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Nurse Practitioner-Led Obstructive Sleep Apnea Screening in Patients with an Implantable Cardiac Monitor, and Confirmed or Suspected Atrial Fibrillation

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Hahn School of Nursing and Health Science

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Abstract

Background: Obstructive sleep apnea (OSA) has been linked to heart disease and vice versa. Millions of Americans suffer from this chronic sleep condition, and a great number of those affected are unaware they have it. According the American Sleep Apnea Association, 80% of patients who fall in the moderate to severe OSA category are undiagnosed. Evidence suggest that untreated OSA can lead to atrial fibrillation (AF), and other cardiovascular problems. These cardiovascular complications can increase the mortality and morbidity of patients who suffer from this sleep syndrome.

Purpose of Project: The goal of the project was to provide OSA screening to patients with implantable cardiac monitors who were observed due to confirmed or suspected AF. The aim of this study was to identify the prevalence of those at high risk. Our overall purpose was to establish early screening protocols, that could potentially lead to early detection and treatment. The screening tool used was the STOP-BANG OSA screening tool due to its high sensitivity and specificity for detecting moderate to severe cases.

Methods: Patients were screened for OSA risk by using the STOP-BANG tool. The phone screening calls were conducted between the hours of 9:00 am to 5:00pm on week days over a period of six months. The scores of 100 patients were obtained, and analyzed by using Microsoft Excel software.

Evaluation/Results: The results showed that 63% of patients screened, scored as high risk for OSA. Of those who scored as high risk, 61.90% were males, 38.10% were female, 25.39% had previously been diagnosed with OSA, 4.76% were previously referred for sleep studies, and 69.84% have never been screened for OSA or referred for a

sleep study. These findings suggested that the majority of patients at high risk for OSA are neither screened nor referred for sleep studies. The patients found to be at highest risk were males, older than 50y/o, obese, with a history of hypertension and syncope.

Discussion: This project has the potential to provide information regarding the prevalence of OSA in patients who are diagnosed or are suspected to have AF. The prevalence of OSA in this patient population can give us knowledge regarding their health care needs. It can also help providers focus interventions that can potentially improve health care outcomes. Early screening can lead to early referral and treatment. This in turn may lead to decrease exacerbation of AF, and improved overall quality of life for patients who have coexisting AF and OSA.

Nurse Practitioner-Led Obstructive Sleep Apnea Screening in Patients with an Implantable Cardiac Monitor, and Confirmed or Suspected Atrial Fibrillation.

Background

According the American Sleep Apnea Association, 22 million Americans suffer from obstructive sleep apnea (OSA), and 80% of those who fall in the moderate to severe category are undiagnosed. Untreated OSA can lead to several complications, especially of cardiovascular nature. These complications include life threatening conditions such as atrial fibrillation (AF), stroke, heart failure, and other cardiovascular issues (American Sleep Apnea Association, 2018). There are many studies that explained the consequences of OSA, especially those affecting the cardiovascular system. Mannarino, Di Filippo, and Pirro (2012), clarified that this syndrome leads to the collapse of the muscle of the pharynx during sleep, resulting in airway obstruction. Cardiac arrythmias are among the conditions associated with OSA. Butt, Dwivedi, Khair, and Lip (2010), advocated for OSA screenings in patients who have cardiovascular disease. They stated that due to the cardiovascular risk factors associated with OSA, patients who suffer from cardiac disease should be screened for sleep apnea, and patients who are diagnosed with OSA need cardiovascular disease screening (Butt et al., 2010). According to the authors, among diseases induced or associated with OSA that also increase the mortality and morbidity in these patients are: coronary artery disease (CAD), heart failure, cardiac arrhythmias, and stroke (Butt et al., 2010).

Several studies have assessed what the prevalence of OSA in the general populations is, as well as in patients who have cardiovascular disease. According to Linz et al. (2018), the prevalence of OSA in the general population ranges from 3%-49%,

compared to 21-74% in patients with AF. The authors explained that this high prevalence, combined with a lack of day-time sleepiness reporting, may warrant the consideration of sleep-study evaluation for patients who are considering rhythm control therapies (Linz et al., 2018). According to Khan et al. (2019), AF is the most common cardiac arrhythmia, and OSA is a risk factor for its onset and reappearance. The authors explained that every year is the United States (US) there are 750,000 hospitalizations, and 130,000 deaths associated with OSA (Khan et al., 2019). Furthermore, Khan et al. (2019), stated that OSA prevalence increases to 50% in patients with poorly controlled AF. The authors reported that despite the evidence demonstrating an association between OSA and AF, the under diagnosis of OSA in patients with cardiovascular issues such as AF, continues to be an issue (Khan et al., 2019).

Nalliah, Sanders, and Kalman (2016), explained that epidemiologic studies verified an independent association between AF and OSA, and argued that the pathophysiologic process of OSA facilitates the progression of AF. The authors pointed at differences in prevalence according to the patient's sex, and suggested that OSA seems to affect males at a higher rate than females. Nalliah, Sanders, and Kalman (2016), continued by saying that the prevalence rates of AF and OSA are increasing globally, with a prevalence in men and women of 17-31%, and 6.9-9% respectively. Abumuamar, Dorian, Newman, and Shapiro (2018), conducted a cohort study and assessed patients who were referred to a cardiac clinic. They found a prevalence of OSA in 85% of these patients, with the highest prevalence found in males (91% in males compared to 70% in women) (Abumuamar et al., 2018).

This evidence-based project (EBP) was conducted at a cardiac clinic where patients with AF or suspected to have this arrhythmia, are not routinely screened for OSA. The need for screening was decided after a review of patient's charts reflected a lack of screening, despite the presence of multiple risk factors associated with OSA. Identified risk factors included a diagnosis of AF and other cardiac arrhythmias, diabetes, hypertension (HTN), high body mass indexes (BMIs), and obesity.

Evidence of Problem

The main strategy of the project was to provide OSA screening to patients diagnosed with, or are suspected to have AF. The aim was to detect the prevalence of patients at high risk for OSA in this patient population. This decision was made based on evidence suggesting that patients with AF and other cardiovascular diseases should be screened for OSA (Butt et al., 2010). This sleep disorder is not only a cardiovascular risk factor, but it has also been associated with an increase in mortality and morbidity in those affected (Butt et al., 2010). The first steps towards pursuing this project included a literature review. The majority of articles were found using the database CNAHL. Other search engines utilized involved PubMed and Google Scholar. The original search yielded 40 articles including one meta-analysis, randomized controlled trials (RCTs), several control and cohort studies, as well as interventional crossover studies. There was limited data from RCTs found in the literature. The keywords used in the search included: *OSA prevalence, OSA screening, STOP-BANG questionnaire, atrial fibrillation and sleep apnea, sleep apnea and cardiovascular disease, sleep apnea and arrhythmias, and sleep apnea screening tools*. A total of 31 articles were chosen from the original

search for the proposal. These articles were ranked based on the John Hopkins' evidence-based level and quality guide (John Hopkins Medicine, 2017).

A systematic review and a meta-analysis conducted by Nagappa et al. (2015), reported that the STOP-BANG questionnaire is a validated tool for the screening of OSA. The authors reviewed 9,206 studies, in order to determine this screening tool's effectiveness and accuracy in OSA screening. They concluded that this tool has a high performance, especially in the sleep clinics and surgical patient populations. They determined that the higher a patient's scores, the higher the probability of him or her having moderate to severe OSA (Nagappa et al., 2015).

According to Luo, Huang, Zhong, Xiao, and Zhou (2014), the STOP-BANG screening tool is superior at predicting OSA than other commonly used tools. The authors prospectively included a cohort of 212 from a sleep- disorder clinic. They asked the subjects to fill out the STOP-BANG, Epworth, STOP, and Berlin questionnaires, before performing and overnight sleep study (polysomnography). They found that the predictive value of the STOP-BANG tool was superior in comparison to the other tools. Furthermore, they suggested that the STOP-BANG questionnaire should be used more in the general population (Luo et al., 2014).

A randomly selected cohort study conducted by Khan et al. (2019), led OSA screenings in patients with persistent AF. They wanted to assess screening rates, and the willingness of those at high risk for OSA to have further evaluation. They assessed 254 patients with persistent AF, and conducted OSA screenings on those who had not been previously screened. The screening tool used was the STOP-BANG questionnaire. According to Khan et al. (2019), 66% of patients who had AF, had never been screened

for OSA. After their screening process was done, they found that 75% of patients scored as high risk (Khan et al., 2019). This study emphasized the importance of identifying OSA in patients who have AF, since according to the authors, sleep apnea is a risk factor in the onset and progression of this cardiac arrhythmia (Khan et al., 2019). They concluded by explaining that despite the high association between AF and OSA, the majority of patients with persistent AF are not screened for OSA. Khan et al. (2019) emphasized that this lack of screening happens despite these patients having AF and other cardiovascular risk factors. These risks factors included obesity, diabetes, and hypertension. The authors ended by advocating OSA screening for all patients who have AF. However, they highlighted that sleep studies should be reserved for those who are at high risk (Khan et al., 2019).

According to Anter et al. (2017), patients who have OSA, have up to four times the risk of developing AF, compared to patients without OSA. They explained that the prevalence of OSA in patients with AF is between 10-60%. There is a pathophysiologic explanation for the changes that occur in the heart that associate OSA with AF. Anter et al. (2017), described that OSA promotes the development of AF by different mechanisms. These mechanisms include the shortening of atrial refractoriness, reduction of cardiac conduction, and stretching of the atria which may trigger AF (Anter et al. (2017). Their study concluded by stating that the high prevalence of OSA in patients with AF calls for universal sleep studies, since elimination of triggers can improve arrhythmia-free survival (Anter et al., 2017).

Abumuamar, Dorian, Newman, and Shapiro (2018), hypothesized that OSA is underdiagnose in patients with AF. They included 123 non-selected patients diagnosed

with AF from arrhythmia clinics in Canada, and conducted a two-day sleep study that included electroencephalogram recordings. Patients with an Apnea-Hypopnea Index (AHI) greater or equal to five, were identified as having OSA. Their final analysis included 100 subjects and found that 85% of these patients had OSA, with age and male sex as predictors of this syndrome in this patient population. The study concluded that OSA is commonly undiagnosed in AF patients, especially women and non-obese patients (Abumuamar, Dorian, Newman, & Shapiro, 2018).

An interventional crossover study conducted by Schlatzer et al. (2015), specified that there is evidence suggesting a link between OSA, paroxysmal AF (PAF), and sudden cardiac death. In this study, the authors evaluated if changes in intrathoracic pressure induced by OSA, cause certain arrhythmias such as premature atrial beats (APBs). They also evaluated if this change in intrathoracic pressure, resulted in changed ventricular repolarization in patients with PAF (Schlatzer et al., 2015). They conducted 12-lead EKG monitoring for 44 patients with OSA, obstructive hypopnea, end-expiratory central apnea, and during normal breathing. They also assessed the prevalence of OSA by performing sleep studies on these patients. Their study found that APBs occurred in 55% of patients with induced obstructive apnea, in 32% of patients with obstructive hypopnea, in 14% of those with end-expiratory central apnea, and only in 9% of patients during normal breathing (Schlatzer et al., 2015). The authors concluded that simulated OSA induces APBs, and leads to significant prolongation of ventricular repolarization. These results were significant, since the authors also stated that the majority of PAF are triggered by APBs (Schlatzer et al., 2015).

Yaranov et al. (2015), stated that OSA is an independent risk factor for ischemic stroke, and it is not included in the risk assessment of patients with AF. They conducted a study with the aim of assessing the effects OSA has on stroke rates in patients with AF. They performed a retrospective chart review, identified patients with AF and new diagnosis of OSA, and excluded those with previous stroke history. According to the authors, from a total of 5,138 patients who underwent sleep studies, 402 (7.7%) patients with previous AF, and who also met inclusion criteria were included in the study (Yaranov et al., 2015). They also included 332 (6.4%) patients after the exclusion criteria was applied. Their study identified 283 patients with OSA, with men having a higher prevalence (73. 1%) (Yaranov et al., 2015). They also found that ischemic strokes were more common in patients with OSA (25.4%) when compared to those who did not have it (8.2%). Yaranov et al. (2015), concluded that OSA is an independent predictor for stroke.

The relationship between AF and OSA is explained in many studies and it is supported by the evidence. Goyal and Sharma (2013), stated that this association could be due in part to a higher prevalence of other risk factors such as, obesity and hypertension among OSA patients. However, the authors explained that the association between AF and OSA is stronger than the association of AF with other risk factors (Goyal & Sharma (2013). The authors also said that OSA is more prevalent in younger patients who have AF, and explained that OSA is an independent risk factor for AF (Goyal & Sharma (2013). Furthermore, Goyal and Sharma (2013), elucidated that treatments of AF are affected as a result of concurrent OSA. They clarified that patient who have AF and concurrent OSA, do not respond as well to pharmacologic and no-pharmacologic treatments of AF, including cardioversion and ablation therapies (Goyal & Sharma 2013).

They also said that the poor response to pharmacologic treatments of AF correlate with the severity of OSA, and that there is a high recurrence of AF after ablation in patients with OSA (Goyal & Sharma, 2013). This observation is backed by other studies that have look at the relationship between these two conditions.

A meta-analysis conducted by Ng et al. (2011), demonstrated that the presence of concurrent OSA with AF poses a 25% increased risk of AF recurrence after ablation therapy. Many studies point out the effects OSA has on cardiovascular health. Somers et al. (2008), stated that it is estimated that OSA affects millions of Americans, and a large proportion of those affected have hypertension or cardiovascular disease. The authors explained that data from observational studies of patients with untreated OSA who underwent cardioversion due to AF, showed an 82% risk of recurrence of AF within one year of the procedure (Somers et al., 2008). According to Goyal and Sharma (2013), several studies have demonstrated a high prevalence of OSA in patients who suffer from AF, as well as poorer treatment responses of AF when OSA is also present. For these reasons, the authors said that patients who have AF should be screened for OSA, and those who score as high risk should be considered for a sleep study (Goyal & Sharma, 2013).

According to Nalliah et al. (2016), the pathophysiologic processes that occur in OSA, work as facilitators for the progression of AF. The authors explained that these pathophysiologic changes include autonomic remodeling, inflammation, atrial stretch, and impairment of gas exchange. In accordance to their article, treating OSA with continuous positive airway pressure (CPAP) can lessen the mechanical problems seen in the AF substrate in OSA (Nalliah et al., 2016). The literature supports the consensus that

treatment of OSA with CPAP can impact treatment of AF, and reduce complications. Goyal and Sharma (2013), explicated that the evidence states that CPAP is an effective treatment for OSA, and that treatment with CPAP can improve AF control in patients with OSA.

Bayır et al. (2013), described the association between OSA and AF by explaining that the prolongation of interatrial conduction time is related to AF. They stated that therapy with CPAP is an effective treatment for OSA, which can translate into a decreased risk of AF associated with untreated OSA (Bayır et al., 2013). The authors conducted a study with 24 patients diagnosed with OSA, and 18 controls. They measured the subjects' basal interatrial and intraatrial electromechanical delays by doppler ultrasound. They then calculated patients' p wave dispersion (Pd) by 12-lead EKG, before starting CPAP therapy. Six months after the initiation of CPAP therapy, they repeated these measurements in patients with OSA. According to Bayır et al. (2013), their study found that the interatrial, right and left intraatrial electromechanically delays, and Pd were greater in OSA patients prior to CPAP therapy, when compared to control groups. The authors noted, that after six months of CPAP therapy, all those values significantly improved compared to their baseline at the start of therapy (Bayır et al., 2013). They concluded by suggesting that the treatment of OSA with CPAP may decrease the risk of AF (Bayır et al., 2013).

According to Kanagala, Narayana, and Friedman (2003), patients with untreated OSA have a higher recurrence of AF after cardioversion. Their study demonstrated that treatment with CPAP is associated with lower AF recurrence (Kanagala et al., 2003). Their prospective study compared the AF recurrences in 27 patients with untreated OSA,

and 12 patients with OSA who were using CPAP appropriately. Based on their reports, the AF recurrence rates for the patients with untreated OSA, were almost two times higher, than for the group who was using CPAP (Kanagala et al., 2003). The authors explained that the recurrence rate in the untreated group was 82%, compared to 42% in the treated group, and 53% in the control group without OSA (Kanagala et al., 2003). Furthermore, the authors described that the recurrence of OSA was higher in the untreated group, despite these group of patients having lower BMIs, better functional capacity, and less history of hypertension when compared with the treated group (Kanagala et al., 2003). According to Kanagala et al. (2003), appropriate treatment with CPAP was associated with a reduction in the recurrence of arrhythmias. They stated that these findings were independent of age, BMI, HTN, arrhythmia therapies, diabetes, and electrocardiogram results. Their study concluded by clarifying that the major determinant of AF recurrence, was whether or not these patients were appropriately treated for OSA with CPAP (Kanagala et al., 2003).

Fein et al. (2013), conducted a study with 426 patient who underwent pulmonary vein isolation (PVI). From these cohort, 62 patients had a confirmed diagnosis of OSA from polysomnography. Out of these 62 patients, 32 were CPAP user, and 30 were not. The authors then compared atrial arrhythmias recurrence, need for a repeat ablation treatment, and use of antiarrhythmics drugs for a period of 12 months. Fein et al. (2013), also compared the outcomes of patients from this same cohort who had OSA, with those who did not. According to the authors, CPAP therapy resulted in an AF-free survival rate of 71.9% compared to 36.7% in those who were not CPAP users (Fein et al., 2013). They also reported that the AF-free survival rate of antiarrhythmic drugs or repeat ablation,

were 65.6% vs 33.3% respectively (Fein et al., 2013). Furthermore, the authors clarified that the AF recurrence rates in patients who were CPAP users were similar to patients who did not have OSA. Fein et al. (2013), specified that the AF recurrence rate following PVI was similar in the non-CPAP users' group and the OSA patients who were managed without ablation. However, the recurrence rate was significantly higher in these two groups compared to those who were CPAP users (Fein et al., 2013). Their study concluded that the treatment of OSA with CPAP in patients undergoing PVI, improved arrythmia free survival (Fein et al., 2013). They also clarified that for patients with OSA who are not treated with CPAP, PVI is of limited value (Fein et al., 2013).

The Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF), is an outpatient registry for patients who suffer from AF in the US. Holmqvist et al. (2015), conducted a study aimed at assessing whether patients with OSA were more likely to require hospitalizations, had worse outcomes, and progressed to persistent AF. A total of 10,132 patients from 176 different sites were included in their study. They chose 1,841 (18%) patients with OSA for an analysis on CPAP treatment vs no CPAP treatment. After capturing their OSA prevalence rates and CPAP treatment at baseline, the participants were followed for 2 years (Holmqvist et al., 2015). The authors reported that patients with OSA were more likely to be on rhythm control therapy, and had more symptoms than those who did not have OSA (22% vs 16%) (Holmqvist et al., 2015). According to the results of their study, these subjects were also at higher risk of hospitalizations; however, risk of death was similar in both groups. Holmqvist et al. (2015), concluded that patients who were on CPAP therapy, were found to be less likely to progress to persistent AF, than those who were not on CPAP treatment.

This project has the potential to improve outcomes in patients who have AF and undiagnosed OSA, by providing early screening. Early screening can lead to early detection and referral for sleep studies. The first aim of this project was to conduct a nurse practitioner (NP)-lead phone follow-up for OSA screening in patients with implantable cardiac monitors and confirmed or suspected AF. The second aim was to establish a protocol to facilitate OSA screening for these patients, during their first encounter with a provider. The third aim was to suggest a sleep study referral for all patients who scored as high risk for OSA, after screening with the STOP-BANG tool. OSA screening has the potential to improve early identification, referral, and treatment. This is turn can lead to prevention of complications, related to concomitant prevalence of OSA and cardiac rhythm disturbances in this patient population.

Evidence-Base Intervention and Benchmark

There is overwhelming evidence suggesting an association between AF and OSA, yet many patients with cardiovascular disease are not routinely screened for this sleep disorder (Khan et al., 2019). According to Khan et al. (2019), a large number of patients with AF have undiagnosed sleep apnea. In their study, 66% of participants who had persistent AF had never been screened for OSA. After screening was done, they also found that 75% were at high risk (Khan et al., 2019).

The process indicator monitored in this EBP project, was the percentage of patients with AF or suspected to have this arrhythmia, who were also at high risk for OSA. The decision to screen these patients, was made based on evidence found in the literature suggesting that patients who has AF should be screened for OSA, and those who are found to be at high risk should be referred for a sleep study (Goyal & Sharma,

2013; Khan et al., 2019). Some studies reported that OSA is more prevalent in patients who have AF than in the general population, which calls for universal sleep studies in these patients (Anter et al., 2017).

Gami et al. (2004), made a comparison between 151 patients with AF and 312 patients without history of AF, in order to assess prevalence of OSA. According to the authors, there was a higher prevalence of OSA in the group of patients with AF (49% vs 32%, p=0.0004) (Gami et al., 2004). Their study found that these findings were true, even after other risk factors were adjusted such as HTN, age, BMI, and CHF. Based on the authors' reports, patients with AF had double the odds ratio for OSA (Gami et al., 2004). Due to the link between OSA and AF, some studies suggested that patients with AF and other cardiovascular diseases should be screened for OSA and vice versa (Butt et al., 2010). According to Mehra et al., (2006), The Sleep Heart Study conducted an analysis comparing 228 patients with sleep-breathing disorders (SBD) to 338 patients without SBD. Their goal was to assess whether AF, and clinically significant arrhythmias were prevalent in patients with SBD (Mehra et al., 2006). Based on their analysis, subjects with SDB were more likely to have AF, non-sustained ventricular tachycardia, and complex ventricular ectopy when compared to those without SDB (Mehra et al., 2006). They also said that the risk of AF increased with the severity of OSA. According to the authors, when compared to patients without SDB, patients with SDB had four times the odds of AF, almost twice the odds of complex ventricular ectopy, and three times the odds of non-sustained ventricular tachycardia (Mehra et al., 2006).

In this EBP, the goal was to screen as many patients as possible. Sleep apnea screenings were conducted weekly for approximately six months. Patients were called,

and screened for OSA by using the STOP-BANG screening tool. The STOP-BANG screening stool was chosen because it is reliable, and based on clinical characteristics of sleep apnea (Stopbang, n.d). According to Chung et al. (2016), it has a sensitivity of 93% for detecting moderate to severe OSA, 100% sensitivity for detecting severe cases, a negative predictive value (NPV) of 90% in moderate to severe cases, and a NPV of 100% in severe OSA. The STOP-BANG screening tool stands for: snoring, tired, observed, pressure, body mass index >35kg/m2, age >50 years old, neck circumference 16inch/41cm or larger and female or 17 inch/43cm or larger and male, gender male (Stopbang, n.d). It contains eight yes or no questions, and provides scores from 0-8. A score of 0-2 is considered low risk, while a score or 3-4 is measured as moderate risk. Patients who score 5-8 are considered high risk. Other criteria for high risk include: patients who answer yes to two of the four STOP questions (snoring, tired, observed, and pressure) and are male, have a BMI>=35 kg/m2, or have a neck circumference of 17inches/43cm in males, or 16inches/41cm in females (Stopbang, n.d).

The aim of this EBP was to screen these patients for OSA, and assess the prevalence of those at high risk in this patient population. After prevalence was determined, the purpose was to suggest that those who scored as high risk be referred for a sleep study, as recommended by the evidence (Goyal & Sharma, 2013; Khan et al., 2019). Another process indicator included the percentage of patients who are found to be at high risk for OSA, and are also sent for sleep studies by their primary care providers (PCPs). The last process indicator was the percentage of patients sent for sleep studies, who were also diagnosed with OSA. Monitoring these last two process indicators it is planned as the second part of this EBP, projected to start on September, 2020. Part two of

this EBP is anticipated to be conducted by a second year Doctor of Nursing Practice (DNP) student at the University of San Diego (USD). Part two of the project would require follow up with patients' PCPs, as well as patients over the phone. The data would be collected weekly, and projected to be completed in six months to one year.

The outcome indicators included early detection, diagnosis, and treatment of OSA. This was planned to be accomplished by implementing OSA screenings as part of the clinic's protocol, after the results of the project were obtained. This protocol would entail that the STOP-BANG questionnaire be conducted during the first encounter between patients and providers. Establishing screening protocols is a way of providing standardization of care, so that patients with high risk factors are routinely screened for OSA. The long-term goal of this project is to have 100% rates of sleep study referrals for all patients who score as high risk for OSA, within one month of screening. Another long-term goal is to offer counseling and education in the reduction of OSA complications. Counseling and education ideally should be provided to 100% of patients who are refer for sleep studies, within the first month after referral. Education is a great way to include patients in their plan of care, and empower them to take an active role in their own health. The overall outcome this project hopes to accomplish in the future, is a decrease in morbidity and mortality related to the concurrent diagnosis of OSA and AF.

Evidence Based Practice Question (PICO Question)

P: In patients with Atrial fibrillation

I: Does OSA screening by using the STOPBANG tool

C: Compared to not screening

O: Leads to early detection, referral, treatment, and better health outcomes?

Project Plan and Process

The goal of the project was to provide OSA screening to patients with implantable cardiac monitors who are being monitored due to confirmed or suspected AF. The aims of this study were to identify the prevalence of OSA in these patients by using the STOP-BANG screening tool, establish a protocol for early identification of patients at high risk, and suggest sleep study referral for patients who score as high risk. The overall goal was for these patients to be identified and diagnosed early, with the hopes of improving AF outcomes.

Facilitators/Stakeholders

The facilitators and stake holders of this project were the Doctor of Osteopathy (DO) and Cardiologist, Dr. Mehran Moussavian, and the Doctor of Philosophy (PhD) and Family Nurse Practitioner (FNP), Dr. Liza Alvarez. Both providers were involved in monitoring the cardiovascular health and treatment plans of these patients. Another facilitator of this EBP was Dr. Joseph Burkard, who is also the faculty advisor and chair of the project.

Project approval Timeline

The cardiac clinic where the project was implemented is affiliated with Scripps Health; however, it did not require their own Institutional Review Board (IRB). USD required IRB approval for the project. The letter of approval from the clinic signed by Dr. Moussavian, and Dr. Alvarez, was obtained on September 19th, 2018. All required documents were submitted to USD's IRB on September 23rd, 2018, with the assistance of Dr. Burkard. USD's IRB approval was obtained on September 24th, 2018, and modified on September 27th, 2018.

Measures

The STOP-BANG screening tool was used to assess the prevalence of patients at high risk for OSA in patients with an implantable cardiac monitor, and confirmed of suspected AF. This screening tool was chosen due to its high reliability and sensitivity at detection of moderated to severe risk for OSA.

Project characteristics/Setting

This EBP was conducted at a cardiology clinic, and included patients who had an implantable cardiac monitor who were diagnosed or suspected to have AF. The majority of patients were of Hispanic heritage, and spoke English or Spanish. Exclusion criteria included patients who did not speak English or Spanish.

Project Design

The data was collected over a period of six months. These patients were monitored by a Cardiologist or a FNP due to confirmed or suspected AF, or other cardiac arrythmias. The reasons for cardiac monitoring included palpitations, syncope, cryptogenic shock, suspected AF, and AF management. This DNP project is a follow-up of the research project “Early Identification and Intervention in Patients with Atrial Fibrillation Using an Implantable Cardiac Monitor to Significantly Improve Guideline-Based Anticoagulation Therapy in an Outpatient Cardiology Clinic”, conducted at the same clinic and authored by Dr. Lisa Alvarez at Hahn School of Nursing at USD.

The initial patient sample was 271 patients, who’s data was deidentified to protect privacy and confidentiality. These patients were monitored for existing or suspected AF with implantable cardiac monitors at the clinic prior to data collection. These implantable cardiac monitors are placed in patients who have cardiac syndromes such as, arrhythmias.

The monitors were also placed in patients who had transient symptoms including palpitations, chest pain, dizziness, or for AF management. Most of the data was collected retrospectively and included patients' demographics, and reason for cardiac monitoring. The answers to several of the STOP-BANG questions were also collected retrospectively including BMI, history of HTN, sex, and age. The rest of the questions were obtained via telephone calls. These phone calls were conducted on a weekly basis, for the first six months after IRB approval was obtained (October, 2018- March, 2019).

Data Collection Plan and Analysis

The phone calls were conducted between the hours of 9:00 am and 5:00 pm every Wednesday, for six months after IRB approval was obtained. Patients were asked to answers the questions on the STOP-BANG screening tool. Due to the time, and day of the week the phone calls where conducted, it was anticipated that several patients may not answer the phones during the first efforts. For this reason, the phone calls were attempted three times over the course of those six months. The aim was to screen as many patients as possible, with a minimum goal of screening at least 100 patients. Their STOP-BANG responses, and scores were aggregated in an excel spread sheet manually. The percentage of patients who scored as high risk for OSA was then calculated, based on the STOP-BANG tool's criteria. The scores of 100 patients was able to be recorded at the end of the data collection period. The data was analyzed by Microsoft Excel in Oct, 2019, but most of the calculations were done manually. Results were presented to all stakeholder, and facilitators by a power point presentation at the clinic were the project was conducted. This stakeholder presentation took place on January 20th, 2020. A poster power point presentation was conducted at USD on March, 12th, 2020. The abstract and

power point poster presentation for this project were sent to the California Association for Nurse Practitioners (CANP) 43rd annual conference, and was accepted on Sept 16th, 2019.

Barriers/Limitations

One of the limitations of this project included the inability of patients to answer all the questions in the STOP-BANG questionnaire. Only 12% patients knew their neck circumference measures. Another question inquired whether someone had witnessed the patients stop breathing during sleep; the majority could not answer this question. This project may not be able to be generalized to the general population, since the data was collected on a small sample of the population who also had similar demographic characteristics. Another limitation of the project was that all data, scores and percentages calculations were done manually; therefore, subjected to human error.

Other anticipated barriers concerned the implementation of the project. These included resistances to establish OSA screening protocols by the clinic where the project was conducted. Besides the initial OSA screenings conducted as part of this EBP (part one), a screening protocol was not implemented as part of the clinic's guidelines by end of the project. Despite the results, and a suggestion for sleep studies to patients at high risk during the stakeholder presentation, PCPs were not suggested to order sleep studies for these patients at the end of part one of this EBP. Another anticipated barrier, included resistance from patient's PCPs to order the suggested sleep studies for those identified as high risk for OSA. Further studies need to be conducted in order to assess the percentage of patients referred for sleep studies, those with definitive OSA diagnosis, outcomes of treatment and patient education, and overall patients' outcomes.

EBP Model

The model chosen as a guide for the implementation of this project was the Iowa Model of evidence-based practice. The Iowa model is composed of several steps including the selection of a topic, team formation, evidence retrieval and grading, EBP standard development, implementation, and evaluation (Doody & Doody, 2011). The main reason this model was chosen for this EBP, was its emphasis on the use of research evidence to guide practice change. Another reason for its use, was its encouragement for the inclusion of the health care team (including patients) in decision making (Dontje, 2007).

The topic identified as the basis for this project was the prevalence of OSA in patients who have AF. This problem was of upmost priority since there is evidence suggesting an association between OSA and AF, as well as OSA and AF exacerbation. The team included a DNP student at USD, Yarlenis Miranda; a FNP, Dr. Lisa Alvarez; a Cardiologist, Dr. Mehran Moussavian; and the project's chair and faculty advisor, Dr. Burkard. In the development of the plan, the literature was reviewed before and during the project's development and implementation. Once the OSA screening was implemented, the data was analyzed, and the prevalence of patients at high risk for OSA in this cohort was obtained. Part two of the project is projected to begin in September, 2020. This second part of the EBP is intended to assess percentages of sleep study referrals, prevalence of OSA diagnosis, and treatment follow up.

Evaluation of Results

From the data analysis, the scores of 100 patients out of the initial 271 subjects were obtained. These 100 scores were attained after screening phone calls were attempted

three times over the course of six months. The results showed that 63 % of patients were at high risk of having OSA. These results correlated with evidence suggesting that the majority of patients with AF and other cardiovascular risk factors, are not routinely screened for OSA (Khan et al., 2019). From the 63% who score as high risk, 61.90% were men and 38.10% were women. These findings also correlated with evidence suggesting a higher OSA risk in men (Abumuamar et al., 2018). From the percentage found to be at high risk, 25.39% had previously been diagnosed, 4.76% were previously referred for sleep studies, and 69.84% have never been screened or referred for a sleep study. These findings also correlate with evidence suggesting that the majority of patients at high risk for OSA are “falling through the cracks”, and are neither screened for OSA, nor referred for sleep studies (Khan et al., 2019). Untreated OSA can negatively affect these patient’s outcomes. This EBP project also found that hypertension, older age, obesity, and male sex play a role in the increased risks for sleep apnea. Among the screened subjects found to be at high risk for this sleep disorder, 90.48% had a history of HTN, 88.8% were older than 50 years old (median and average age of 62 years old), 55.5% were obese, 30.16% were overweight (average and median BMI were 32.60% and 31.64 respectively), and 61.9% were male. Another observation of the project was that among those who scored as high risk, the most common reason for cardiac monitoring was syncope (33.33%), followed by palpitations (19.05%), suspected AF (19.05%), cryptogenic shock (14.29%), unknown cause (7.93%), and at last the management of existing AF (6.35%). After the data was analyzed, we concluded that the patients at highest risk were males, older than 50 years old, obese, with a history of hypertension and syncope.

The data was displayed as a percentage in graphs and pie charts, since it paints a better picture of the need to screen these patients. The use of percentages makes the results easier to understand, especially for people who are not familiar with other statistical measures or have low literacy levels. Percentages also simplifies the comparison of different values, and quantify the need to establish a screening protocol in this practice. The results were showcased as pie charts and bar graphs. The pie charts simplified the results by showing the relationship between the different criteria, and portraying the percentages as part of a whole picture. The graphs help compared the results of the project while simplifying their understanding. *Figures 1-5* makes is easier for stakeholders, and other members of the staff to understand the overall results of the project.

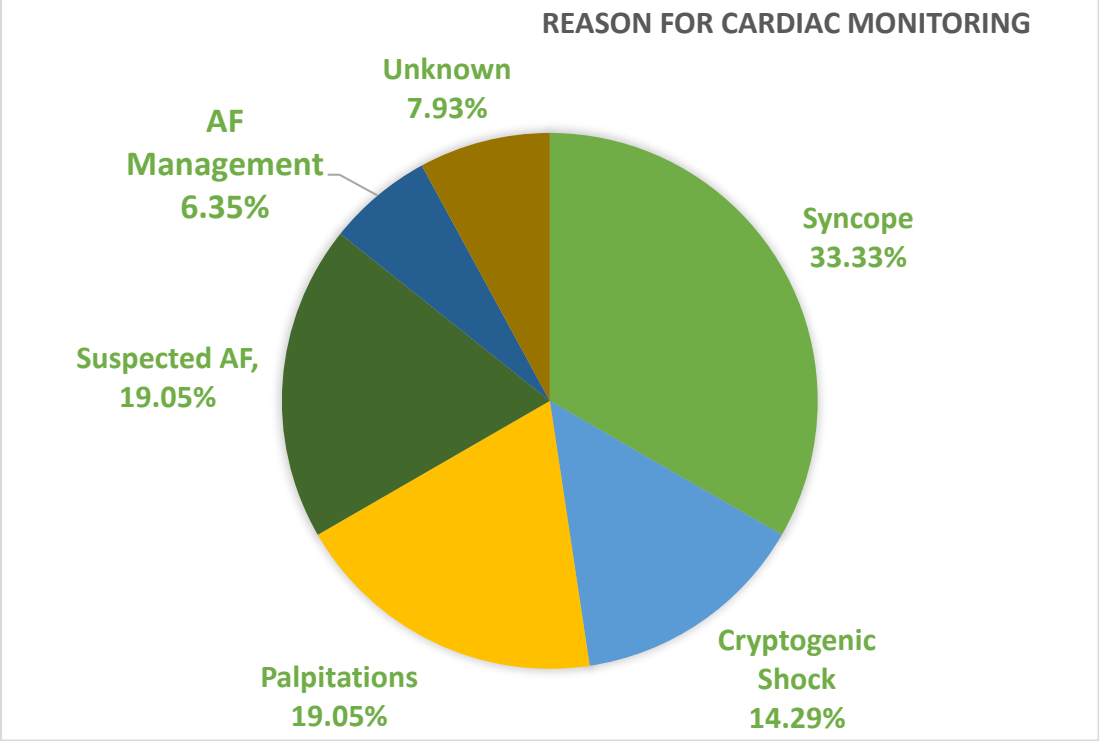

Figure 1. Reason for Cardiac Monitoring

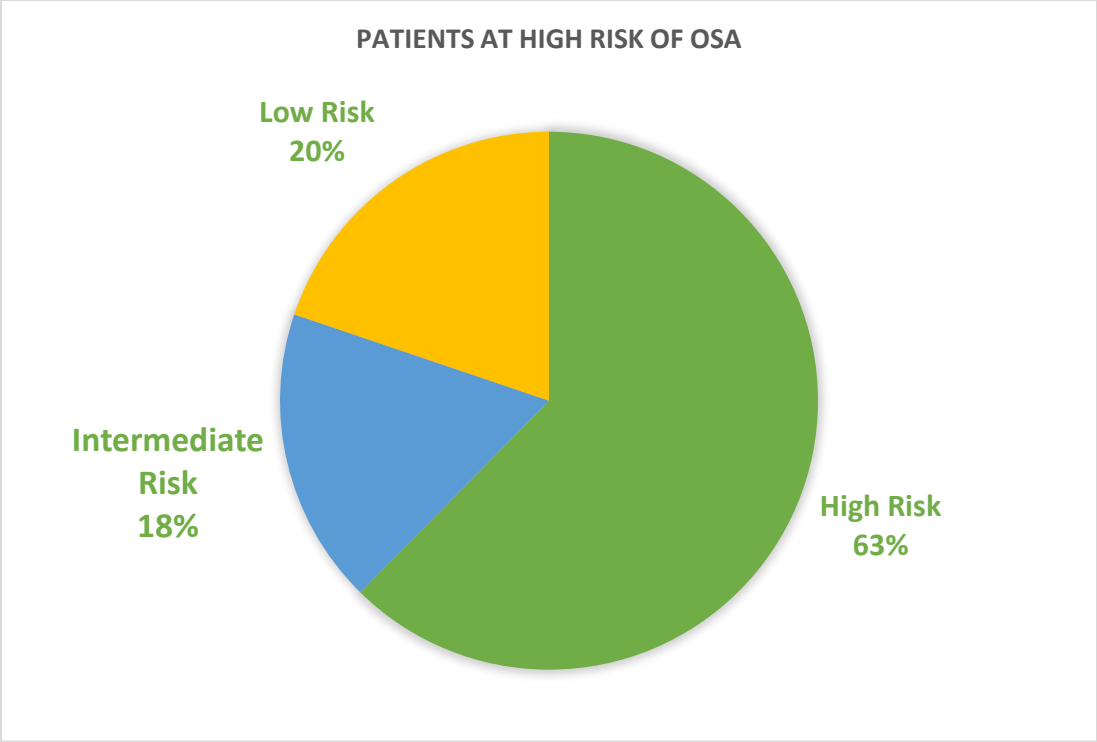

Figure 2. Risk Levels of OSA

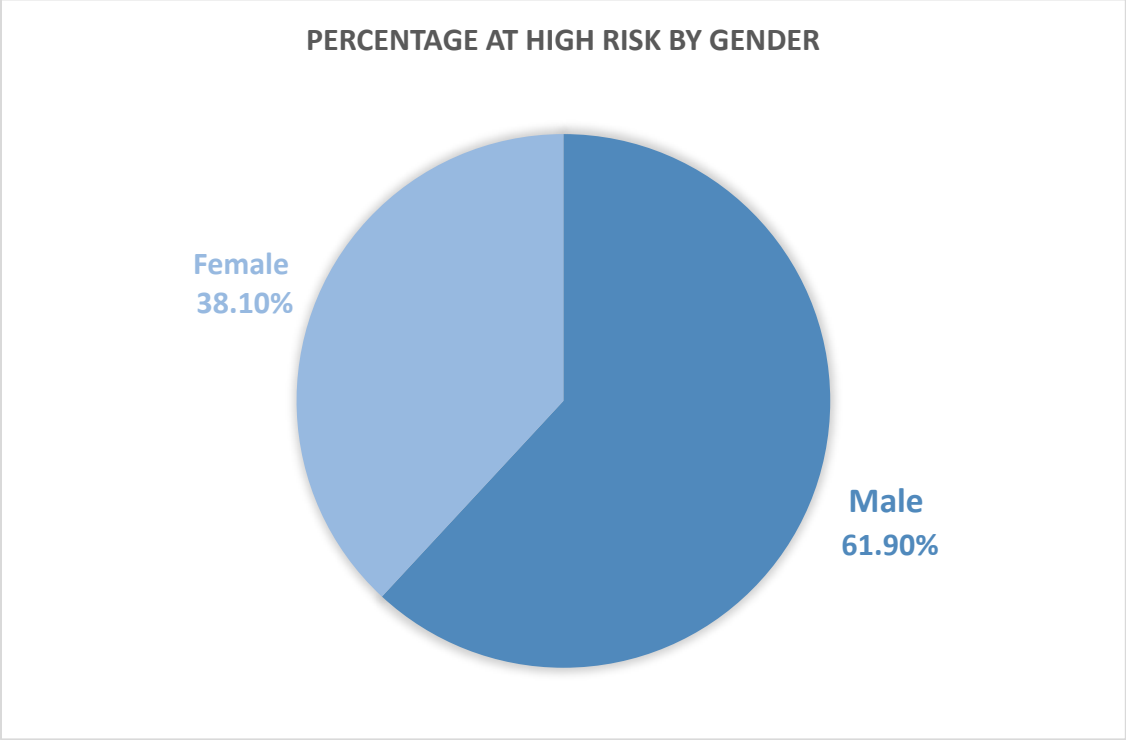

Figure 3. Percentage at High Risk by Gender

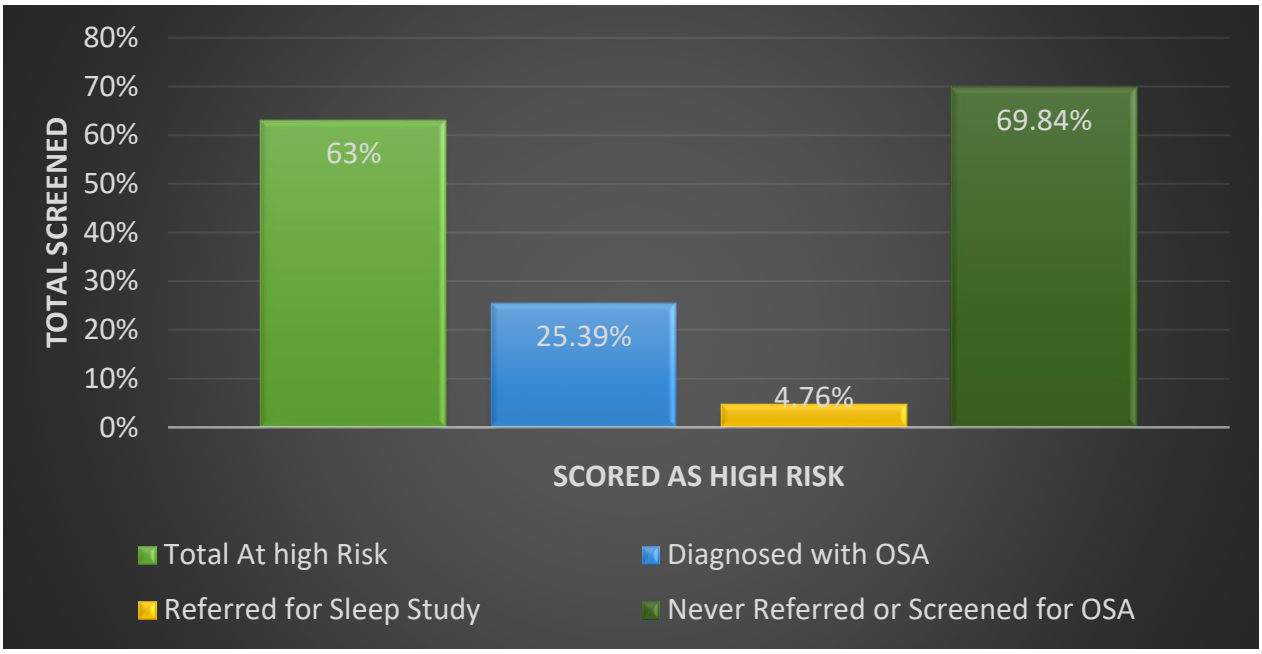

Figure 4: Percentages of Diagnosed, Referred, and Screened

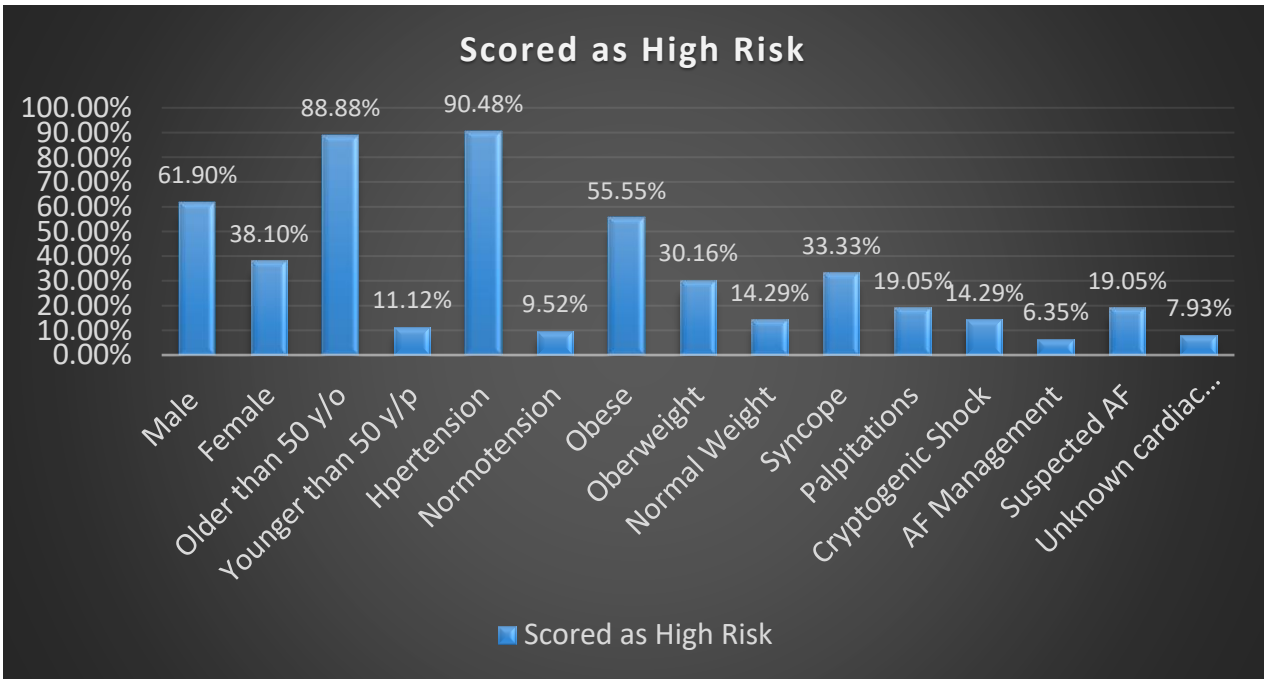

Figure 5: Patients Demographics and Risk Factors

The purpose of this project was to provide early screening of OSA to patients diagnosed with or suspected to have AF, and detect the prevalence of patients at high risk. The long-term goal of the project is for these patients to be screened early, and for

those at high risk to be referred for a sleep study. Early screening and referral can lead to early diagnosis and treatment. Evidence should guide practice, especially when it can make a difference in patients' outcomes. Based on the evidence, early intervention with OSA screening and treatment, can decrease complications associated with this cardiac arrythmia. This in turn can decrease morbidity and mortality in this patient population. This intervention also has the potential of reducing the cost associated with complications of AF for patients, and health care institutions. Cost reduction can provide relief pertaining to burden of disease. It can also improve access to quality health care for those affected.

Cost/Benefit Analysis

According to Knauert, Naik, Gillespie, and Kryger (2015), untreated OSA increases the risk of several conditions including arrhythmias, coronary artery disease (CAD), heart failure, and stroke. The authors said that AF is very common in patients who have sleep apnea, and untreated sleep apnea is a predictor for AF recurrence (Knauert et al., 2015). They also highlighted that patients who have severe OSA, are less likely to respond to therapy with antiarrhythmic drugs. Based on their article, the annual cost of treatment for AF for a single patient is $8705, which accounts for $26 billion annually in the US (Knauert et al., 2015).

Knauert et al. (2015), also reported that patients with OSA are at higher risk of having CAD, with men being at high risk for negative cardiovascular complications (myocardial infarctions) if OSA is not treated. According Knauert et al. (2015), the cost to treat myocardial infarction is $14,000 per patient per year. They explained that this

complication can be prevented with the consistent use of CPAP therapy (Knauert et al., 2015).

Another complication of untreated OSA is the development of ischemic stroke. Knauert et al. (2015), reported that this condition can be attenuated with OSA treatment. They stated that annual cost of treatment for a single patient with stroke ranges from $100,000 - $300,000 (Knauert et al., 2015). Early detection and treatment of OSA can decrease complications associated with concurrent cardiac disease. By decreasing complications, we can make a great difference in reducing the overall cost associated with treatment of these conditions.

Most of the data for this project was collected retrospectively, therefore, there was no cost related to establishing appointments. It required access to a computer, and telephone for the initial data collection. All phone calls were conducted by a DNP student. This step incurred no additional cost to the clinic or the student, other than the time spent calling patients. Training for stakeholders, providers, and staff members would require no additional cost, since this training would be provided during business hours at monthly staff meetings.

According to the American Sleep Association (n.d), the cost of at home sleep studies varies from $100-$500, which is covered by most insurance companies. The American Sleep Association (n.d), also stated that the estimated average price for a CPAP machine is $850. Based on Brannon (2019), CPAP machines are also covered by insurance companies, so long as the patient has paid the deductible.

The hypothetical cost and benefits of the project, based on decrease AF complications alone were estimated on Table 1. These numbers are theoretical, based on

projected costs of materials and information found on two articles (Brannon, 2019; Knauert et al., 2015); further literature review may be needed. The numbers were manually calculated; therefore, subjected to human error.

Table 1: Cost-Benefit Analysis

Resource	Cost	Rationale
Administrative training	$0	OSA screening was be conducted by DNP student weekly.
Provider and Staff training	$0	This training can be provided during business hours, at monthly staff meetings.
Educational Material, 2000 copies X0.10 cents per copy Poster Board	$200 $300	This can include flyers and brochures that could be distributed to patients and staff members, as well as a poster board that will be placed in the clinic's break room.
Sleep Study	$300	This cost is typically be covered by insurance companies.
CPAP machine	$850	This cost is typically covered by insurance companies.
Total	$1,650	Approximate cost of project implementation including cost of sleep study and CPAP treatment.
Benefit	Savings	Rationale
Reduce complication of untreated OSA: Atrial Fibrillation (100 patients x $8,750 per patient per year)	100 patients screened x $8,750 cost of AF treatment per patient per year = $875,000 per year	Untreated OSA increases risk of AF exacerbations, and antiarrhythmic therapy resistance.
Total	$875,000 per year	Approximate annual cost of treatment for complications of OSA.
Intangible benefits	Decrease mortality and morbidity related to OSA complications including AF exacerbations.	
Total Savings	**$848,350 of possible annual savings related to decrease complications of OSA due to early detection, and treatment. ROI= 51,315%**	

Anticipated Project Outcomes

The short-term outcomes include providing OSA screening to 100% of patients with confirmed or suspected AF, within six months of the project implementation. The second short-term outcome is to suggest a sleep study to 100% of patients who score as high risk for OSA, within six months of project implementation. The first long-term outcome is to provide sleep apnea counseling to 100% of patients suggested for a sleep study, within one year of project implementation. The second-long term outcome is to incorporate OSA screening for all patients with AF at their first clinical encounter, within the one year of project implementation. Meeting these outcomes can have a great impact on the management of patients with diagnosed or suspected to have AF, since it can detect risk of OSA, and also the course of treatment.

Implications for Practice

This project has the potential to increase OSA screening in patients with AF or suspected to have AF. Establishing a protocol to screen these patients during the first encounter with a provider can lead to early detection, sleep study referral, and ultimately early treatment. By increasing the percentage of patients with AF who are screened for sleep apnea, the number of AF exacerbations, complications, morbidity and mortality could also be decreased.

Communication Plan

The project's results were disseminated as a power point, and poster presentations. The first step was to present the results to all stakeholders including Dr. Lisa Alvarez, Dr. Mehran Moussavian, and Dr. Joseph Burkard. The stakeholder presentation took place at the clinic on Jan 20th, 2020. Based on the results of the project,

a recommendation was given to the stakeholders. This recommendation advised that patients' who scored as high risk for OSA should be referred for a sleep study; therefore, their PCPs should be notified and advised to issue a referral. The sustainability of the project was discussed with all stakeholders, after the results' presentation. A discussion about the continuation with the second part of the project was conducted with Dr. Lisa Alvarez. The second part of the EBP is anticipated to be carried out by a second year DNP student, who will be selected by Dr. Joseph Burkard.

The project's abstract for poster presentation was submitted to the California Association for Nurse Practitioners (CANP) 43rd annual educational conference. The acceptance letter from CANP for poster presentation was received on September 16th, 2019. This conference was to take place in the county of Riverside on March 18-22, 2020. The manuscript is anticipated to be submitted for publication to the Journal of Clinical Nursing (JCN). This journal is an international and scientific journal that advocates for the development of knowledge applicable to the nursing practice (Journal of Clinical Nursing, n.d). The journal was chosen because it publishes peer-reviewed clinical articles, original research, and issues that help nurse practitioners become better at their practice. It also advocates for meeting practice needs, and it encourages feedback and advocacy. JCN also focuses on the importance of policy and its role in shaping practice outcomes.

Sustainability

The most important step in order to ensure sustainability, is education of providers, stakeholders, and members of the staff at the clinic. There needs to be an emphasis in education regarding the association of cardiac disease and OSA. There is

also a need to highlight the importance of early detection and treatment, and their role in decreasing morbidity and mortality. The second step is to establish a protocol, where patients are screened during their first encounter with their provider. This clinic specializes in the care of patients who have cardiac disease. Screening for OSA during the first encounter will benefit all patients, not just the ones who have AF. In order for the project to be successful, all members of the staff also need to be invested in the project's success, as a way to ensure compliance with the screening protocol. Another way to ensure sustainability, is to alter the electronic health record (EHR), so that patients detected as high risk for OSA are flagged. This step will act as a reminder for providers, so that sleep study referrals are ordered as soon as possible.

The project's champion at the clinic is Dr. Lisa Alvarez. Dr. Alvarez has an interest in monitoring the long-term effects of OSA and AF. As previously mentioned, this project will have a second part that projected to start on September, 2020. This long-term continuation of the EBP will also ensure sustainability. The plan for part two of the project, is to conduct follow up phone calls with patients who were suggested for a sleep study. Compliance with sleep studies, and the percentage of OSA diagnosis can be tracked, and recorded in the data sheet. The plan also entails providing counseling to patients, on ways to reduce risk factors associated with OSA. Providing education to patients is another way to ensure sustainability of project. The main goal is to have a positive impact in the lives of patients, and improve their outcomes.

Conclusion

This project provided information regarding the prevalence of OSA in patients who are diagnosed with or suspected to have AF at a cardiac clinic. The results of this

project showed that 63% of patient that met the inclusion criteria were at high risk for OSA. The majority of those at high risk were males. Other risk factors patients at high risk had in common included a history of HTN, obesity or overweight, and an age greater than 50 years old. The results of this project correlated with evidence that suggested that patient with cardiovascular disease, especially AF, are at risk of having undiagnosed OSA. There are many studies that explained that undiagnosed OSA is among the reasons for AF exacerbations and development of other cardiac arrhythmias. For these reasons, these patients should be screened routinely for OSA. Early identification, referral and treatment may lead to decrease exacerbation of AF, and improved overall quality of life for patients who have coexisting AF and OSA.

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