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Utilizing the STOP-Bang Questionnaire to Assess Risk of Obstructive Sleep Apnea in Hospitalized Patients with Heart Failure to Facilitate Sleep Medicine Referrals Upon Discharge

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By

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Abstract

Background: Obstructive sleep apnea (OSA) is the most common sleep-breathing disorder. Undiagnosed OSA is highly prevalent in the population, especially in those with heart failure. OSA and heart failure combined create a negative feedback loop that can lead to poor clinical outcomes. Unfortunately, many cardiac patients are never screened for OSA.

Purpose: The purpose of this project is to improve screening rates for OSA via the STOP-Bang questionnaire and establish an efficient and effective process for referrals to sleep medicine for heart failure patients screening high-risk.

Methods: The design was a quality improvement project with pre- and post-testing and a retrospective and prospective chart review of patient data. The study took place in the cardiovascular intensive care unit (CVICU) at UK HealthCare over three 30-day phases. The intervention of the study was a nursing education session on the STOP-Bang questionnaire and an automatic warning for a sleep medicine referral for those screening high-risk.

Results: There was no positive effect on screening rates following the education session despite nurses reporting increased knowledge and confidence in administering the tool. The intervention of the discharge warning had no significant effect on referrals to sleep medicine.

Conclusion: There is still more work to be done to address undiagnosed OSA in heart failure patients. Although reported knowledge and confidence increased following the education session, screening rates were not positively affected. Addressing the barriers to screening for OSA needs to be done to get as close as possible to all patients being screened. The automatic discharge warning did not improve referral rates despite many patients screening high-risk. Future interventions should incorporate provider involvement, address screening barriers, and expand the automatic warning to more patient populations within the hospital setting.

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Dedication

I would like to dedicate this project to my husband, Jason Mitchell, who has always encouraged and supported me. It is a dream come true to finally reach this milestone and there is no one I would rather celebrate it with. Thank you for believing in me and having the patience to stand by me throughout my long academic career. I will never forget it was your encouragement that I needed to push me to apply for nursing school in the first place. I was scared to fail, but you knew better and helped to guide me along the way. Thank you for being the best husband and father. I love you.

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Background and Significance

Problem Statement

OSA is the most common sleep-breathing disorder and is defined by recurrent episodes of apnea and hypopnea (Hwang et al., 2021). The obstruction associated with OSA occurs due to weight from the neck and upper chest compressing the airways during sleep (American Academy of Sleep Medicine, 2020). The episodes of breathing cessation occur repeatedly during sleep and can last for over 10 seconds (Piamjariyakul et al., 2021). Central sleep apnea, a less common type, stems from a neurological failure of the brain to send the appropriate signals to conduct respiration (Piamjariyakul et al., 2021). It is estimated that at least 50% of those with heart failure have either one type of sleep apnea or a combination of both; even more may remain undiagnosed (Kasai et al., 2011). Although there are differences between the two types of sleep apnea, the negative effects on quality of life remain the same (Gullvåg et al., 2019). Polysomnography is the gold standard for diagnosis of sleep apnea but can be difficult to access as a referral to sleep medicine is needed and involves overnight monitoring with sleep studies. Additionally, many patients are never identified as being at high-risk for sleep apnea as screening rates are low.

Context, Scope, and Consequences of the Problem

Undiagnosed OSA is highly prevalent in the population, especially in those with cardiac conditions, such as heart failure. It is estimated that 15-30% of males and 10-15% of females in North America have OSA (Kline, 2023). Additionally, according to Rundo (2019), the majority of those with OSA remain undiagnosed. OSA is highly associated with obesity, and the prevalence may be increasing as the obesity pandemic continues to rise (Kline, 2023). Risk

factors for OSA include advanced age, male gender, obesity, and craniofacial or upper airway abnormalities (Kline, 2023).

The consequences of undiagnosed OSA in heart failure patients include increased risk of poor clinical conditions such as HTN, arrhythmias (including atrial fibrillation), and MI (Piamjariyakul et al., 2021). Frequent episodes of apnea and hypopnea increase awakenings throughout the night. OSA puts strain on the heart by increasing incidents of hypoxia, arrhythmias, intrathoracic pressure, vascular inflammation, sympathetic nervous system activation, and metabolic disturbances (Pearse et al., 2016; Yaggi et al., 2016). All of these factors contribute to an increased workload on the heart (Piamjariyakul et al., 2021). It is estimated that between 30 and 70% of those with OSA also have HTN (Ravichandran et al., 2023). Those with combined heart failure and sleep apnea have an increased risk of CAD and sudden cardiac death (Piamjariyakul et al., 2021). Not surprisingly, those with sleep apnea have greater odds of developing heart failure according to the Sleep Heart Health Study (Azarbarzin et al., 2020). The risk is even greater in those with untreated sleep apnea (Jennum et al., 2016).

Current Evidence-Based Interventions

Currently, screening for OSA is often missed at UK HealthCare, though the STOP-Bang questionnaire is readily available in the electronic medical record (EMR). The STOP-Bang questionnaire is widely recognized as a validated tool as it has a high sensitivity and specificity rating, both >90% (Yeghiazarians et al., 2021). Although the questionnaire is a required component of the admission work-up for all adult patients at UK HealthCare, this step is often missed. Since the evidence shows that many people with sleep apnea may be going undiagnosed, it is important to screen for the condition.

Heart failure patients are a special population that should be assessed for OSA due to their increased risk of the condition and the negative consequences of not receiving treatment. Currently, there is no established process for notifying providers of a patient's risk of sleep apnea, even if they are screened. The literature shows that screening for OSA alone is not enough; a comprehensive process for getting patients who screen high-risk for OSA to be evaluated, diagnosed, and treated is recommended.

Purpose

The purpose of this project was to identify patients with heart failure who are at high-risk of OSA and provide them with sleep medicine referrals at discharge. Once patients are identified as being high-risk for OSA via the STOP-Bang questionnaire, an automatic warning in the EMR will prompt providers to order a sleep medicine referral upon discharge.

Objectives

1. To increase STOP-Bang questionnaire screening rates for heart failure patients admitted to the CVICU following the nursing education session.
2. To increase sleep medicine referrals at discharge for heart failure patients in the CVICU screening high risk for OSA (STOP-Bang total score ≥ 5) following the intervention of the automatic discharge warning.

Review of Literature

Review and Synthesis of Evidence

The databases used for the literature review were PubMed and CINAHL. Inclusion criteria was being published within the past 10 years, written in English language, and from academic journals. The search was focused on adult populations with heart disease. Studies excluded were those greater than 10 years old and including pediatric populations. Key words included “Obstructive sleep apnea” “OSA” “sleep apnea” “disordered sleep” AND “heart failure” “heart disease” “cardiovascular” OR “screening” “STOP-Bang” “referral” “consult” “sleep medicine” “polysomnography” “sleep study” “CPAP” “positive airway pressure” AND “outcomes” “quality of life” “benefits.” Preference was given to higher levels of evidence such as meta-analyses, although varying levels were included. A total of nine studies were included in the literature review.

There is strong evidence to support the use of the STOP-Bang questionnaire as a validated screening tool for OSA. The evidence supports the screening tool in use due to its high sensitivity for detecting OSA and high prevalence of undiagnosed sleep apnea in the population (Yeghiazarians et al., 2021; Hwang et al., 2021; Oh et al., 2019). The American Heart Association recommends screening for OSA and for patients with class II-IV heart failure and suspected OSA to receive evaluation via formal sleep assessment (2021).

Although risk awareness can lead to patients seeking care and treatment from sleep medicine providers, the literature supports that screening for OSA alone is not the best practice (Mackey, 2022). A comprehensive approach that involves screening and evaluation by sleep medicine providers is recommended (Henry et al., 2022; Yeghiazarians et al., 2021; Mackey,

2022). A sleep medicine referral for those who screen high-risk for OSA will provide them with proper evaluation, diagnosis, and treatment, if needed.

Typical treatment for those with moderate-severe or severe OSA includes positive airway pressure (PAP) during sleep. For those who have combined heart failure and OSA, receiving PAP has been shown to significantly reduce mortality and improve quality of life (Yeghiazarians et al., 2021; Yamamoto et al., 2019). Quality of life is improved in many ways with treatment, including reduced snoring, reduced daytime sleepiness, and better mood and health related outcomes (McEvoy et al., 2016). The use of effective continuous positive airway pressure (CPAP) can also improve vascular risk associated with OSA (Yaggi et al., 2016). Research has shown that treatment with CPAP can reduce blood pressure, improve insulin sensitivity, and reduce cardiovascular complications and death (McEvoy et al., 2016). However, the benefits of CPAP therapy are only realized with adherence to treatment, which can be difficult for some.

The literature showed that untreated OSA has many negative consequences that affect more than an individual's sleep quality. Without treatment, the quality of life for those with heart failure can be negatively impacted. The frequent disruptions in sleep that are associated with OSA can have both acute and chronic physiological consequences (Yeghiazarians et al., 2021). Disturbances related to physical capacity and mental faculties, such as concentration, can be affected (Gullvåg et al., 2019). Excessive daytime sleepiness can negatively impact cognition as it affects memory, attention, executive functioning, and mood (Lal et al., 2021). Additionally, excessive daytime sleepiness can pose a major safety concern for those operating motor vehicles and can also impair productivity (Lal et al., 2021).

Although there was strong support for the STOP-Bang questionnaire in the literature, there are still other screening tools available to screen for OSA such as the Epworth Sleepiness

Scale. The STOP-Bang questionnaire was selected for this project as the literature showed its high rates of sensitivity and specificity, both of which are important factors to consider with a screening tool.

Current Practice Gaps

Current practices at UK HealthCare include administering the STOP-Bang questionnaire during the admission work-up. For many patients, however, this screening is not completed. Additionally, there is no process in place to notify providers of a patient's score based on the STOP-Bang questionnaire; patients who screen positive are not likely to receive follow-up care based on their score. Many providers are unaware of the screening tool in the EMR and have no formal guidance on what to do with the results. The sleep medicine department at UK HealthCare reported that they do not receive many referrals based on inpatient admissions. Additionally, they report a high rate of "no-shows" for the referrals they do receive.

Being in the hospital setting is an opportune time to capture patients that have undiagnosed OSA and to connect them to the resources they need upon discharge. OSA is a condition that often goes undiagnosed and can worsen outcomes, especially for those with heart failure (Yeghiazarians et al., 2021). The evidence supports screening patients for OSA via the STOP-Bang questionnaire and providing referrals to those who screen high-risk to sleep medicine. The proposed intervention of the automatic warning would efficiently notify providers of patients needing sleep medicine referrals at discharge.

Theoretical Model

The theoretical model used to guide this DNP project was the Lewin's 3-stage model of change (Figure 2). Lewin's model includes three stages of change that can occur on a macro or

individual level. The stages include unfreeze, movement, and refreeze. Prior to implementing a change, the unfreeze stage is a time dedicated to reconciling issues with the old processes and building positive attitudes toward the new changes (Tracy, 2020). During this time, communication regarding why the change is needed is vital to the success of its implementation. The advantages of the change need to be emphasized and those involved need to work to build "driving forces" (Tracy, 2020). It is also important to identify resistance during the unfreeze stage and to address barriers prior to implementation. Training for the upcoming change takes place in the unfreeze stage.

The movement stage occurs with implementation of the new change and is most successful with open communication throughout the process. Once implemented, the old processes should no longer be used to help the team transition to the new method. A resource person should be identified to help team members with the new changes throughout the process (Tracy, 2020). The team is encouraged to celebrate success to reinforce positive attitudes and promote acceptance. The refreezing stage takes place after implementation and involves evaluation of the new change. Communication is important throughout all stages to help address resistance and barriers and to increase positive attitudes.

The Lewin's 3-stage change model was used to guide this DNP project throughout its implementation. During the unfreeze stage, current practices for OSA screening were observed. In the movement stage, education for staff focused on why screening heart failure patients for OSA was needed and how to screen with the STOP-Bang questionnaire. Nurses were able to report their thoughts on the practice change and identified barriers. The refreezing stage involved evaluating the screening and referral process for effectiveness.

Methods

Design

The design of this study was a quality improvement project, with pre- and post-testing via REDCap surveys and a retrospective and prospective chart review of patient data. Retrospective data was collected for one month prior to the "go live" date of the EMR automatic discharge warning. Retrospective data was compared to intervention data prior to education over a month and for a month after education was provided to nursing staff. The nursing surveys were used to evaluate knowledge, confidence, and perception of barriers in administering the STOP-Bang questionnaire.

Sample

The study sample included adult patients with heart failure admitted to the CVICU during the time periods of phase 1: July 1, 2023 – July 30, 2023 (prior to the "go live" of the discharge warning), phase 2: August 1, 2023 – August 30, 2023 (after the "go live" of the discharge warning), and phase 3: October 18, 2023 – November 16, 2023 (after the nursing education session). Patients excluded from the study included those under the age of 18 and those with a history of OSA. The participants for the nursing educational session survey included nurses working in the CVICU during the project and who attended the CV Council meeting on October 17, 2023.

Setting

The practice change took place at UK Albert B. Chandler Hospital in Lexington, KY. The agency provides acute care services to the region, including advanced heart failure therapies. The mission at UK HealthCare is to stay committed to academic health care that focuses on research, education, and clinical care. The agency provides advanced care to patients and strives

to improve health care delivery. Their stated vision is to create a healthier Kentucky and their values include diversity, innovation, respect, compassion, and teamwork.

The proposed practice change aligns with the agency's mission of fostering an efficient process for health care delivery by connecting patients at high-risk of OSA with the care they will need at discharge for further management. The goal of the project was to improve patient outcomes by helping patients with undiagnosed OSA get the treatment they need to improve their health. The project's intended outcomes are in line with the agency's mission to create a healthier Kentucky.

The collaborators for the project include the heart failure team at UK HealthCare and those within the sleep medicine department. This includes providers, nurses, and ancillary staff involved on those teams. Hospital administrators have an interest as well, because they will see the financial impacts of the project. Outside sleep medicine clinics are potential partners for the project as external referrals can be ordered.

There are many facilitators to support this project. The chief of cardiology, Dr. Vincent Sorrell, supports this project and has approved the practice change. Dr. Pasha with pulmonary and sleep medicine has also given support. The EPIC/IT team at UK HealthCare helped to build the warning in the discharge summary that will facilitate the referral process. The clinical nursing educator in the CVICU, Dr. Linda Clements, has been instrumental in gaining approval for the warning to be added to the EMR. CCTS services have been used to help collect the data for this project.

Obtaining buy-in from nursing staff was a barrier during the implementation phase. The success of the project was contingent on nurses completing the STOP-Bang questionnaire. Although the screening takes less than a minute to complete, it was often left blank. The

screening tool is a required component of the admission process and is available in the "Navigators" tab on the EMR. Staff education focused on acquiring support from nurses and to address perceived barriers to administering it.

Procedure

IRB approval was obtained for this project (Appendix E). The instrument used for this project was the validated and widely accepted STOP-Bang questionnaire. The screening tool measures the risk of moderate-severe OSA. For patients screening high-risk of OSA (total score ≥ 5), a warning was triggered in the discharge summary for providers to order a sleep medicine referral. This warning was only populated for patients whose primary team was cardiology. Patients with a history of OSA would not trigger the warning. Approval for the implementation of this automatic warning was obtained by Dr. Vincent Sorrel, the acting Chief of Cardiovascular Medicine at UK HealthCare.

Data was collected on participants included in the study over the period of a month prior to implementation of the intervention (July 1, 2023 – July 30, 2023) and compared to results over a month once the intervention was implemented (August 1, 2023 – August 30, 2023) and for a month following the nursing education session (October 18, 2023 – November 16, 2023).

Education was provided to nursing staff on the STOP-Bang questionnaire to determine if that increased rates of screening for OSA. The nursing education session took place on October 17, 2023. The education was conducted with a PowerPoint Presentation via a Zoom session. Data collected via chart review helped determine if the targeted education to nurses in the CVICU influenced screening and referral rates. The pre- and post-testing was conducted to assess knowledge, confidence, and perceived barriers of nursing staff on the STOP-Bang questionnaire (Appendix D). The pre-test was available for two weeks prior to the education

session and was sent via email to all CVICU nursing staff. The post-survey following the education session was open for two weeks and was sent via email to all CVICU nursing staff. The survey was conducted via REDCap software. The surveys used were not a standardized tool as the education session was created specifically for this project. The questions on the survey were tailored to the education session provided to nursing staff.

Over the three-month period, the data collected from the chart review included demographic data, STOP-Bang questionnaire responses and total score, and if they received a sleep medicine referral at discharge. The data was used to provide information on the effectiveness of the automatic warning on referrals to sleep medicine. The data from the chart review was collected by CCTS and sent de-identified to the primary investigator for analysis.

Data Analysis

SPSS was the software used for statistical analysis. For the pre- and post-testing, frequency distributions were used to describe the results. There were not enough respondents to effectively compare pre- and post-testing with matched data sets for any statistical significance. Frequencies were calculated for the chart review to describe the population and their screening scores. Chi-square testing was used to determine significance in the data collected from the EMR for patients included in the study. This statistical test was done to see if there was an association between any of the co-morbidities included in the study and screening high-risk for OSA. Chi-square testing was also used to determine if there was a significant difference between the three phases for screening and referral rates.

Results

CVICU Nursing Education Session Results

The CVICU nursing survey was completed by 25 participants, with 19 of those completing the pre- survey and 6 completing the post-survey. Only three surveys were matched as the same participant taking both the pre- and post-survey. Demographic data was collected with the pre-survey (Table 1). The age of participants ranged from 23-48 years, with an average age of 31. The highest level of education completed by participants ranged from an associate's degree to a doctorate. The majority of participants had a bachelor's degree (78.9%). Most participants had been a nurse or worked in the CVICU as a nurse for less than five years. Only 5.6% of participants had worked in the CVICU for more than 10 years.

The rating for familiarity with the STOP-Bang questionnaire increased following the education session from 31.6% to 66.6%. Participants reporting that they knew how to screen for OSA increased from 47.4% to 100% following the education session. Participants reporting that they knew the STOP-Bang questionnaire was a required component of the admission process increased from 68.4% to 100%. All participants reported knowing that the STOP-Bang questionnaire screened for OSA prior to the education session; however, this information had to be included in the nursing survey cover letter as a requirement of the IRB. All the participants reported that untreated OSA can lead to worsening heart failure on the pre- and post-survey. Participants' knowledge on a score of 5 or higher being positive for screening high-risk of OSA increased from 94.7% to 100% following the education session. The majority of participants reported that they agreed or strongly agreed that completing the STOP-Bang questionnaire was important to patient care. Following the education session, all participants agreed that heart failure patients should be screened for OSA and that those who screen high-risk should be

referred to sleep medicine at discharge. Confidence in administering the screening tool increased from 5.3% to 33.3% for those who strongly agreed.

The most frequently reported barrier to administering the STOP-Bang questionnaire was knowledge about the screening tool and where to find it in the EMR. Patient status was the next most reported barrier. Other barriers identified were completing the neck circumference measurement, having too many other nursing responsibilities, and feeling as though it is not always appropriate to complete for night shift admissions.

Chart Review

A total of 175 patients were included in the study. Of those, 53 were in phase 1 (07/01/23-07/30/23), 60 were in phase 2 (08/01/23-08/30/23), and 62 were in phase 3 (10/18/23-11/16/23). The majority (66%) were male and 34% were female (Table 2). The age of patients ranged from 27 to 92 years, with a mean of 62 years. Most were white (89%). Only 6% were Black or African American and 4% were all other races. BMI ranged from 15 to 56, with a mean of 28. The most common co-morbidities in the sample were HTN (88.6%), CAD (74.3%), and diabetes (54.3%) (Table). For the co-morbidities examined (atrial fibrillation, diabetes, HTN, CAD, pulmonary HTN, and MI), none showed a significant association with screening risk for OSA (p values: 0.190, 0.191, 0.906, 0.961, 0.428, and 0.287) (Table 5).

Screening rates for phase 1 were 58.5%, phase 2 were 71.7%, and phase 3 were 58.1%. There was no significant difference between the phases for screening (p value: 0.219) (Table 3). Of the 175 patients included in the study, 110 were screened. Of the 110 screened, 23.6% had a total score on the STOP-Bang questionnaire of 5 or greater. Only 3.8% of those scoring high-risk for OSA received a sleep medicine referral at discharge. The rate of referrals for those screening

high-risk was not significant between the phases (p value: 0.354) (Table 4). Only one patient received a sleep medicine referral out of the 26 who screened high-risk.

Discussion

As this project highlights, there was a significant number of patients with heart failure who screened high-risk for OSA. This finding relates to the information found in the literature of there being many people in the population who may have undiagnosed untreated sleep apnea. There is still a gap that exists in getting patients who screen high-risk for OSA to be evaluated by sleep medicine. For patients with heart failure, not being treated for OSA can worsen their condition. The objectives of this project were not met, as screening rates did not increase after the nursing education session and referrals to sleep medicine remained low for patients who screened high-risk.

Nevertheless, this project has impacted the clinical setting, as nursing staff reported increased knowledge about the STOP-Bang questionnaire and greater confidence in administering it. There are still barriers preventing the completion of the questionnaire such as patient status and having too many other nursing responsibilities. It is a requirement for the STOP-Bang questionnaire to be completed within 24 hours of admission; however, many patients are critical upon arrival to the unit, and nurses must prioritize patient care. Many patients in the CVICU are sedated and intubated and are unable to answer the questions; additionally, family members may not be present at the bedside. These barriers often lead to not completing the screening tool within 24 hours, if at all. Due to the identified barriers, nurses were educated that the screening generally takes less than a minute to complete and can be administered when

patient status improves. It would be better to administer the screening tool later than to not complete it at all.

Plans for Sustainability

The automatic warning in the discharge order set for adult patients whose primary team is cardiology will continue to exist in the EMR at UK HealthCare. Getting this automatic warning implemented has impacted the site, as it will continue to notify providers of patients screening high-risk for OSA and prompt them to order a sleep medicine referral at discharge. Sustainability for this project in the future is maintained by the automation of the screening and referral process within the EMR. Since undiagnosed OSA has a high prevalence within the population at large, it is suggested to expand the automatic warning for all adult populations at UK HealthCare.

Implications for Practice, Education, Policy, Research, and Finance

Implications for future research include evaluating barriers to patients getting sleep medicine referrals and treatment. It will be important for future studies to assess provider knowledge and perceptions related to untreated OSA. A concern identified by Dr. Pasha with the pulmonary department at UK HealthCare was the high rate of no-showed appointments for patients who were referred from the inpatient setting. Barriers related to patients making it to their sleep medicine appointments. Additionally, adherence to treatment for OSA with CPAP can be a common problem (Yaggi et al., 2016). There are many steps involved to get patients evaluated and treated for OSA; future research could look at the many barriers along the way to help close this gap.

Future research should involve technology, such as at home testing for detection of OSA. The WatchPAT device is available for at home testing and can be used in the hospital setting.

The device could help streamline a diagnosis for OSA and is much cheaper than traditional testing with overnight polysomnography; it is estimated to cost $99 (Kenny et al., 2016) The WatchPAT device has been validated in comparison to results achieved with polysomnography (Kenny et al., 2016). Although overnight polysomnography is the gold standard for diagnosing sleep apnea, there are many downsides to this practice including limited resources, high costs, long waiting lists, and reluctancy to do overnight testing by patients (Kenny et al., 2016). Future research should examine the cost-benefits related to at home testing and hopefully strengthen its use in practice. For the WatchPAT device, a sleep medicine provider will need to read the report and evaluate the patient in clinic. Building relationships with these providers is essential to addressing undiagnosed OSA and will require a collaborative effort.

Education for nurses on the STOP-Bang questionnaire should be continued for both incoming and current nurses. This education is usually excluded from nursing orientation and may be a contributing factor to low screening rates. Since it is a requirement to screen all adults admitted to UK HealthCare for OSA, it is recommended to include information on the STOP-Bang questionnaire during orientation.

There is support from UK HealthCare from a policy standpoint as it is currently a requirement to screen all adult patients admitted to the hospital for OSA. The STOP-Bang questionnaire can be administered in the outpatient setting as well. Screening for OSA should be done more routinely, especially in primary care and cardiology offices. Local and national attention should be brought to undiagnosed OSA as it is estimated to affect many Americans and has negative health and cost-related outcomes.

Cost Implications and Cost Benefit

There were no extra costs identified with implementing this project as only resources available were used. The screening tool and automatic warning were implemented within the EMR (EPIC) at UK HealthCare. The education session took place via a Zoom session during a planned staff meeting. For patients referred to sleep medicine due to the screening process, additional costs related to those appointments may arise. The pulmonary/sleep medicine department at UK HealthCare may see an increase in revenue related to additional referrals. Although this project did not yield an increase in referrals, it has the potential to do so in the future.

The cost of untreated OSA nationwide is estimated to be $3 billion; this figure accounts for costs directly related to medical care (Yaggi et al., 2016). Untreated OSA contributes to increased medical costs related to co-morbidities, increased hospitalizations, and mortality (Yaggi et al., 2016). When considering factors in addition to medical costs, another study estimated the total burden of untreated OSA to be $149.6 billion nationwide (Watson, 2016). This figure was estimated in 2015 and is likely much higher now when considering inflation. The factors contributing to high costs are related to co-morbidities, mental health consequences, workplace related accidents and/or loss of productivity, and motor vehicle accidents (Kunisaki et al., 2016).

Early diagnosis and treatment of OSA could help alleviate the high costs associated with the condition (Alakörkkö et al., 2023). The cost-benefit of treating OSA with CPAP compared to no treatment is astounding. CPAP therapy contributes to an estimated $24,000 per life year gained and $16,000 per quality of life year gained (Watson, 2016). Treating every person with OSA in the United States would cost around $49.5 billion but is estimated to save $100.1 billion

(Watson, 2016). The savings and health-related benefits of treating OSA show how important it is to address undiagnosed OSA.

Translation of Findings

The translation of findings for this project were shared via public oral presentation on April 8, 2024. In addition, the written findings were uploaded to UKnowledge. Once published on UKnowledge, the project paper can be searched for and read by the public.

Limitations

A limitation of this study was low participation in the nursing survey. Many respondents to the pre- survey did not complete the post-survey, even though there was high attendance at the education session. Only three pre- and post-surveys could be matched as the same participant. This limitation affects evaluation of the educational session as it makes it difficult to compare and analyze individual responses. With a low participation rate in the survey, it limited the analysis as it would not yield significant results.

There were very low rates of referrals for patients who did screen high-risk for OSA. With the unexpectedly low referral rate, potential barriers could have been related to knowledge about the warning or technical limitations. The automatic warning was only approved for patients whose primary team was cardiology, which could have been a contributing factor. Joy Coles, APRN with the heart failure team stated that the providers did not see the warning populate during the discharge planning, even for high-risk patients. This potential barrier will be investigated to see if there are any technical issues with the automatic warning that could explain the low referral rates.

Further limitations include a low sample size and specific population with results that could not be generalized to the population at large. The study focused on patients admitted to the intensive care unit and included those with a heart failure diagnosis. Many patients in the study likely had advanced heart failure and only represent a small portion of the general population. If this study was implemented on another unit, the results would likely vary. Additionally, screening rates may have been higher on units with lower acuity since patient status was a commonly reported barrier in the CVICU.

This study was limited by only involving nursing staff. Cardiology providers should have been included in the design of the study, which could have made a difference in referral rates. An education session for providers on the automatic warning should have been conducted. Evaluated provider knowledge and perceptions would have been beneficial for the study.

Conclusion

In conclusion, the results of the project showed that there is still more work to be done to address undiagnosed OSA in heart failure patients. Although reported knowledge and confidence increased following the education session, screening rates were not positively affected. A little over half of the patients included in the study were screened following the education session. More work to address barriers needs to be done to get as close as possible to all patients being screened for OSA. The automatic warning did not yield any improvement in referral rates despite many patients screening high-risk for OSA. The data showed that although many heart failure patients screened high-risk for OSA, there is still a gap that exists in connecting them to sleep medicine providers for further evaluation. Future interventions should incorporate provider involvement, address screening barriers, and expand the automatic warning to more patient

populations within the hospital setting. Screening, alone, is not enough; patients who are identified as being high-risk for moderate-severe OSA need to be evaluated and treated by sleep medicine providers to receive the health benefits associated with CPAP therapy. A comprehensive and collaborative approach is needed to accomplish this goal.

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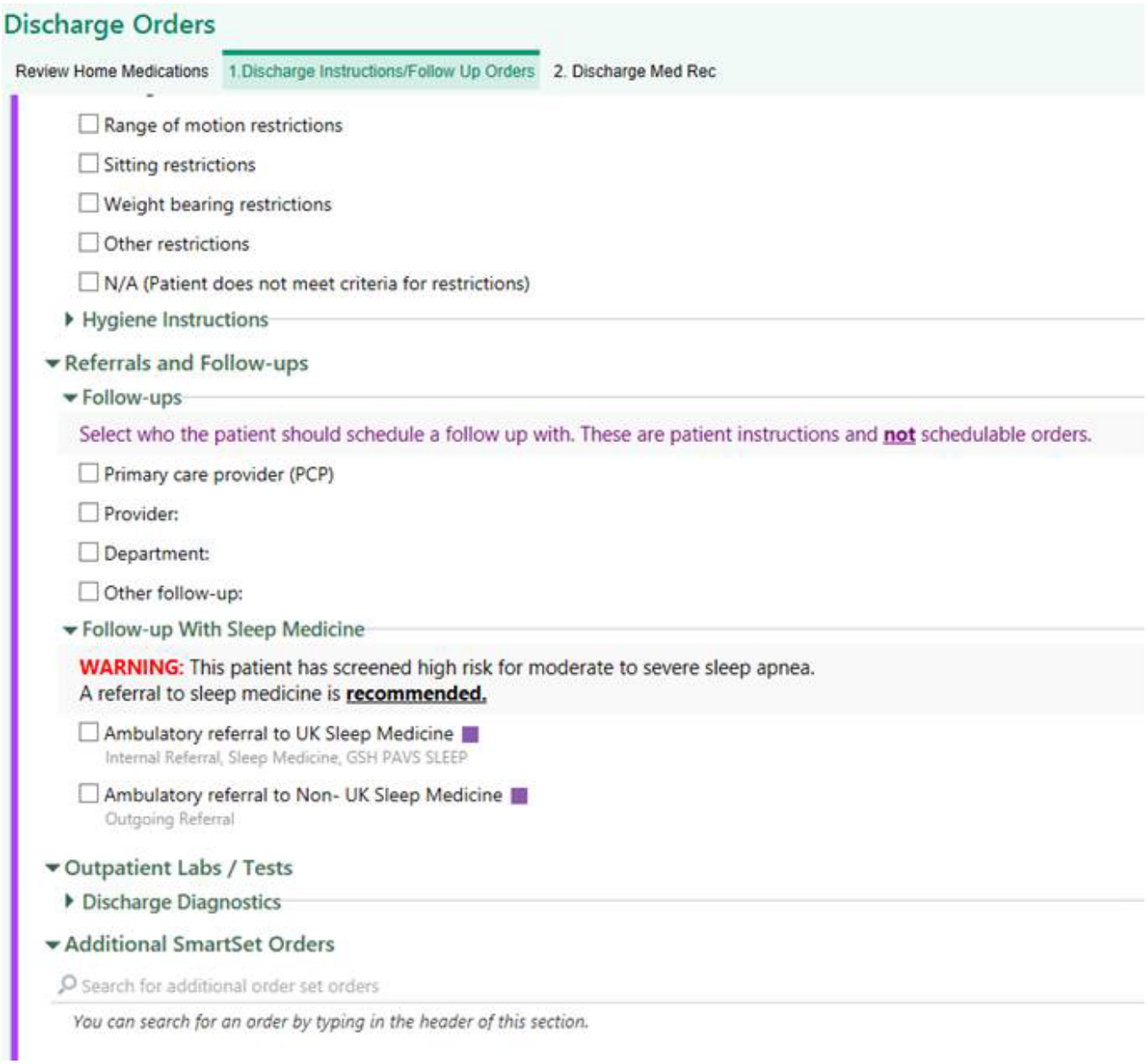
List of Appendices

Appendix A. Discharge Warning for Sleep Medicine Referral



Appendix B. STOP-Bang Questionnaire

STOP		
Do you **S**NORE loudly (louder than talking or loud enough to be heard through closed doors)?	Yes	No
Do you often feel **T**IRED, fatigued, or sleepy during daytime?	Yes	No
Has anyone **O**BSERVED you stop breathing during your sleep?	Yes	No
Do you have or are you being treated for high blood **P**RESSURE?	Yes	No

BANG		
BMI more than 35kg/m2?	Yes	No
AGE over 50 years old?	Yes	No
NECK circumference > 16 inches (40cm)?	Yes	No
GENDER: Male?	Yes	No

TOTAL SCORE		

High risk of OSA: Yes 5 - 8

Intermediate risk of OSA: Yes 3 - 4

Low risk of OSA: Yes 0 - 2

Appendix C. CVICU Nursing Survey Cover Letter

CVICU Nursing Survey

You are being contacted to participate in a UK HealthCare DNP project research survey. The purpose of this survey is to collect data on nursing knowledge and perceptions regarding the STOP-BANG questionnaire. The primary objective of the study is to better understand nursing knowledge related to the screening tool and perceptions on administering it. Although participants may not gain personal benefit from completing the survey, answers provided will give better insight into the screening process of heart failure patients in the Cardiovascular ICU at UK HealthCare. Increasing nursing knowledge on the screening tool could improve screening rates and connect patients who screen high-risk of obstructive sleep apnea with the resources needed upon discharge.

The survey will take approximately 5 minutes to complete. There are no anticipated risks associated with completing the survey. Participants can quit the survey at any time and for any reason. Participation is voluntary and answers provided will remain anonymous. No IP addresses will be collected. Participants will create a unique identifier that will further maintain their privacy. Participants will be asked to use the same unique identifier on both the pre and post survey. Completing the survey will serve as consent for participation in the study.

If you have any questions or concerns, please contact the primary investigator of the study:

Chelsea Mitchell, RN, BSN
(859) 619-6138
cfge222@uky.edu

If you have any concerns or questions about your rights as a volunteer in this research, contact staff in the University of Kentucky Office of Research Integrity (ORI) between the business hours of 8am and 5pm EST, Monday-Friday at (859) 257-9428 or toll free at 1-866-400-9428.

Appendix D. CVICU Nursing Survey

What is your age?

_____

What is your highest level of education completed?

◯ Associate's degree
◯ Bachelor's degree
◯ Master's degree
◯ Doctoral degree

How long have you worked as a nurse?

◯ Less than 1 year
◯ 1-5 years
◯ 5-10 years
◯ >10 years

How long have you worked in the CVICU at UK Healthcare?

◯ Less than 1 year
◯ 1-5 years
◯ 5-10 years
◯ >10 years

Yes or No: I know where to find the STOP-BANG questionnaire in EPIC?

◯ Yes
◯ No

I am familiar with the STOP-BANG questionnaire.

◯ Strongly agree
◯ Agree
◯ Neutral
◯ Disagree
◯ Strongly disagree

What condition does the STOP-BANG questionnaire screen for?

◯ Heart failure
◯ Obstructive sleep apnea
◯ Coronary artery disease
◯ Depression

Yes or No: I know how to screen for obstructive sleep apnea?

◯ Yes
◯ No

True or False: Untreated obstructive sleep apnea can lead to worsening heart failure?

◯ True
◯ False

True or False: The STOP-BANG questionnaire is not a required component of the admission work-up?

◯ True
◯ False

True or False: A score of 5 or higher on the STOP-BANG questionnaire is positive for high risk of obstructive sleep apnea?

◯ True
◯ False

Completing the STOP-BANG questionnaire is important for patient care.

◯ Strongly agree
◯ Agree
◯ Neutral
◯ Disagree
◯ Strongly disagree

Heart failure patients should be screened for obstructive sleep apnea.

◯ Strongly agree
◯ Agree
◯ Neutral
◯ Disagree
◯ Strongly disagree

Heart failure patients who screen high risk for obstructive sleep apnea should receive a sleep medicine consult upon discharge?

◯ Strongly agree
◯ Agree
◯ Neutral
◯ Disagree
◯ Strongly disagree

I feel confident in my ability to administer the STOP-BANG questionnaire.

◯ Strongly Agree
◯ Agree
◯ Neutral
◯ Disagree
◯ Strongly disagree

True or False: I have enough time in my work day to complete the STOP-BANG questionnaire?

◯ True
◯ False

Select all that apply:

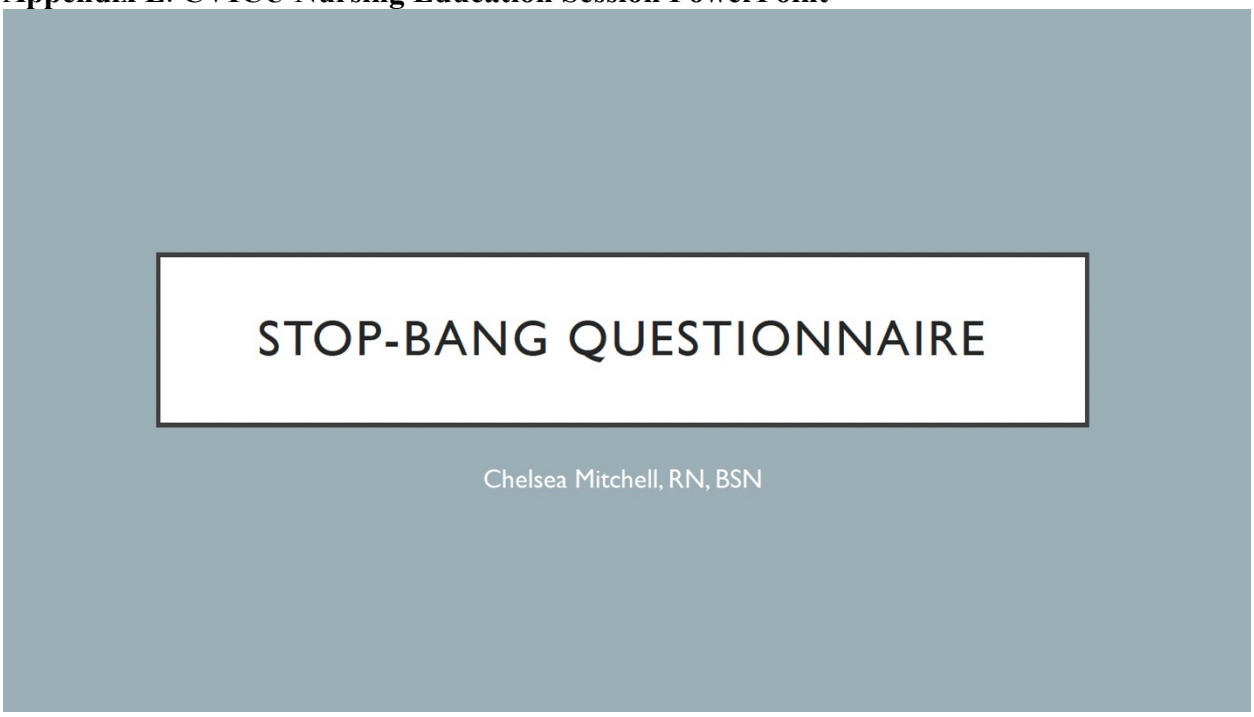
What barriers exist that make it difficult to complete the STOP-BANG questionnaire?

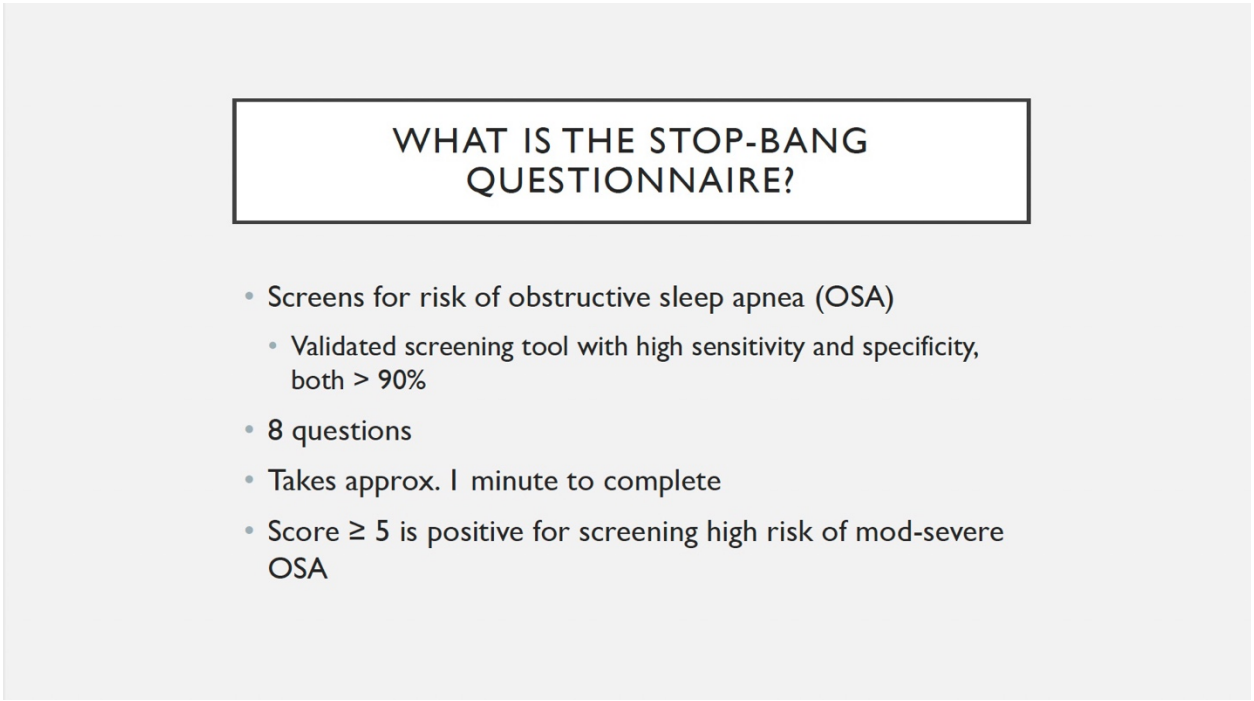
☐ None
☐ Takes too long to complete the screening
☐ Patient status
☐ Lack of knowledge related to the screening tool and/or where to find it in EPIC
☐ Other

If you selected "other" on previous question, please describe below:

_____

Appendix E. CVICU Nursing Education Session PowerPoint





STOP

S	So you **snore** loudly (louder enough to be heard through closed doors or louder than talking)?	Yes	No
T	Do you **often feel tired**, fatigued or sleepy during the daytime?	Yes	No
O	Has anyone **observed** you stop breathing or choking or gasping during your sleep?	Yes	No
P	Do you have or are you being treated for high blood **pressure**?	Yes	No

Bang

B	**BMI** more than 35?	Yes	No
a	**Age –** over 50 years old?	Yes	No
n	**Neck** circumference – is it greater than 17" if you are a male or 16" if you are a female?	Yes	No
g	**Gender –** are you a male?	Yes	No

Score your yes tally:

- 0 – 2 Low risk
- 3 – 4 Intermediate risk
- 5 – 8 High risk

Retrieved from: https://www.hennepinhealthcare.org/sleep-apnea-questionnaire/

WHY DOES THIS MATTER?

- Have you had any patients show signs of sleep apnea with no diagnosis?
- DNP project purpose: Connecting heart failure patients who screen high risk for OSA with a sleep medicine consult upon discharge
  - Project will focus on heart failure patients→ cyclic nature of OSA and worsening HF
  - Automatic alert for cardiology providers for patients who screen positive to order sleep medicine consult upon discharge
- Required component of admission work-up (within 24 hours)
  - Where to find screening tool? →NAVIGATORS tab

QUESTIONS/COMMENTS??

POST-TEST SURVEY

- Please take a moment to fill out post-test survey sent to your UKY email

Appendix F. IRB Approval Letter

University of Kentucky | Office of Research Integrity
IRB, RDRC

XP Initial Review

Approval Ends:	IRB Number:
9/17/2024	89599

TO: Chelsea Mitchell, Bachelors of Science in Public Health and Nursing
College of Nursing
PI phone #: 8596196138

PI email: chelsea.gess@uky.edu

FROM: Chairperson/Vice Chairperson
Medical Institutional Review Board (IRB)

SUBJECT: Approval of Protocol

DATE: 9/18/2023

On 9/18/2023, the Medical Institutional Review Board approved your protocol entitled:

Utilizing the STOP-BANG Questionnaire to Assess Risk of Obstructive Sleep Apnea in Hospitalized Patients with Heart Failure to Facilitate Sleep Medicine Referrals Upon Discharge

Approval is effective from 9/18/2023 until 9/17/2024 and extends to any consent/assent form, cover letter, and/or phone script. If applicable, the IRB approved consent/assent document(s) to be used when enrolling subjects can be found on the approved application's landing page in E-IRB. [Note, subjects can only be enrolled using consent/assent forms which have a valid "IRB Approval" stamp unless special waiver has been obtained from the IRB.] Prior to the end of this period, you will be sent a Continuation Review (CR)/Annual Administrative Review (AAR) request which must be completed and submitted to the Office of Research Integrity so that the protocol can be reviewed and approved for the next period.

In implementing the research activities, you are responsible for complying with IRB decisions, conditions and requirements. The research procedures should be implemented as approved in the IRB protocol. It is the principal investigator's responsibility to ensure any changes planned for the research are submitted for review and approval by the IRB prior to implementation. Protocol changes made without prior IRB approval to eliminate apparent hazards to the subject(s) should be reported in writing immediately to the IRB. Furthermore, discontinuing a study or completion of a study is considered a change in the protocol's status and therefore the IRB should be promptly notified in writing.

For information describing investigator responsibilities after obtaining IRB approval, download and read the document "PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research" available in the online Office of Research Integrity's IRB Survival Handbook. Additional information regarding IRB review, federal regulations, and institutional policies may be found through ORI's web site. If you have questions, need additional information, or would like a paper copy of the above mentioned document, contact the Office of Research Integrity at 859-257-9428.

see blue.
405 Kinkead Hall | Lexington, KY 40506-0057 | P: 859-257-9428 | F: 859-257-8995 | www.research.uky.edu/ori/
An Equal Opportunity University

List of Tables

Table 1. Nursing Survey Demographic Characteristics

	Demographic characteristic	n (%)
AGE (n=19)	20-25 years	3 (15.8%)
	26-30 years	10 (52.6%)
	31-40 years	4 (21.1%)
	>40 years	2 (10.5%)
EDUCATION (N=19)	Associates	2 (10.5%)
	Bachelors	15 (78.9%)
	Masters	1 (5.3%)
	Doctorate	1 (5.3%)
# Years as a nurse (n=19)	<1 year	2 (10.5%)
	1-5 years	11 (57.9%)
	5-10 years	2 (10.5%)
	>10 years	4 (21.1%)
# Years in CVICU (N=18)	<1 years	2 (11.1%)
	1-5 years	11 (61.1%)
	5-10 years	4 (22.2%)
	>10 years	1 (5.6%)

Table 2. Summary of Demographic Characteristics (*N* = 174)

Demographic Characteristics	Mean (SD) or n (%)
Gender	
Male	116 (66.3%)
Female	59 (33.7%)
Age	62 (11.9)
BMI	28 (6.2)
Race	
White	156 (89.1%)
Black/African American	11 (6.3%)
Multi-Racial	2 (1.1%)
Asian-Indian	2 (1.1%)
All Other Races	4 (2.4%)
Co-Morbidities	
HTN	155 (88.6%)
CAD	130 (74.3%)
DM	95 (54.3%)
Atrial Fibrillation	78 (44.6%)
pHTN	29 (16.6%)
MI	16 (9.1%)
Data Group	
Phase 1 (Pre-Intervention)	53 (30.3%)
Phase 2 (Post-Intervention)	60 (34.3%)
Phase 3 (Post-Education Session)	62 (35.4%)

Table 3. Screening and Referral Rates

	Phase 1 (n = 53)	Phase 2 (n = 60)	Phase 3 (n = 62)	p value
Screening Rates	31 (58.1%)	43 (71.7%)	36 (58.1%)	0.219
Referral Rates	0 (0.0%)	0 (0.0%)	1 (1.6%)	0.354

Table 4. Rates of Screening High-Risk for OSA and Referrals

	N (%)
STOP-Bang Total Score (n = 110)	
< 5 (Negative)	84 (76.4%)
≥ 5 (Positive)	26 (23.6%)
Referral Ordered for Patients Screening High-Risk (n = 26)	
Yes	1 (3.8%)
No	25 (96.2%)

Table 5. Association Between Co-Morbidities and Screening High-Risk for OSA

	(%) Screening High-Risk for OSA	p value
Atrial Fibrillation (n = 78)	29.8%	0.190
Diabetes (n = 95)	28.1%	0.191
Hypertension (n = 155)	23.5%	0.906
CAD (n = 130)	23.5%	0.961
pHTN (n = 29)	17.4%	0.428
MI (n = 16)	8.3%	0.287