Yes	No	**Observed?**
○	○	Has anyone observed you stop breathing or choking/ gasping during your sleep?
Yes	No	**Pressure?**
○	○	Do you have or are being treated for high blood pressure?
Yes	No	
○	○	**Body mass index more than 35 kg/m²?**
Yes	No	
○	○	**Age older than 50 years?**
		Neck size large? (measured around Adam's apple)
Yes	No	For male, is your shirt collar 17 inches or larger?
○	○	For female, is your shirt collar 16 inches or larger?
Yes	No	
○	○	**Sex = male?**

Notes: Scoring criteria (for general population): low risk of OSA, yes to 0–2 questions; intermediate risk of OSA, yes to 3–4 questions; high risk of OSA: yes to 5–8 questions, yes to 2 of 4 STOP questions + individual's sex is male, yes to 2 of 4 STOP questions + BMI >35 kg/m², yes to 2 of 4 STOP questions + neck circumference (male) 17″/(female) 16″. Property of University Health Network.
Abbreviations: OSA, obstructive sleep apnea; BMI, body mass index.

Appendix B

OSA Risk Factor Reduction Sheet

Risk factors — Certain factors increase the risk of sleep apnea

- Increasing age – OSA occurs at all ages, but it is more common in middle and older age adults.
- Male sex and hormones – OSA is twice as common in males as females, especially in middle aged males and in those on replacement hormones.
- Obesity – The more obese a person is, the more likely he or she is to have OSA.
- Sedation from medication or alcohol – These reduce breathing and prevent awakening during sleep, and can lengthen periods of apnea (no breathing), with potentially dangerous consequences.
- Abnormality of the airway that narrows it (eg, large tonsils).

Treatment: Continuous positive airway pressure (CPAP) — The most effective predictable, and commonly used treatment for sleep apnea uses air pressure from a mechanical device to keep the upper airway open during sleep. A CPAP device uses an air-tight attachment to the nose, typically a mask, connected to a tube and a blower which generates the pressure. Devices should fit comfortably into the nasal opening, or over the nose or nose and mouth. CPAP should be used any time the person sleeps (day or night).

Behavior and lifestyle changes — Most people with OSA can benefit from certain behavior changes.

Changing sleep position — Adjusting sleep position (to stay off the back) may help improve sleep quality in people who have OSA when sleeping on the back. However, this is difficult to maintain throughout the night and is rarely an adequate solution.

Weight loss — Weight loss is very helpful for people who are obese or overweight. Weight loss through dietary changes, exercise, and/or surgical treatment is equally effective. However, it can be difficult to maintain weight loss; the five-year success of non-surgical weight loss is only 5 percent, meaning that 95 percent of people regain lost weight.

Avoiding alcohol and other sedatives — Alcohol can worsen sleepiness, increasing the risk of accidents or injury. People with OSA are often counseled to drink little to no alcohol, even during the daytime. Similarly, people who take anti-anxiety medications or sedatives to sleep should speak with their healthcare provider about the impact of these medications on sleep apnea.

If you have OSA, you will need to notify other healthcare providers, including surgeons, about your condition and the potential risks of being sedated. People with OSA who are given perioperative anesthesia and/or pain medications require special management and close monitoring to reduce the risk of a blocked airway.

Other treatments — While behavioral changes and CPAP are typically recommended as initial therapy for people with OSA, other treatments may be used in some situations.

Appliances — An oral appliance (or "mandibular advancement device") can reposition the jaw, bringing the tongue and soft palate forward to relieve obstruction in some people

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