IMPACT OF AN OBSTRUCTIVE SLEEP APNEA SCREENING PROTOCOL ON PROVIDER ADHERENCE IN A PRIMARY CARE SETTING

by

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TABLE OF CONTENTS

1. REVIEW OF THE LITERATURE 1

Introduction 1
Obstructive Sleep Apnea 1
OSA complications 2
OSA Diagnosis 2
Background and Significance 3
Significance of the Problem 4
Validated Screening Questionnaires 5
OSA Treatment 5
Methods 6
Overview of Studies 6
Search Strategies 6
Study Selection 6
Eligibility 7
Results 7
Characteristics of the Literature 7
Synthesis of Literature 9
Risk Factors and Comorbidities 9
Comparison of Validated Screening Tools 10
Discussions and Conclusions 11
Summary 11
Implications for Practice 12

2. QUALITY IMPROVEMENT PROPOSAL 14

Introduction 14
Problem and Aim Statement 15
Organizational Microsystem Assessment 18
Clinic Demographics 18
Quality Improvement Model 20
Johns Hopkins Evidence-Based Practice Process 20
Current Workflow 21
Methods 22
Intervention and Implementation Summary 22
Intervention and Implementation 23
Pre-implementation Strategies 23
QI Implementation 25
Costs 25
Necessary Training 26
Barriers 26
Evaluation and Analysis 26

Safety and Confidentiality 27

3. QUALITY IMPROVEMENT MANUSCRIPT 29

Contribution of Authors and Co-Authors 29
Manuscript Information 30
Abstract 31
Background 31
Methods 31
Interventions 31
Results 32
Conclusion 32
Clinical Problem 32
Review of the Literature 35
Theoretical Framework 37
Purpose and Aims 37
Methods 38
Context 38
Interventions 39
Measures 40
Statistical Analysis 41
Results 41
Discussion 46
Limitations 49
Recommendations 50
Conclusion 51

4. ADVANCED NURSING ESSENTIALS REFLECTION 53

Introduction 53
Domain 4: Scholarship for the Nursing Discipline 55
Domain 7: Systems-Based Practice 56
Domain 8: Informatics and Healthcare Technologies 58
Conclusion 59

CUMULTIVE REFERENCES CITED 61

APPENDICES 69

APPENDIX A: PRISMA DIAGRAM 70

APPENDIX B: JOHNS HOPKINS EVIDENCE-BASED PRACTICE MODEL 72

APPENDIX C: STAKEHOLDER ANALYSIS FORM 74

APPENDIX D: OSA SCREENING/REFERRAL ALGORITHM 77

APPENDIX E: STOP-BANG QUESTIONNAIRE 79

APPENDIX F: PROVIDER COMMUNICATION QUESTIONNAIRE 81

APPENDIX G: PATIENT EDUCATION HANDOUT 86

APPENDIX H: SWIM LANE DIAGRAM 89

APPENDIX I: EDUCATION POSTER 91

LIST OF TABLES

Table Page

1. Table 1: SMARTIE Goals 16
2. Table 1 Continued 17
3. Table 1 Continued 18
4. Table 2: Patient Statistics 46

LIST OF FIGURES

Figure Page

1. Figure 1: Overall Results of OSA screening protocol 42
2. Figure 2: Pre-and-Post-Intervention Results 43
3. Figure 3: Mid-term Results 44
4. Figure 4: End-term Results 45
5. Figure 5: Prisma Diagram 71
6. Figure 6: Johns Hopkins Evidence-Based Practice Model 73
7. Figure 7: Stakeholder Analysis Form page 1 (John's Hopkins Medicine, n.d.). 75
8. Figure 7 Continued: Stakeholder Analysis Form page 2 (John's Hopkins Medicine, n.d.). 76
9. Figure 8: OSA Screening/Referral Algorithm 77
10. Figure 9: STOP-Bang Questionnaire (American Academy of Sleep Medicine [AASM], 2023) 80
11. Figure 10 Continued: Provider Communication Questionnaire page 2 82
12. Figure 10 Continued: Provider Communication Questionnaire page 3 84
13. Figure 10 Continued: Provider Communication Questionnaire page 4 85
14. Appendix 11: Patient Education Handout side 1 (American Thoracic Society, n.d.). 87
15. Figure 11 Continued: Patient Education Handout side 2 (American Thoracic Society, n.d.). 88
16. Appendix 12: Swim Lane Diagram 89
17. Figure 13: Education Poster 92

CHAPTER ONE

REVIEW OF THE LITERATURE

Introduction

Consistent quality sleep is critical for overall health, impacting our ability to function optimally. Sleep conditions put individuals at risk for multiple diseases and poor health outcomes (United States Preventive Services Task Force [USPSTF], 2022). Obstructive Sleep Apnea (OSA) is a common sleep disorder that increases health care costs and results in detrimental health consequences. OSA is a standalone risk factor for various cardiovascular, metabolic, and neurocognitive conditions that are of global concern, and is associated with all-cause mortality (Senaratna et al., 2017; Slowik et al., 2024; USPSTF, 2022). Moreover, it is a serious concern for public safety as it is associated with increased risk for motor vehicle accidents (MVA) and fatalities (Chen et al., 2021). Although the consequences of undetected OSA are extreme, it is widely underdiagnosed. Approximately 36 million people are affected, yet only 6 million people are diagnosed (Ling, 2024). Given the severe consequences of undiagnosed OSA, early detection of high-risk individuals is paramount.

Obstructive Sleep Apnea

OSA, defined as episodic partial (apnea) or complete (hypopnea) collapse of the airway during sleep, leads to deoxygenation and fragmented sleep (Slowik et al., 2024). OSA is caused by the narrowing and closure of the pharynx, resulting in snoring, apnea, and daytime drowsiness (Pivetta et al., 2021). Other symptoms include fatigue, nighttime arousal, headaches, and memory issues (Chen et al., 2021). Risk factors include age, race, sex, family history,

craniofacial anatomy, obesity, smoking, nasal congestion, and sedative and alcohol use (Mayoclinic, 2023; Rundo, 2019). Men have a 2-3 times greater risk of developing OSA than women; Black, Hispanic, or Chinese ethnicities are at moderate increased risk for developing OSA (Mayoclinic, 2023; Waseem et al., 2021).

OSA complications OSA is associated with diabetes, heart disease, and cognitive dysfunction, all of which are generally managed by Primary Care Providers (PCPs) (Slowik et al., 2024). Complications of OSA range from decreased quality sleep and fatigue to chronic illnesses, including cardiovascular diseases: coronary artery disease (CAD), hypertension, and stroke; metabolic diseases: diabetes, metabolic syndrome, and obesity; respiratory diseases: asthma and chronic obstructive pulmonary disorder (COPD), and immune system disorders: infections and chronic inflammation (National Institute of Health [NIH], 2022). Furthermore, OSA is linked to neurocognitive disorders, including dementia, short-term memory loss, behavioral changes, and mental health disorders (American Academy of Neurology [AAN], 2024; Spira et al., 2014).

OSA Diagnosis To diagnose OSA, sleep studies are performed at home or at a clinic (Pivetta et al., 2021). Lab polysomnography (PSG) is the gold standard of diagnosis (Pivetta et al., 2021). Severity is determined by the amount of Apneic, hypopneic, or sleep arousal events per hour of sleep. These events are measured during a sleep study using the Apnea-Hypopnea Index (AHI) (Slowik et al., 2024). The AHI is used to define the severity of OSA. In general, mild OSA is defined as 5 to 15 events per hour, moderate OSA as 16 to 30 events per hour, and severe OSA as more than 30 events per hour (USPSTF, 2022). Without screening protocols in

place, the likelihood that all individuals at-risk of OSA will undergo diagnostic workup is extremely low (Miles et al., 2017; Shieu et al., 2022).

Background and Significance

In a large cohort study, moderate-to-severe forms of OSA were detected in 24% of women and 50% of men aged 40-85 years (Heinzer et al., 2015). Furthermore, severe OSA was independently linked to hypertension, diabetes, metabolic syndrome, and depression (Heinzer et al., 2015). While several risk factors are associated with the development of OSA, hypertension and obesity are comorbid (Heinzer et al., 2015; Mayoclinic, 2023; Shapira-Daniels et al., 2020). Obesity significantly elevates the risk of OSA, with a 10% weight gain correlating to a six-fold increase in risk and a 36% rise in AHI events (Rundo, 2019). Alternatively, a 10% weight reduction can decrease these events significantly, by about 26% (Rundo, 2019). Approximately 50% of those with obesity or hypertension also have OSA (Patial et al., 2023; Rundo, 2019). More alarmingly, OSA has a threefold risk increase for the development of new onset hypertension (Ou et al., 2023). Persons between the ages of 30 and 70 appear to have particular risk of developing OSA (Kee et al., 2018; Mayoclinic, 2023).

Current national guidelines support screening in certain high-risk populations including those with hypertension and obesity (Kapur et al., 2017; USPSTF, 2022). Validated screening tools are underutilized in primary care due to a lack of knowledge about tool administration and screening protocols (Amra et al., 2018; Miles et al., 2017). In Montana, over 30% of adults are obese with a Body Mass Index (BMI) greater than 30. Notably, people between the ages of 35 and 64 have considerably higher rates of obesity than the total population (Montana Department of Health and Human Services [DPHHS], 2024). Moreover, approximately 30% of Montana

adults have high blood pressure, with percentages rising with age (Montana DPHHS, 2021). Unfortunately, no data exists for OSA diagnosis in Montana. Since obesity and hypertension are comorbid with OSA, the prevalence of both indicates that rates of OSA are likely higher than are currently being diagnosed, highlighting the need for screening protocols (Montana DPHHS, 2024).

Significance of the Problem

OSA prevalence ranges from 6% to 50% in the United States of America (USA) (Senaratna et al., 2017). Prevalence has skyrocketed over the last two decades, due in large part to rising obesity rates (American Academy of Sleep Medicine [AASM], 2014). Within the USA, approximately 82% of men and 93% of women with OSA are undiagnosed, prompting the Centers for Disease Control (CDC) to partner with national sleep organizations, including the AASM, to create the National Healthy Sleep Awareness Project [NHSAP], whose aim is to educate healthcare professionals and the public about risk factors and symptoms of OSA with the hopes of increasing detection (Morgenthaler et al., 2015; Rundo, 2019). Lack of screening protocols within primary care settings contributes to underdiagnosis (Ononye et al., 2019). Without protocols, screening is at the provider's discretion, however, less than 50% of providers question their patients about sleep (Grandner & Malhotra, 2015; USPSTF, 2022). Additionally, most symptoms of OSA are not well recognized by patients, making them less likely to initiate conversation about sleep-disordered breathing; only 20% of patients express concerns about their sleep (Chen et al., 2021; Miller & Berger, 2016). Furthermore, the severity of OSA does not always correlate with symptoms. Patients can be asymptomatic, even at moderate-to-severe levels of OSA, decreasing the likelihood that providers will refer patients without a screening

protocol (Chen et al., 2021; Miles et al., 2017). Although hypertension and obesity are known risk factors for OSA, providers rarely screen or refer patients with these conditions for further evaluation (Kee et al., 2018; Miller & Berger, 2016).

Validated Screening Questionnaires Without screening protocols, less than 3% of high-risk patients are routinely screened in primary care clinics (Ononye et al., 2019; Miles et al., 2017). Several screening tools exist to increase detection of OSA including the Epworth Sleepiness Scale (ESS), the Berlin Questionnaire (BQ), the STOP Questionnaire (SQ), and the STOP-bang Questionnaire (SBQ) (Chiu et al., 2017; Silva et al., 2011; USPSTF, 2022). The positive predictive value (PPV) of each of these tools is fairly high, but the negative predictive value (NPV) remains variable (Kapur et al., 2017). Therefore, these tools should be utilized to detect OSA risk but should not replace PSG for the diagnosis of OSA (Kapur et al., 2017). The SBQ consistently demonstrates superiority in detection of OSA risk over other tools (Kapur et al., 2017). This 8-question survey is validated for use in general adult populations (Edinger et al., 2012). Subjective and objective measures offer tangible and measurable data that correlate with risk factors and specific symptoms of OSA (Edinger et al., 2012). An SBQ is considered positive if three or more items are scored (Pivetta et al., 2021). The entire questionnaire takes approximately 1-2 minutes to complete. Within general populations, the sensitivity is greater than 90% (Kapur et al., 2017).

OSA Treatment The most common form of treatment for OSA is positive pressure airway (PAP), as it is the most successful for eliminating apnea and hypopnea events overnight (MayoClinic, 2023). PAP is delivered via a facial mask during sleep and is continuous (CPAP) or auto-titrating, (APAP) in which the machine changes pressures based on airway resistance

(MayoClinic, 2023). Although other forms of PAP exist, CPAP is the most widely researched and most effective form of OSA treatment (MayoClinic, 2023).

Methods

Overview of Studies

A scoping review of current evidence was performed on primary-sourced articles from databases accessed through the Montana State University library. Evidence-based articles and literature that targeted methods of improving OSA screening in primary care settings were identified and reviewed. The research focused on screening strategies, specifically, their sensitivity and specificity, in primary care settings utilizing USA data.

Search Strategies The evidence was reviewed and synthesized according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Appendix A) (Prisma, 2024). Data-based searches included: CINAHL; Web of Science; Pubmed; and Google Scholar. Study considerations included years published between January 2014 and August 2024. Articles excluded were those that did not include USA data, were not in English, and were not between the ages of 30 and 70 years. Search terms included: “Obstructive sleep apnea” OR “OSA” AND “screening” OR “questionnaire” AND “STOP-Bang” OR “SBQ” AND “Primary care.” The United States Preventive Services Task Force (USPSTF) and the American Association of Sleep Medicine [AASM] were also utilized in the literature research as these organizations provide recommendations regarding guidelines specific to the subject matter.

Study Selection The initial search yielded 924 articles, with a total of 826 remaining after duplicates were removed. Screening of abstracts further deducted articles based on the

aforementioned exclusion criteria. A total of 40 full articles were further screened with 12 articles considered as eligible after all others were excluded due to inability to obtain full articles or previously mentioned criteria. Utilizing the Polit and Beck Evidence Hierarchy scale, the highest levels of available evidence within the specific demographics were included in this literature review and synthesis (Polit & Beck, 2019).

Eligibility Preference was given to previously trialed interventions utilizing the SBQ for screening of OSA in primary care settings, specifically including patients with obesity or hypertension, although studies assessing other health conditions within the age range at any medical center within the USA were deemed eligible for inclusion of article selection. Articles comparing alternative screening methods to the SBQ within these populations were also eligible. Research assessing the relationship between screening protocols, adherence to screening, referrals, and follow-up were included. Articles assessing the quality of other questionnaires alone, like the STOP, ESS, or Berlin, were excluded.

Results

Characteristics of the Literature

The included articles (n=12) were published between 2014 and 2024 (Table 1.1). Of the twelve articles, one was a subset of a randomized controlled trial (Lyons, et al., 2022). Two articles were clinical guidelines (Kapur et al., 2017; USPSTF, 2022). Three articles were prospective cohort studies (Donovan et al., 2017; Shapira-Daniel et al., 2020; Shieu et al., 2022), of which, one included an intervention component (Donovan et al., 2017) and one was a multicenter cohort study (Shieu et al., 2022). One article was a retrospective cohort study

(Kreitinger et al., 2020). One article was a quality measure (Aurora & Quan, 2016). Three articles were quality improvement projects (QIP) (Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019) and one was a cross-sectional study (Braley et al., 2018). These twelve articles reviewed provided evidence of outcomes relevant to this review of the literature: four demonstrated the sensitivity, specificity, and predictive values of OSA screening with STOP-Bang on OSA diagnosis using either HSAT or PSG (Kapur et al., 2017; Kreitinger et al., 2020; Lyons et al., 2022; Shapira-Daniels et al., 2020), of which, one assessed symptomatic atrial fibrillation patients undergoing ablation (Shapira-Daniels et al., 2020); one assessed young veterans with PTSD and insomnia (Lyons et al., 2022); and one assessed bariatric surgical patients (Kreitinger et al., 2020). Only one article compared different validated screening tools (Kreitinger et al., 2020). All three QIPs focused on screening protocols and their influence on screening rates (Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019), of which, one article utilized the ESS (Miles et al., 2017), while two articles utilized the SBQ (Ononye et al., 2019; Tokarczyk, 2019). All twelve articles reported on associated comorbidities and risk factors for OSA; eight assessed and reported on primary care provider assessment, screening, referral, and follow-up care (Aurora & Quan, 2016; Braley et al., 2018; Donovan et al., 2017; Kapur et al., 2017; Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019; USPSTF, 2022). All twelve articles assessed USA demographics. Four took place at a family practice clinic (Kapur et al., 2017; Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019), while three took place at hospitals (Kreitinger et al., 2020; Lyons et al., 2022; Shapira-Daniels et al., 2020).

In terms of interventions, nine out of twelve articles focused on some sort of intervention, of which, five of those articles represent interventions provided by primary care providers

(Donovan et al., 2017; Miles et al., 2017; Ononye et al., 2019; Shieu et al., 2022; USPSTF, 2022); six focused on in-person interventions (Kreitinger et al., 2020; Lyons et al., 2022; Miles et al., 2017; Ononye et al., 2019; Shapira-Daniels et al., 2020; Shieu et al., 2022; Tokarczyk, 2019), while one used phone calls for screening (Donovan et al., 2017). One article did not specify (Braley et al., 2018). Four focused on screening interventions and their effect on referral to sleep studies (Donovan et al., 2017; Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019). In terms of follow-up, three articles assessed PAP treatment after diagnosis (Donovan et al., 2017; Miles et al., 2017; Shapira-Daniels et al., 2020), while only 1 assessed provider follow-up post-diagnosis (Miles et al., 2017).

Synthesis of Literature

Risk Factors and Comorbidities

Several risks and comorbidities related to OSA are demonstrated throughout the literature. Age, BMI, neck circumference, and observed apnea are significant independent predictors for moderate to severe OSA (Kreitinger et al., 2020; Shapira-Daniels et al., 2020). Consistently, the majority of patients confirmed to have moderate-to-severe OSA are obese, have higher rates of hypertension, or history of stroke or atrial fibrillation, highlighting these as predictive risk factors for OSA. In all of these conditions, OSA is grossly underdiagnosed (Aurora & Quan, 2016; Kapur et al., 2017; Kreitinger et al., 2020; Miles et al., 2017; Shapira-Daniels et al., 2020; Shieu et al., 2022; USPSTF, 2022). Evidence is less clear on OSA prevalence in other conditions, such as Diabetes Mellitus Type 2 (DM2), coronary artery disease (CAD), and heart failure, with most studies confirming these as risk factors, while one found the frequency to be equal with or without OSA (Aurora & Quan, 2016; Braley et al., 2018; Miles et al., 2017; Shapira-Daniels et al., 2020; Shieu et al., 2022;). In the majority of studies,

most people found to be at risk for OSA have several of the aforementioned comorbidities (Braley et al., 2018; Miles et al., 2017; Shapira-Daniels et al., 2020; Shieu et al., 2022). The literature shows that middle to older age patients have increased OSA prevalence, however, evidence is variable regarding sex differences. Some suggest that post-menopausal women may be evening out the scores (Braley et al., 2018; Shapira-Daniels et al., 2020; Shieu et al., 2022).

Comparison of Validated Screening Tools Consistently, the SBQ demonstrates superiority over other screening tools for detection of patients at-risk for OSA and is essential to identification of those at-risk of developing OSA in a variety of settings (Kreitinger et al., 2020; Ononye et al., 2019; USPSTF, 2022). Moreover, the SBQ demonstrates high levels of sensitivity in multiple clinical settings and ethnic groups (Braley et al., 2018; Donovan et al., 2017; Lyons et al., 2022; Shapira-Daniels et al., 2020). Research consistently demonstrates that higher STOP-Bang scores significantly increased the likelihood of detecting OSA, with sensitivity rates ranging from 81% to 100% (Braley et al., 2018; Kreitinger et al., 2020; Shapira-Daniels et al., 2020). Additionally, studies demonstrate similar sensitivity rates regardless of sex, ethnicity, population, or diagnostic setting (Braley et al., 2018; Kreitinger et al., 2020; Shapira-Daniels et al., 2020). The PPV of the SBQ to consistently predict OSA is statistically significant, especially in moderate to severe cases (Kreitinger et al., 2020; Ononye et al., 2019; Shapira-Daniels et al., 2020).

Though the SBQ is excellent at detecting those at-risk for moderate to severe OSA, variability exists regarding its sensitivity in mild cases (Donovan et al., 2017; Lyons et al., 2022). Moreover, there are inconsistencies in the literature regarding the thresholds for detection of at-risk patients. One study suggests that a cutoff point of 3 indicates excellent detection, while

others indicate that a cutoff point of 4 is better at detecting OSA (Braley et al., 2018; Kreitinger et al., 2020; Lyons et al., 2022; Shapira-Daniels et al., 2020; Shieu et al., 2022). Overall, there is consensus that a cutoff point of 3 is sufficient in detection of OSA risk (Kreitinger et al., 2020; Shapira-Daniels et al., 2020; Shieu et al., 2022). Data is limited in determining SBQ sensitivity in specific subgroups, including atrial fibrillation patients and young Army veterans. The results suggest that the SBQ may not be suitable for these populations, particularly young Army veterans (Lyons et al., 2022**;** Shapira-Daniels et al., 2020). The SBQ is a promising solution to help detect OSA early. This tool allows healthcare professionals to quickly (in under two minutes) and easily identify patients at-risk for OSA without disrupting workflow, leading to earlier intervention and improved outcomes (Ononye et al., 2019; Tokarczyk, 2019). Multiple studies demonstrate that using the SBQ benefits diverse patient populations, increasing the likelihood of detection and diagnosis of OSA (Ononye et al., 2019; Shapira-Daniels et al., 2020; Shieu et al., 2022).

Discussions and Conclusions

Summary

Untreated OSA causes severe personal, financial, and public consequences. Evidence demonstrates that obesity and hypertension have a bidirectional relationship with OSA: OSA worsens them, and they, in turn, increase the risk of OSA (Aurora & Quan, 2016; Heinzer et al., 2015). Validated screening tools exist to assist providers in categorizing patients at-risk for OSA for referral. Of these, the SBQ consistently demonstrates superiority in detecting those at-risk for OSA (Kapur et al., 2017; Tokarczyk, 2019). PCPs are ideal candidates for OSA screening as they are the initial point of contact for patients and have a unique, trusting relationship with

patients. When screening protocols are implemented in primary care, compliance with screening, referral, and treatment adherence significantly increases (Miles et al., 2017; Shapira-Daniels et al., 2020).

Implications for Practice

Practice recommendations exist to help guide providers on screening for OSA in primary care (Aurora & Quan, 2016; Kapur et al., 2017; USPSTF, 2022). The AASM recommends use of validated screening tools in high-risk populations, including patients with obesity (BMI ≥30kg/m2), resistant hypertension (blood pressure outside of goal range regardless of medication adherence to three medications, or hypertension requiring four medications to control), among others (Aurora & Quan, 2016; Kapur et al., 2017). This guideline endorses the use of the SBQ (Kapur et al., 2017). Currently, the USPSTF (2022) has a grade I, stating inconclusive evidence to support routine screening in asymptomatic patients. This does not include high-risk patients or those who present with symptoms; however, the literature is clear that patients do not openly discuss their symptoms with providers and without protocols, providers are unaware of how to effectively screen high-risk patients for OSA (Donovan et al, 2017; Lyons et al., 2022; Ononye et al., 2019; Miles et al., 2017; Shieu et al., 2022). The USPSTF (2022) recognizes the health risks of OSA, such as HTN, DM2, CAD, and stroke. However, its recommendation only specifies stroke as an exclusion criterion, leaving the rest as inclusive. This lack of clarity of high-risk conditions may increase neglect and underdiagnosis of high-risk populations. With OSA screening protocols in place, screening rates and referrals increase by 30% to 100% in some primary care clinics (Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019).

Barriers to referral and treatment adherence include time, distance, cost, and PAP side-effects (Braley et al., 2018; Donovan et al., 2017; Ononye et al., 2019). When patients are managed by their PCPs, adherence to diagnosis and treatment significantly improves, with compliance rates as high as 93-100% nearly two years after treatment initiation (Miles et al., 2017; Shapira-Daniels et al., 2020). Furthermore, referral to sleep clinics for diagnosis and treatment is covered by most insurance companies, decreasing out-of-pocket cost to patients (BCBSM, 2019; CMS, n.d.; Montana DPHHS, 2017). Financial benefits for providers exist, with reimbursement of initial screening, diagnosis, education, and follow-up visits, financial benefits for providers exist (BCBSM, 2019; CMS, 2024; Miles et al., 2017; Montana DPHHS, 2017). With implementation of the SBQ into practice, providers can easily detect OSA risk, leading to early intervention. Timely diagnosis and treatment are essential in prevention of deadly complications, hospitalizations and associated healthcare costs (Aurora & Quan, 2016; Kapur et al., 2017). These preventive measures may also reduce unnecessary workplace and traffic accidents. Given the compelling evidence, integration of the SBQ should be part of routine assessment for high-risk patients.

CHAPTER TWO

QUALITY IMPROVEMENT PROPOSAL

Introduction

Worldwide, obstructive sleep apnea (OSA) impacts nearly 1 billion people, with moderate to severe cases accounting for close to half of the total amount (Benjafield et al., 2020). The global societal, financial, and health impact of OSA is unknown, as no study exists assessing these outcomes. Recent data suggest that the United States of America (USA) has the second highest rates of OSA, falling behind only China (Benjafield et al., 2020). The National Council on Aging [NCOA, 2024] estimates that 39 million USA adults have OSA, yet approximately only 6 million are diagnosed. Left untreated, OSA leads to a myriad of adverse health effects including cardiovascular, metabolic, endocrine, respiratory, and neurocognitive disorders (Pivetta et al., 2021). Economically, untreated OSA contributes to soaring healthcare costs, with an estimated $150 billion annually in the USA alone (American Academy of Sleep Medicine [AASM], 2016). Furthermore, it is a major contributor to lost productivity, motor vehicle and workplace accidents (AASM, 2016). OSA is linked to 36% of driving accidents, with truck drivers having a 5-fold increased risk for near-misses, and 45% of pilots reporting falling asleep while controlling an aircraft (Chung, 2021). USA data suggest that 9-38% of the population has OSA (Boers et al., 2024). Currently, no state data exist for OSA, highlighting the challenges in identifying high-risk populations, the underestimation of prevalence, and the lack of awareness for providers and patients. Utilizing National data trends, approximately 99,000-418,000 Montanans have OSA (United States Census Bureau, n.d.). The American Academy of Sleep

Medicine (AASM) guideline recommends validated screening tools be utilized to screen high-risk individuals (Kapur et al., 2017). Previous Quality Improvement (QI) projects support this recommendation, demonstrating significant increases in patient screening and referral rates with implementation of a validated tool compared to provider judgement alone (Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019). These results emphasize the effectiveness of screening protocols and align with the sleep health objectives of Healthy People 2030, which include the goal to "increase the proportion of adults with sleep apnea symptoms who get evaluated by a healthcare provider" (Office of Disease Prevention and Health Promotion [OASH, n.d., para. 1). As the first point of contact for most patients, especially in rural regions, Primary Care Providers (PCPs) can expand access for early detection by seamlessly integrating OSA screening in annual preventive exams (Shapira-Daniels et al., 2020).

Problem and Aim Statement

Despite evidence supporting OSA screening for high-risk populations in primary care, the vast majority are not screened (Aurora & Quan, 2016; Braley et al., 2018). In one small primary care clinic, rates of obesity and hypertension, two comorbid conditions with OSA, are high, yet OSA screening and diagnosis rates are low. When patients are screened for OSA, use of a validated screening tool is not standardized. As a result, patients can slip through the cracks, with missed opportunities to detect OSA.

The aim of this quality improvement project is two-fold. First, to implement a practice change of annual OSA screening in patients with hypertension and/or obesity, specifically between the ages of 30-70 years, with the use of the STOP-Bang Questionnaire (SBQ) in a

primary care setting. Second, the project aims to increase the proportion of screening and referral rates for individuals who screen positive on the SBQ. The project proposal intends to create an algorithm, based on AASM 2016 guidelines, for staff to refer to when deciding who to screen, how to screen, and when to refer for sleep studies (Kapur et al., 2017). The overall purpose of the project intends to increase early detection of OSA which is a crucial step in preventing disease burden and aids the process of expedited treatment. This aligns with previous QI project aims focusing on enhancing OSA screening in primary care (Miles et al., 2017; Ononye et al**.,** 2019). As outlined in the SMARTIE goals, these are measured by comparing pre-and-post intervention screening rates, with secondary goals of enhancing referral rates to sleep centers to confirm diagnosis. Ultimately, long-term goals include early detection and expedited treatment of OSA, via CPAP, thereby reducing and preventing serious health and financial complications of OSA.

Table 1: SMARTIE Goals

<table>
<tr><td colspan="3">Short-term SMARTIE Goal #1: RNs/CMAs and providers will utilize the OSA screening protocol at least 50% of the time by mid-to-late January, 2025</td></tr>
<tr><td colspan="3">Description of strategies to be utilized to accomplish goal including any needed resources:
· Providers and nursing staff will be trained in use of the STOP-Bang Questionnaire
· OSA screening package will be streamlined into existing annual visit workflow for ease of use
· Provider Communication Questionnaire included into workflow for staff reminder</td></tr>
<tr><td>Data to be collected:</td><td>Method of Collection and who is responsible:</td><td>Planned data analysis:</td></tr>
<tr><td>· Number of patients screened during annual visits</td><td>· Responsible party: Sarah
· Weekly Collection and review of Provider Communication Questionnaires</td><td>· Percentage of SBQ screeners used from total annual visits performed</td></tr>
<tr><td colspan="3">Description of strategies to be utilized to accomplish goal including any needed resources:
· Provider education presentation on use of algorithm for decision-making, benefits of referral, early diagnosis, and treatment of OSA
o Education pamphlets/materials to be provided during education sessions
· Education handout provided for patients after visit
· Staff Communication Questionnaires for staff reminder</td></tr>
</table>

Table 1 Continued

Short-term SMARTIE Goal #2: 40% of high-risk patients (those with hypertension and/or obesity) who screen ≥3 points on the SBQ will be referred to sleep studies. This goal was set to provide appropriate follow-up of high-risk OSA patients by mid-to-late January, 2025		
Description of strategies to be utilized to accomplish goal including any needed resources: · Provider education presentation on use of algorithm for decision-making, benefits of referral, early diagnosis, and treatment of OSA o Education pamphlets/materials to be provided during education sessions · Education handout provided for patients after visit · Staff Communication Questionnaires for staff reminder		
Data to be collected:	Method of Collection and who is responsible:	Planned data analysis:
· Number of referrals to sleep studies	· Responsible party: Sarah · Weekly collection and review of Communication Questionnaires	· Referral rates from Communication Questionnaires
End-term SMARTIE Goal #1: RNs/CMAs and providers will utilize the OSA screening protocol at least 100% of the time by mid-February, 2025 This goal was set to provide standardization of patients screened for OSA		
Description of strategies to be utilized to accomplish goal including any needed resources: · Follow-up email to providers and office manager for feedback on ease of use and barriers to implementation of the screening protocol after initial evaluation. · Adjust process based on end-use feedback and update end-users via email · OSA screening package will be streamlined into existing annual visit workflow for ease of use		
Data to be collected:	Method of Collection and who is responsible:	Planned data analysis:
· Number of patients screened during annual visits	· Responsible party: Sarah · Weekly Collection and review of Communication Questionnaire	· Percentage of SBQ screeners used from total annual visits performed
End-term SMARTIE Goal #2: 80% of high-risk patients (those with hypertension and/or obesity) who screen ≥3 points on the SBQ will be referred to sleep studies by mid-February, 2025 This goal was set to provide appropriate follow-up of high-risk OSA patients		
Description of strategies to be utilized to accomplish goal including any needed resources: · Follow-up with providers via email, phone calls, and in-person sessions to determine barriers to referral after initial evaluation. · Develop strategies specific to referral barriers		
Data to be collected:	Method of Collection and who is responsible:	Planned data analysis:

Table 1 Continued

End-term SMARTIE Goal #3: At least 50% of all high-risk patients screened for OSA receive education handout on risks, benefits, diagnosis, and treatment at the end of annual visit		
Description of strategies to be utilized to accomplish goal including any needed resources: · RN/CMAs and providers to be educated via in-person session on benefits of patient education · Handouts streamlined into workflow process for ease of use · Communication Questionnaires to include questions regarding handout for staff reminder by mid-to-late January, 2025		
Data to be collected:	Method of Collection and who is responsible:	Planned data analysis:

Organizational Microsystem Assessment

The practice area targeted for this QI project is a small, privately owned primary family practice clinic located in a micropolitan urban area in the south-western part of Montana. Billing providers include one medical doctor and three nurse practitioners (NP), all of whom practice on a full-time basis. Support staff include one registered nurse (RN), who works directly with the medical director, and two certified medical assistants (CMA), who are shared among the NP staff. Additionally, one clinic manager oversees two administrative assistants, performs human resource (HR) duties, and manages workflow operations. The clinic serves 2827 patients of all ages, with a focus on prevention and treatment of acute and chronic conditions. The majority of patients are between midlife and geriatric ages, insured, and are Caucasian. Sixty two percent of patients are female, and over 38% have a diagnosis of hypertension, a BMI equal to, or greater than, 35, or both.

Clinic Demographics

The need for this project at this specific site came as a direct recommendation from a provider who began to notice a practice gap between the number of patients at risk for OSA

versus those who were screened, particularly concerned about the increasing number of patients who presented with resistant hypertension, including hypertensive crisis. Stakeholder participation includes the office manager and assistants who will coordinate and initiate the screening process, ensuring all eligible patient charts receive appropriate documentation. Additionally, the nursing staff will screen and facilitate care of all eligible patients. Finally, all providers will provide further assessment, referral, education, and follow-up care for OSA patients. In terms of the demographics specifically related to OSA at the QI project site, there were more females than males in all groups. Out of the total population, 1874 (66.3%) are between the ages of 30-70 years. The majority of this subpopulation are female (58.5%). Of this age group, 24% have a diagnosis of hypertension (blood pressure ≥130/80), and 25% have a diagnosis of obesity (BMI ≥35). This is congruent with current state data which states that nearly 1 in 3 Montana adults have a BMI greater than 30 (Montana DPHHS, 2024). Similarly, nearly 1 in 3 Montana adults have hypertension (Montana DPHHS, 2024). Of the patients with hypertension, 25% of them have a diagnosis of OSA. Similarly, 21% of patients with obesity have OSA. At the clinic, over 20% of patients in this age group have both hypertension and obesity. Moreover, 84% of obese patients also have hypertension. This aligns with National data suggesting a causal relationship between obesity and hypertension, with obesity attributing to 65-78% of primary hypertension (Shariq & McKenzie, 2020). Of this group, only 14% have a diagnosis of OSA. This aligns with Worldwide and National data, both of which suggest that OSA is under-recognized in 80-90% of cases (Santilli et al., 2021). The literature is clear that obesity is comorbid with OSA (40-90% of those diagnosed with obesity have OSA), and that both have a causal relationship with hypertension: 83% of those with hypertension have mild

OSA and 30% have moderate to severe OSA (Rundo, 2019). Furthermore, worsening OSA leads to worsening hypertension (Xia et al., 2023). Review of current evidence reveals that OSA is extremely common, especially in high-risk populations, including those with hypertension and obesity (Santilli et al., 2020). Additionally, OSA is an independent risk factor for secondary hypertension, demonstrating the comorbid relationship of these two illnesses (Santilli et al., 2020). This highlights that the majority of these populations at the clinic remain undiagnosed but at high-risk for OSA. Furthermore, annual screening rates of OSA in high-risk populations is effectively 0% at the clinic. When guidelines for standardized screening with the use of validated tools are implemented into primary care, screening rates, referral rates, and ultimately, timely detection and treatment of OSA substantially increase (Donovan et al., 2019; Kapur et al., 2017; Miles et al., 2017; Ononye et al., 2019; Soni, 2021). Therefore, current evidence supports the implementation of a screening protocol for patients at high-risk for OSA in primary care practice settings.

Quality Improvement Model

The Johns Hopkins Evidence-Based Practice (JHEBP) model (Appendix B) was utilized as a guide for practice change development, implementation, and evaluation. This specific model was chosen because of its structure, which focuses on improving patient care through incorporation of best practices based on research in daily workflow (Johns Hopkins Medicine, n.d.). Moreover, at each step of the process, appendices help guide the process to ensure quality measures and outcomes are met and that no steps are missed (Johns Hopkins Medicine, n.d.).

Johns Hopkins Evidence-Based Practice Process

The three-step process includes the practice question, evidence, and translation (PET). The process is an integrative, continuous process that starts with an inquiry which then guides the user to determine a practice question, based on the Population, Intervention, Comparison, Outcome (PICO) framework. From there, evidence is reviewed to refine the practice question, ensuring its relevance, and assessing whether the evidence provides solutions. The translation phase utilizes best-evidence to influence practice change, with desired results being practice improvement and better patient outcomes (Johns Hopkins Medicine, n.d.). In each of these phases, the users reflect on the process to determine challenges, feasibility, and accessibility of the practice change for both stakeholders and patients, with changes made to the process based on these data. When applying the JHEBP model to this QI project, the initial query came from a provider at the clinic, who noticed increasing rates of resistant hypertension, with no identifiable underlying cause, in patients without a screening or diagnosis of OSA. Based on this inquiry, the team determined the Population, Intervention, Comparison, Outcome (PICO) question to be: in a primary care setting, does the implementation of a screening protocol affect OSA screening and referral rates for high-risk populations when compared to no standardized screening protocol? Review of current evidence on the topic reveals that OSA is extremely common, especially in high-risk populations, including those with hypertension (Santilli et al., 2020).

Current Workflow

Current workflow of annual visits is as follows: when a patient arrives, the clinic manager or office assistant checks the patient in, providing consent and screening forms to be filled out in the waiting room. The office manager then puts together a folder which includes an intake form, with current vital signs, completed consent and screening tools, and a current

medication list. This folder is then placed outside the assessment room in a wall holder. The patient is taken back with the CMA or RN for vital sign measurements and completion of annual intake forms. The patient then waits for the provider in the assessment room. The RN/CMA flags any pertinent information on the intake forms for the provider to address with the patient. The provider then takes the folder and enters the assessment room for the annual visit. Documents in the folder are reviewed with the patient and a plan of care is created. Once the visit is complete, the provider writes down any lab work or referrals needed for the RN/CMA to complete. The RN/CMA then puts the folder in the office manager's wall holder, with all completed documents scanned and uploaded into the EHR by the office assistant/manager.

Methods

Intervention and Implementation Summary

The proposed practice change will take place at a privately-owned family practice clinic in the Southwestern part of Montana, whose population majority consists of midlife to geriatric clientele. The clinic's staff include one Medical Doctor (MD), three NPs, one RN, 2 CMAs, one clinic manager, and two clinic assistants. The focused patient population includes all patients aged 30-70 years with a diagnosis of hypertension or obesity. Nursing staff will initiate OSA screening with the validated SBQ at annual visits for this population. The implementation process will occur over a six-week period starting in early-to-mid January, 2025 and ending mid-to-late February, 2025. Throughout the implementation phase, data will be collected from stakeholders to assess for challenges, accessibility, and feasibility of the proposed practice

change. Based on these data, changes to the implementation process will be made. Data collection will occur every week with a pre-and-post implementation comparison of data.

Intervention and Implementation

The three-step process of the JHEBP model includes the practice question, evidence, and translation (PET). Identification of a problem is the beginning of the process. After identification of the practice problem as previously addressed above, step one calls for team formation to provide insight and expertise related to the problem. It was determined that each member of the clinic would play an important role in the practice change process from beginning to end, making all members stakeholders.

Pre-implementation Strategies QI protocol pre-implementation steps included one-to-one discussions with stakeholders, to review the current screening process and to better understand current workflow, including each member's role in the process. Discussions centered around shared-decision making regarding best approaches for practice change implementation to ensure its greatest success and stakeholder buy-in. Next, clarification of the practice question was finalized. Based on the aforementioned PICO model, the question to be answered is: in primary care settings, does the implementation of a screening protocol impact OSA screening and referral rates when compared to no standardized screening protocol? Stakeholder educational sessions regarding risks of undiagnosed OSA, benefits of screening and referral to sleep studies, including early treatment interventions and decreased disease burden and sequelae, will take place with all stakeholders. Educational handouts will be provided during this session.

Based on the Johns Hopkins Evidence-Based Practice (JHEBP) model, the objectives of this project include boosting screening and referral rates in order to enhance early detection rates

of OSA in high-risk patients. Step two of the JHEBP model focuses on evidence review, with an outline for how to search for, appraise, and summarize, the current literature on the topic. The evidence reviewed supports the use of a standardized screening process for OSA in high-risk patients in primary care. The use of validated screening tools, such as the SBQ, and education materials for providers, such as screening algorithms, drastically improves screening and referral rates (Miles et al., 2017; Ononye et al., 2019; Soni et al., 2019). Utilizing step two of the JHEBP, the project aims to implement the SBQ with screening and referral algorithms and education sessions with stakeholders to achieve this practice change. The final step emphasizes the development of a detailed action plan to implement the change into practice. This includes adaptation of the change into the specific clinical setting and identification of required resources for change implementation. Involving key stakeholders early in this process is critical for success and on-going conversations with staff to ensure seamless implementation will be performed via phone call, email, and in-person meetings. Utilizing the JHEBP model appendix, titled, "Stakeholder Analysis," (Appendix C), key stakeholder roles were addressed. Continued use of this tool throughout the practice change initiative promotes communication between stakeholders. Throughout implementation, a key step in the final phase is to assess fit, feasibility, and accessibility of the new process. Utilizing a communication questionnaire (CQ) as part of the screening package allows for continuous assessment of the process form to detect any potential barriers and evaluate feasibility and accessibility of the process change in workflow. Communication with staff will be conducted on a weekly basis, either in person or by email, to address any concerns with fit, feasibility, or accessibility of the screening protocol for any

stakeholders. Based on the CQ results, changes to the implementation process will be made accordingly to achieve best possible outcomes.

QI Implementation QI project implementation tools include a paper version of a screening/referral process algorithm adapted from the AASM (2023) guidelines (Appendix D), a validated OSA screening tool, the SBQ, (Appendix E), and a CQ (Appendix F). Together, these will be referred to as the screening package. Furthermore, an education handout from the American Thoracic Society (n.d.) (Appendix G) will be made available for all eligible patients to enhance health literacy and follow-up adherence. In discussion with stakeholders, it was determined that the most seamless method of process implementation would be to add the screening package to all annual visit folders. Unfortunately, there is no easy method of inserting an EHR alert into current workflow for staff to be made aware of which patients are required to have OSA screening at their annual visits, thereby removing the option of the patient filling the screening tool out ahead of time in the waiting room. Adding the screening algorithm to the screening package aims to address this barrier. The algorithm will alert nursing staff to determine, based on diagnoses and current BMI, whether the patient requires OSA screening. The RN/CMA will then fill out the SBQ during patient check-in. Based on the results, providers will determine whether referral for a sleep study is warranted. Providers will hand out education flyers to each positive-screened patient prior to the end of their visit. The SBQ will then be scanned and uploaded into the patient's EHR by the office manager or office assistant. Appendix H specifies the step-by-step process via a swim lane diagram.

Costs Cost associated with project implementation currently amount to zero dollars. The implementation of the screening package into practice does not add additional cost, as these are

free online tools easily printed off in paper form. Since screening for OSA is part of preventive health, no extra visits for patients are necessary, as screening is effortlessly streamlined into annual visits. Moreover, follow-up visits for education or treatment options can provide reimbursement opportunities for providers (AASM, 2023).

Necessary Training Each stakeholder involved retains the necessary training, skills and licenses to perform such duties as described in the intervention process. All nursing staff, including RN and CMAs are trained and licensed to obtain vital sign measures and document results accordingly. All providers are authorized to assess patients, interpret results, and refer patients to sleep studies based on screening results, as this is within their scope of practice as licensed clinicians.

Barriers Potential barriers to practice change include perceived increased workflow by stakeholders, providers failing to remember to screen or fill out the CQ, and staff being unsure of who and how to screen for OSA, or who to refer for sleep studies. Since paper forms will be utilized, there is always a risk of misplacement of documents. Furthermore, patients may choose to not participate in screening. The short-term and long-term SMARTIE goals provided specifically address these potential barriers.

Evaluation and Analysis

Evaluation of the process and practice change outcomes will be conducted utilizing specific metrics including provider adherence rates to the screening protocol, as well as referral rates. Moreover, data regarding which specific diagnosis triggers the screening process will be monitored and collected by the project leader. If screening and/or referral was not conducted, data will demonstrate how frequently and on what basis. Data collection will be obtained via the

CQ. Staff will fill out the CQ at the end of each screened visit throughout the six-week intervention period. The data will be reviewed each week and changes to implementation will occur based on results. Finally, data analyses of goal rates versus actual rates of screening and referral will be conducted via percentage calculation. These results will then be interpreted at the end of the implementation period by the project leader. This is in alignment with previous QI projects monitoring the impact of screening protocols on OSA detection and subsequent diagnosis and treatment rates. Project goals focus on standardization of OSA screening as evidenced by improved OSA screening and referral-for-diagnosis rates, thereby enhancing early treatment and minimizing health sequelae. This aligns with previous QI project aims and outcomes focusing on enhancing screening of OSA in primary care (Miles et al., 2017; Ononye et al**.,** 2019). As outlined in the SMARTIE goals, these are measured by comparing pre-and-post intervention screening rates, with secondary goals of enhancing referral rates to sleep centers to confirm diagnosis. Ultimately, long-term goals include early detection and expedited treatment of OSA, via CPAP, thereby reducing and preventing serious health and financial complications.

Safety and Confidentiality

Patient safety is of utmost importance and while this project aims to improve patient outcomes, this is only ensured by assessing and protecting patient safety. Patient safety measures in place at the clinic include HIPPA recommendation guidelines and storage of records which will be maintained via clinic policy throughout the duration of the practice change implementation. The practice change is within the capabilities of the clinic's confidentiality protocols already in place safeguarding the transfer of paper-to-electronic documents. Furthermore, no records will be transferred off-site. No new procedures are necessary regarding

patient safety, as screening protocols require no more involvement than usual care during routine assessment. The decision for patients to participate in a sleep study, however, does increase safety risk, demonstrating the need for comprehensive health literacy and informed consent to ensure shared decision-making. In terms of confidentiality, all information transferred from the clinic for the purpose of this project will be de-identified, as the main source of data will come from the CQ which does not require any identifying patient information. The SBQ will only ever be electronically uploaded into patient EHRs at the clinic site, ensuring appropriate VPN and technological safety.

CHAPTER THREE

QUALITY IMPROVEMENT MANUSCRIPT

Contribution of Authors and Co-Authors

Manuscript in Chapter 3

Author: Sarah Catherine de Groot BSN, RN

Contributions: Conceptualization and design of the quality improvement project, literature review, development and implementation of intervention strategies, data collection and analysis, manuscript drafting, critical revision, and final approval of the completed work.

Co-Author: Marcy Hanson, PhD

Contributions: Oversight of project development and implementation, guidance on quality improvement methodology, critical review and feedback throughout all phases of the project, and approval of the final manuscript.

Co-Author: Rebecca Hoover, PhD, RN, BSN, MMB

Contributions: Support with project design and methodology, review of written content, feedback on data analysis, and editorial input during manuscript preparation.

Manuscript Information

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MMB

Impact of an obstructive sleep apnea screening protocol on provider adherence in a primary care clinic

Status of Manuscript:
☒ Prepared for submission to a peer-reviewed journal
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Abstract

Background

Uncontrolled Obstructive Sleep Apnea (OSA) has devastating repercussions, contributing to the leading cause of death in the United States (US): cardiovascular disease. However, nearly 90% of cases remain undiagnosed nationally (Aurora & Quan, 2016). The American Academy of Sleep Medicine (AASM) recommends routine OSA screening with validated tools in high-risk populations, including adults with hypertension and/or obesity (2017). Standardized screening protocols may enhance early detection and treatment of OSA, mitigating the catastrophic health outcomes of this silent killer.

Local Problem

Providers on site rarely performed routine, standardized OSA screening on high-risk patients. This project aimed to increase routine OSA screening, risk detection, and subsequent referrals for 30 to 70-year-old patients with hypertension and obesity.

Methods

A screening protocol adapted from the AASM 2016 guidelines was created for staff. Education sessions for all stakeholders occurred prior to implementation.

Interventions

Interventions included implementation of a screening/referral algorithm, a validated screening tool (the STOP-Bang Questionnaire), and a communication questionnaire for staff to complete on all eligible patients. Reminders included sticky notes placed on computers.

Education posters were placed in all examination rooms, and education pamphlets were made available for positive-screened patients.

Results

At pre-intervention, 14-25% of patients with hypertension and/or obesity were screened, detected, and referred for OSA diagnosis. At post-intervention, screening rates were 53%, risk detection rates were 75%, and diagnostic referral rates were 67%.

Conclusion

This project successfully increased OSA screening, enhanced risk detection, and improved diagnostic referral rates, demonstrating the efficacy of structured screening in primary care settings.

Clinical Problem

Obstructive Sleep Apnea (OSA) is a common disorder characterized by periods of partial (hypopnea) or complete (apnea) airway collapse during sleep, leading to deoxygenation, nighttime arousals, and chronic inflammation (Slowik et al., 2024). OSA is a standalone risk factor for various cardiovascular, metabolic, and neurocognitive conditions that are of global concern and is associated with all-cause mortality (Senaratna et al., 2017). The economic burden of OSA is catastrophic, with estimated healthcare costs upwards of $150 billion annually in the United States (US) alone (American Academy of Sleep Medicine [AASM], 2023). OSA drives workplace and motor vehicle accidents, contributing to lost productivity and public safety concerns (Chung, 2021). Recent data suggest that the US prevalence of OSA falls behind only China, with approximately 82% of men and 93% of women remaining undiagnosed

(Morgenthaler et al., 2015). OSA prevalence has increased by 442% over two decades and is projected to surpass 75 million in the US by 2050, primarily driven by rising obesity rates. (Boers et al., 2024; USPSTF, 2022). The Centers for Disease Control (CDC) has partnered with national sleep organizations to create the National Healthy Sleep Awareness Project [NHSAP] to educate healthcare professionals and the public about risk factors and symptoms of OSA to increase detection (Boers et al., 2024; Morgenthaler et al., 2015).

Specialists perform sleep studies at home or in a clinic to diagnose OSA (Pivetta et al., 2021). Lab polysomnography (PSG) is the gold standard of diagnosis, and the number of apnea, hypopnea, or sleep arousal events per hour of sleep determines severity. These events are measured using the Apnea-Hypopnea Index (AHI) (Slowik et al., 2024). OSA is highly comorbid with hypertension and obesity, as 40-90% of those diagnosed with obesity also have OSA; a 10% weight gain correlates to a six-fold increase in risk and a 36% rise in AHI events (Rundo, 2019). Conversely, a 10% reduction in weight reduction can significantly decrease OSA events, lowering the AHI by approximately 26% (Rundo, 2019). Approximately 30 to 83% of hypertensive individuals have OSA, with moderate-to-severe forms posing a threefold risk increase for the development of resistant secondary hypertension, diminishing the efficacy of medications (Ou et al., 2023; Rundo, 2019).

Although Primary Care Providers (PCPs) manage hypertension and obesity, OSA remains grossly undiagnosed in these high-risk populations, complicating treatment and worsening health outcomes (Santilli et al., 2020). Given the severe health consequences of untreated OSA, it is prudent for providers to effectively screen and refer patients early. The AASM 2016 guidelines recommend screening asymptomatic high-risk individuals including

adults with obesity (Body Mass Index (BMI) ≥30kg/m2) and hypertension, among others (Kapur et al., 2017). The United States Preventive Task Force (USPSTF) has a grade I for insufficient, stating inconclusive evidence to support routine OSA screening in asymptomatic patients (2022). Most patients, however, do not openly discuss their symptoms with providers, and providers do not consistently ask their patients about sleep (Grandner & Malhotra, 2015; USPSTF, 2022). Additionally, most symptoms of OSA are not well recognized by patients, making them less likely to initiate a conversation about sleep-disordered breathing; only 34.2% of patients with OSA symptoms seek medical care (Chen et al., 2021; Office of Disease Prevention and Health Promotion [OASH], n.d.). Lack of structured screening leads to diagnostic delay and worsening of complications, with most persons only being screened and diagnosed when a subsequent comorbidity is already present (Lyons et al., 2022). Moreover, the severity of OSA does not always correlate with symptoms; over 65% of patients with moderate-to-severe OSA are asymptomatic, decreasing the likelihood that providers will consider screening without standardized protocols in place (Carter, 2017).

The absence of state-specific OSA data in Montana underscores a critical gap in addressing this condition despite its well-established links to the top ten leading causes of death within the state, including heart disease, stroke, dementia, diabetes, and fatal car accidents (Centers for Disease Control and Prevention [CDC], 2024; USPSTF, 2022). In the rural state of Montana, one-third of adults are obese and/or have hypertension, placing a significant portion of the population at high risk for OSA (Montana DPHHS, 2024). As the first point of contact for most patients, especially in rural regions, PCPs can expand access to early detection by

seamlessly integrating OSA screening into annual preventive exams (Shapira-Daniels et al., 2020).

In one small primary care clinic in South-central Montana, rates of obesity and hypertension were high, yet diagnosis of OSA was low. One in four clinic patients has hypertension or obesity. Moreover, 84% of obese patients at the clinic also have hypertension, reflecting National data suggesting a causal relationship between obesity and hypertension, with obesity attributing 65 to 78% of primary hypertension (Shariq & McKenzie, 2020). Baseline data showed that 14 to 25% of adults aged 30 to 70 with hypertension, obesity, or both had a prior OSA diagnosis. Assuming these diagnoses occurred through the clinic, estimated screening, detection, and referral rates ranged from 14% to 25%, though no formal data existed. Providers did not use a standardized screening protocol to stratify risk and identify candidates for diagnostic evaluation. Routine screening for OSA in asymptomatic patients may close the gap between high-risk populations, such as those with hypertension and/or obesity, and the devastating health consequences of untreated OSA.

Review of the Literature

Extensive research highlights that age, BMI, neck circumference, and observed apnea are strong independent predictors for moderate-to-severe OSA (Kreitinger et al., 2020; Shapira-Daniels et al., 2020). Several health conditions contribute to OSA, including endocrine, neurological, and cardiovascular disorders (Slowik et al., 2024). Specifically, severe OSA is independently linked to hypertension, diabetes, metabolic syndrome, and depression (Heinzer et al., 2015). Consistently, most patients diagnosed with moderate-to-severe OSA are obese and have higher rates of hypertension, a history of stroke, or atrial fibrillation—highlighting these as

predictive risk factors for OSA (Heinzer et al., 2015). Despite this, OSA remains grossly underdiagnosed in all these conditions (Aurora & Quan, 2016; USPSTF, 2022). Previous Quality Improvement Projects (QIPs) demonstrate significant improvement in OSA detection and diagnosis rates with the implementation of a validated tool compared to provider judgment alone (Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019). Treatment adherence drastically improves when patients are managed by their PCPs, with compliance rates as high as 93% nearly two years after initial treatment, underscoring the need for PCPs to have clear clinical guidance on screening and managing this condition (Shapira-Daniels et al., 2020). The STOP-Bang Questionnaire (SBQ) is a validated tool for assessing OSA risk in general adult populations (Edinger et al., 2012). This eight-question survey uses subjective and objective data to identify risk factors and symptoms associated with OSA (Ononye et al., 2019). An SBQ score of 3 indicates a positive result (Pivetta et al., 2021).

The SBQ is quick and convenient, taking approximately 1–2 minutes to complete, and can be administered on paper or electronically at no cost (Edinger, 2012). It demonstrates high sensitivity across diverse clinical settings and ethnic groups, with sensitivity rates exceeding 90% in general populations (Kapur et al., 2017). Higher SBQ scores significantly increase the likelihood of detecting OSA, with sensitivity ranging from 81% to 100% regardless of sex, ethnicity, population, or diagnostic setting (Braley et al., 2018; Donovan et al., 2017; Lyons et al., 2022; Shapira-Daniels et al., 2020). Severity correlates with cutoff scores: higher SBQ scores predict worsening OSA (Braley et al., 2018; Kreitinger et al., 2020; Lyons et al., 2022; Shapira-Daniels et al., 2020; Shieu et al., 2022). However, the negative predictive value of the SBQ is

variable, indicating that while it is an effective screening tool, it should not replace sleep studies for formal diagnosis (Kapur et al., 2017).

Theoretical Framework

The Johns Hopkins Evidence-Based Practice (JHEBP) model involves a three-step process, which includes the practice question, evidence, and translation (PET) (Johns Hopkins Medicine, n.d.). This model was utilized to integrate a routine OSA screening protocol for asymptomatic high-risk patients with hypertension and/or obesity into a primary care clinic. After determining the practice question, evidence regarding OSA risk and screening protocols was reviewed to refine the question, evaluate its applicability, and assess whether the evidence provided solutions. Evidence supported the implementation of an OSA screening protocol using the SBQ in asymptomatic high-risk patient populations in primary care; utilizing a communication questionnaire as part of the screening package allowed for continuous assessment of the process to detect any potential barriers and evaluated feasibility and accessibility of the process change in workflow. Communication with staff was conducted weekly, either in person or by email, and any concerns about the fit, feasibility, or accessibility of the screening protocol for stakeholders were addressed. Based on communication with stakeholders, changes to the implementation process were made accordingly to increase adherence, ease workflow, and enhance outcomes.

Purpose and Aims

The project's overall purpose was to implement standardized OSA screening in asymptomatic patients with hypertension and/or obesity between the ages of 30 and 70 years,

using the SBQ in a primary care setting. The project intended to increase early detection of OSA, which is fundamental for preventing disease, decreasing the healthcare burden, and expediting treatment. (Lyons et al., 2022). There were two primary aims of this QIP. First, to increase estimated screening rates from 14% to 25% at pre-intervention to 100% at post-intervention within an 8-week period for eligible patients at new visits and annual examinations. Second, the project aimed to increase referral rates for positive-screened individuals on the SBQ to 80% post-intervention. The project proposal intended to create an algorithm, adapted from the AASM 2016 guidelines, for staff to reference in decision-making (Kapur et al., 2017).

Methods

Context

The proposed practice change occurred at a privately owned family practice clinic in South-central Montana, whose population mainly consists of midlife to geriatric patients, consistent with the highest age risk for OSA development (Slowik et al., 2024). The clinic's staff included one Medical Doctor (MD), three Nurse Practitioners (NPs), one Registered Nurse (RN), two Medical Assistants (MAs), one clinic manager, and two clinic assistants: all stakeholders in the project. Inclusion criteria included all patients aged 30 to 70 years with either hypertension and/or obesity, specifically, a blood pressure reading of ≥130/80 and/or a BMI ≥35. These high-risk participants were chosen using convenience sampling as data were collected during annual examinations and at new establishment of care visits. Exclusion criteria included a previous diagnosis of OSA. Among the total clinic population (n=2826l), 66.3% (n=1874) were between the ages of 30 and 70 years, with 58% female. Within this age group, 24% of patients (n=450) had a diagnosis of hypertension (blood pressure ≥130/80), and 25% (n=467) had a diagnosis of

obesity (BMI ≥35), with 84% (n=392) of obese patients also having hypertension. Notably, 20% of patients (n=375) in this age range had both hypertension and obesity. Despite this, only 14% of this subgroup (n=53) had a diagnosis of OSA. Clinic intake forms were conducted on paper, either by MAs or the RN on intake.

Interventions

During an eight-week implementation phase, a comprehensive screening protocol, adapted from the AASM 2016 clinical guidelines, was implemented with the goal of early OSA risk detection in patients with hypertension and/or obesity. The initial interventions consisted of a paper-based screening and referral process algorithm (appendix D), a printed version of the validated STOP-Bang Questionnaire (SBQ) (appendix E), and a communication questionnaire (appendix F) for staff to complete for all eligible patients. Collectively, these components were referred to as the screening package. Additionally, education pamphlets (appendix G) were made available for all eligible patients to enhance health literacy and encourage follow-up adherence. Unfortunately, no method existed to insert an Electronic Health Record (EHR) alert into workflow for staff reminders or to capture data on patient eligibility, removing the possibility of patients filling the SBQ out at home. The screening algorithm was added to the package to address this barrier. Initially, the screening package and education pamphlets were placed in all annual visit folders for easy access.

However, after reassessing fit, feasibility, and accessibility at week five, stakeholders agreed to include new patients at establishment-of-care visits to improve use and early detection. This patient population would be screened at their first visit and, if positive, would be asked to schedule a follow-up appointment for further evaluation and shared treatment decision-making.

Other changes made in week five included applying sticky notes to nursing staff computers with screening reminders for adherence improvement. Patient education posters (appendix I) highlighting the health consequences of untreated OSA were added to all examination rooms to enhance health literacy and follow-up adherence. The implementation phase was extended from six to eight weeks to assess these changes adequately. Patients with established diagnoses of hypertension and/or obesity, or those with day-of vital sign measures indicating elevated blood pressure or BMI, were screened for OSA risk using the SBQ. MAs or the RN screened patients during intake by referencing the screening algorithm. If a patient screened positive with a score of ≥3, the provider was notified and shared decision-making-guided follow-up for a diagnostic referral. Providers were responsible for handing out education pamphlets to all positive-screened patients prior to the end of their visit. The office manager or assistants uploaded the scanned SBQs into the EHR. All stakeholders were responsible for completing the communication questionnaire.

Measures

QIP evaluation involved assessment of SBQ implementation outcomes and subsequent referrals to sleep studies by providers. Two mid-term SMARTIE goals were established: 50% utilization of the SBQ by staff for eligible patients and a 40% referral rate of patients with positive SBQ screens. End-term SMARTIE goals included 100% utilization of the SBQ by staff for eligible patients, an 80% referral rate for positive-screened patients, and 50% distribution of education pamphlets to positive-screened patients. All data were collected from the deidentified communication questionnaires and SBQs for analysis. Data included gender, age range, qualifying diagnoses, screening participation, SBQ score, sleep study referral participation, and

receipt of an education pamphlet. Patients were stratified into low-, intermediate-, or high-risk categories based on SBQ cutoff scores. A positive SBQ score of ≥ 3 prompted a sleep study referral per the algorithm provided (Kapur et al., 2017). Analysis of these outcomes evaluated the efficacy of adopting a screening protocol for asymptomatic high-risk patients in primary care.

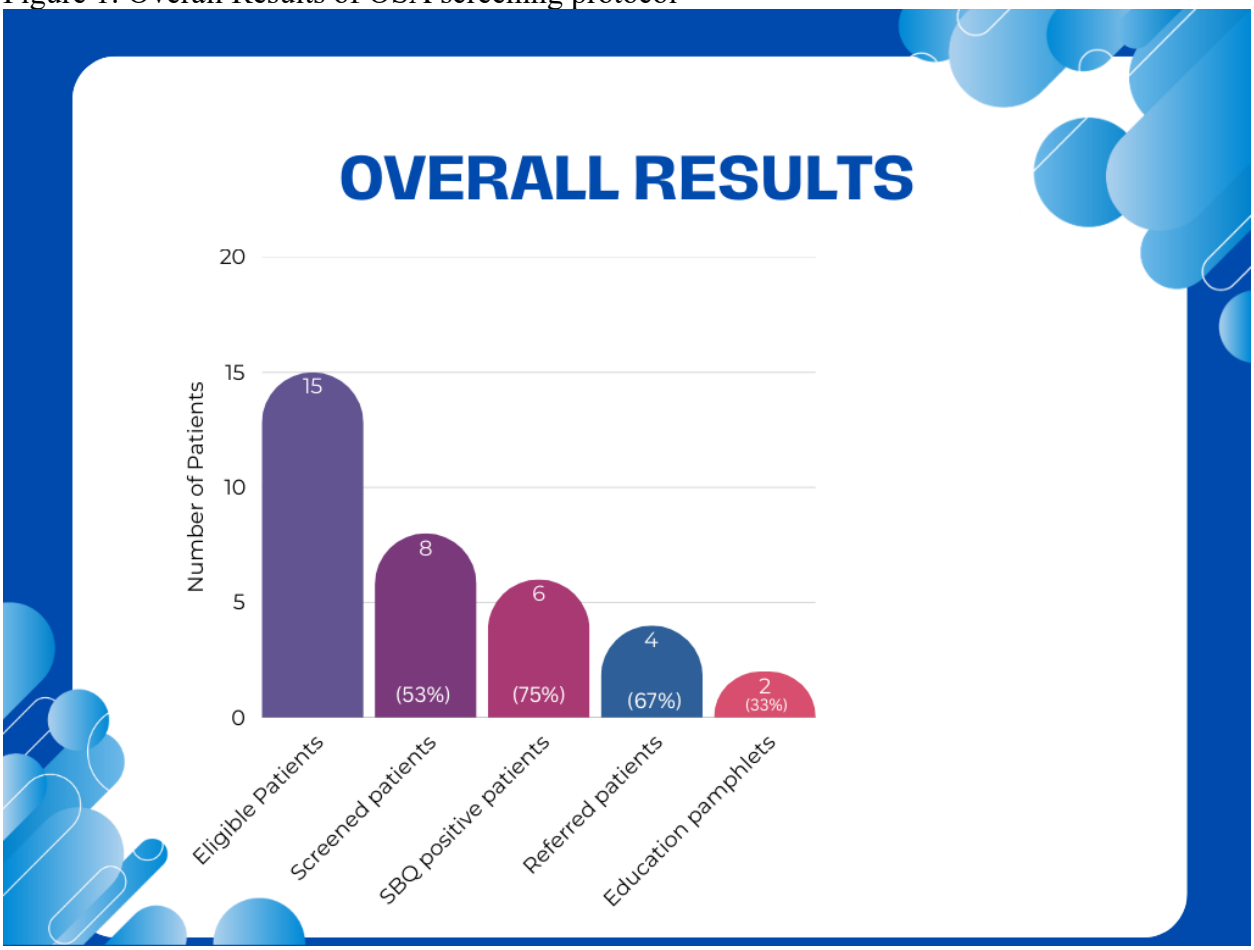
Statistical Analysis

Post-intervention data demonstrating eligible patients, screening, detection, and referral rates were calculated via percentages. Pre-and-post-intervention screening, risk detection, and referral rates were also calculated using percentages and comparing SMARTIE goal rates to actual results. Finally, descriptive statistics were used to define and illustrate the characteristics of screened patients. Microsoft Word and Canva were utilized for data analysis.

Results

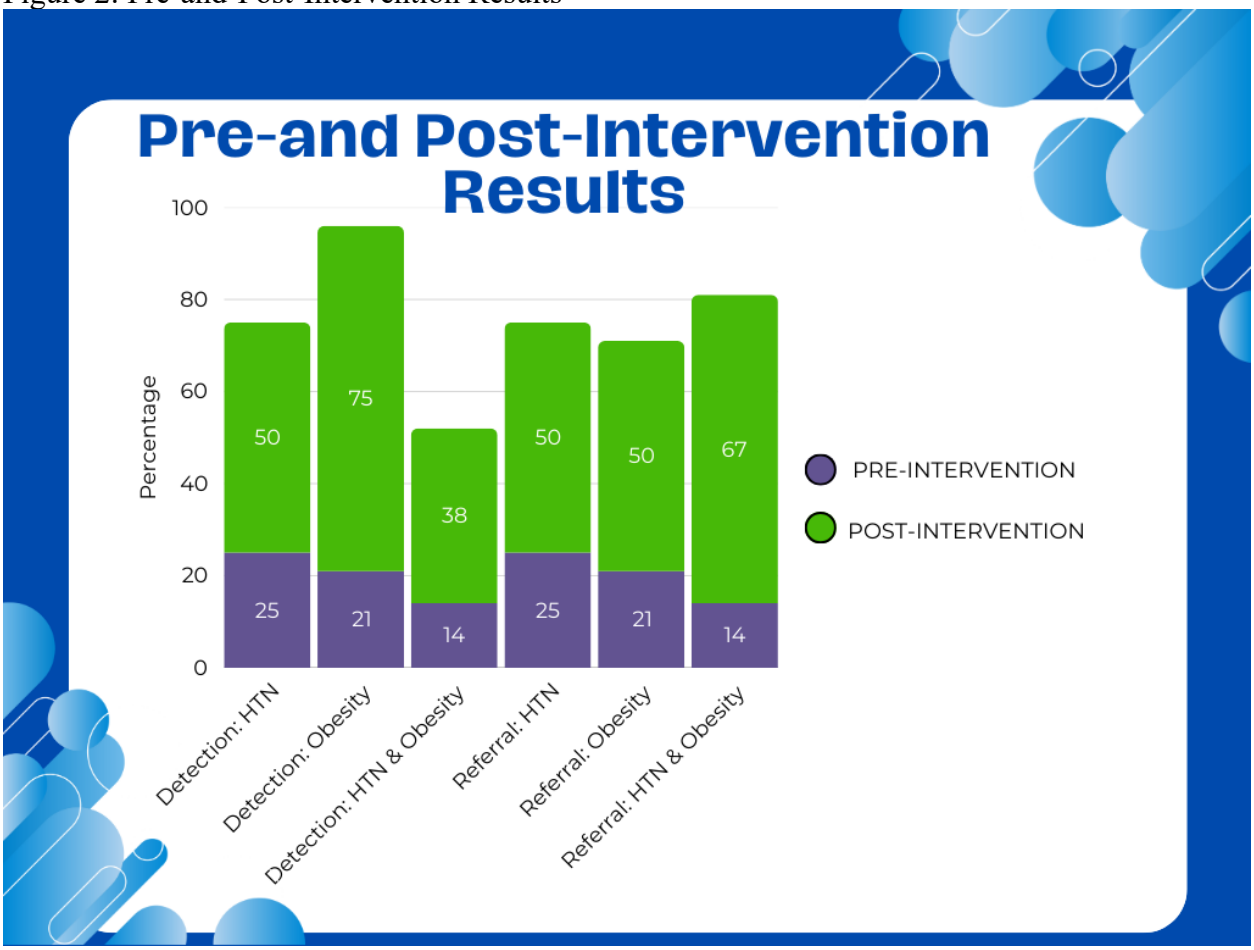
During an eight-week intervention phase, the total number of annual and new patient visits was ninety-seven. Of these visits, fifteen patients were eligible for OSA screening, and 53% (n=8) were screened. Of the screened patients, 75% (n=6) screened positive with an SBQ score of ≥3. Of the positive-screens, 67% of patients (n=4) were referred for sleep studies. The education pamphlet administration rate was 33% (n=2), as referenced in Figure 1.

Figure 1: Overall Results of OSA screening protocol



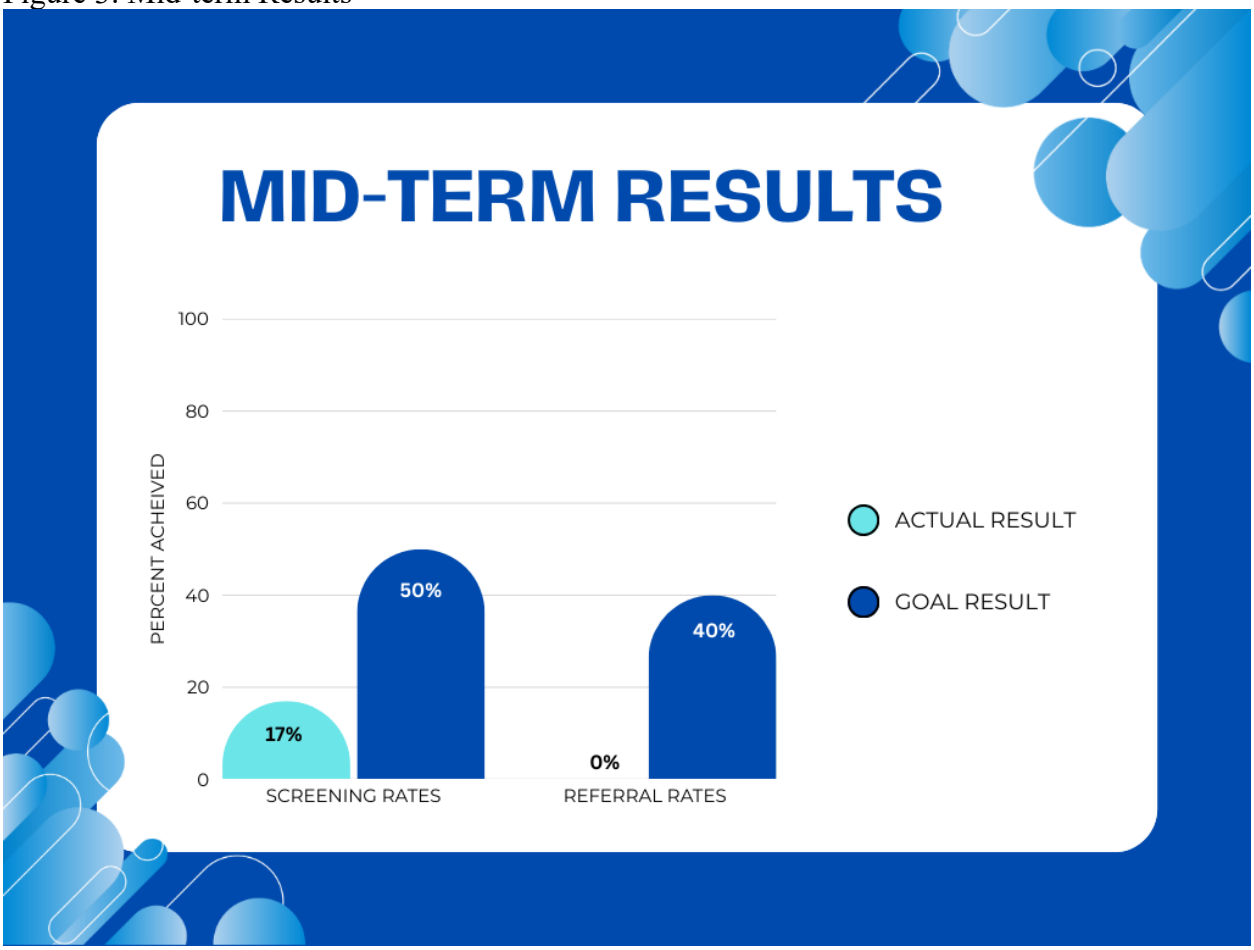
When comparing pre- and post-intervention data, the detection and referral rates for OSA among patients with hypertension and/or obesity improved significantly. Estimated Pre-intervention OSA detection rates ranged from 14 to 25%. After the intervention, detection rates increased between 38 and 75%, while referral rates rose between 50 and 67%, as referenced in Figure 2.

Figure 2: Pre-and-Post-Intervention Results



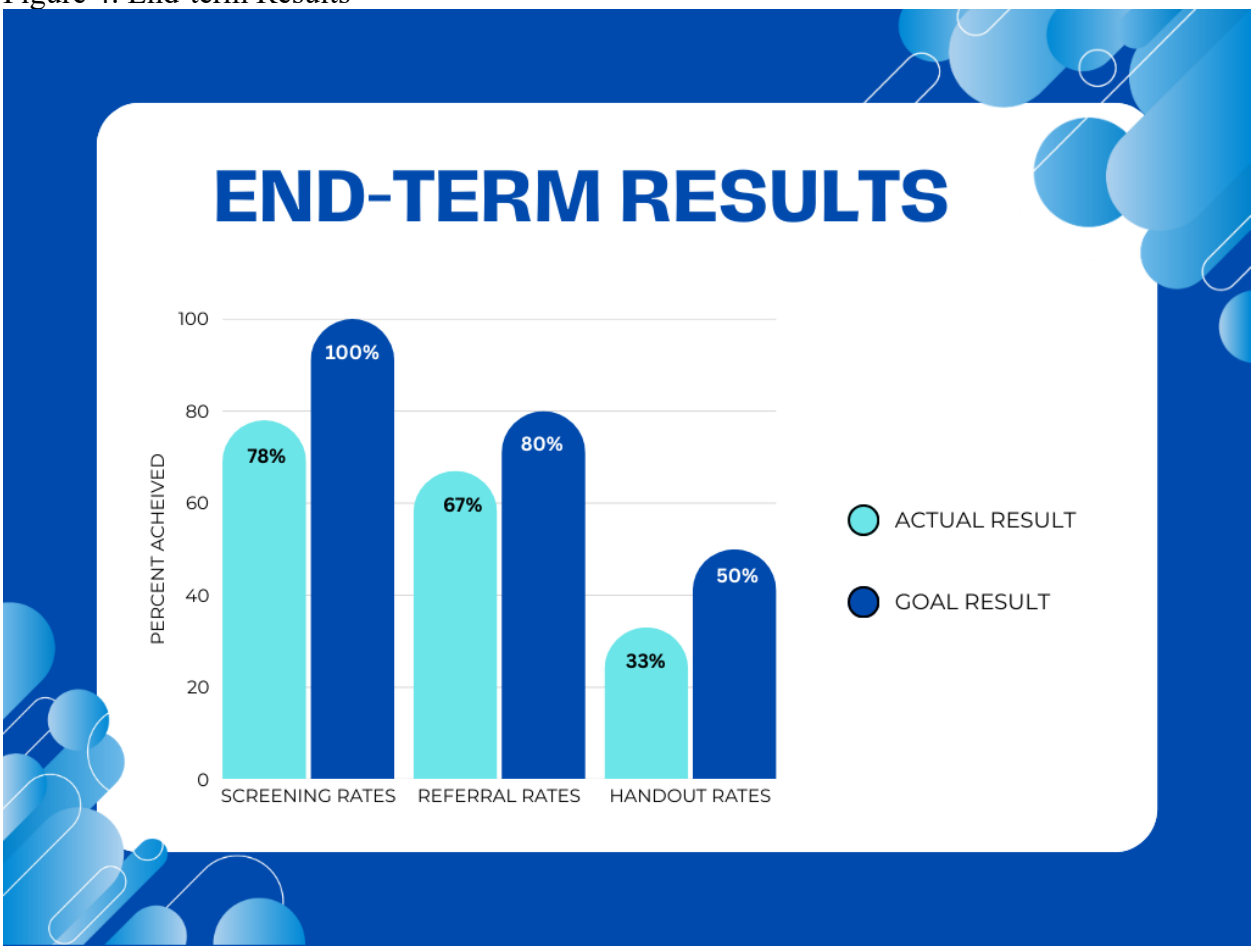
During the first three weeks of project implementation, 30 annual visits occurred with six eligible patients identified for OSA screening; 17% (n=1) were screened with an SBQ score of 1. Zero percent (n=0) were referred for diagnosis, as referenced in Figure 3.

Figure 3: Mid-term Results



Between weeks four and eight, including the additional intervention changes made at week five, 67 annual and new patient visits occurred, with nine patients meeting screening eligibility. Of these eligible patients, 78% (n=7) were screened, noting a 61% increase from the first three weeks. Among those screened, 86% (n=6) tested positive on the SBQ with a score of ≥3. Sixty-seven percent (n=4) were referred for a sleep study, as highlighted in Figure 4.

Figure 4: End-term Results



Regarding patient demographics, the median age range was 40-49 years. Eighty-eight percent (n=7) and 14% were male (n=1). Obesity rates were 75% (n=6), and hypertension rates were 50% (n=4), while combined rates were 38% (n=3). The median SBQ score was 3, while the only male patient had an outlying SBQ score of 7. The Median OSA risk category was intermediate, as demonstrated in Table 2.

Table 2: Patient Statistics

Patient #	Age Range	Gender	Hypertension	Obesity	SBQ Score	OSA Risk Category	Referred for Sleep Study
1	50-59	Female	No	Yes	4	Intermediate	Unknown
2	40-49	Male	Yes	Yes	7	High	Yes
3	<30	Female	No	Yes	1	Low	No
4	>70	Female	Yes	Yes	3	Intermediate	Yes
5	30-39	Female	Yes	Yes	3	Intermediate	Refused
6	60-70	Female	No	No	2	Low	Yes
7	40-49	Female	No	Yes	3	Intermediate	Yes
8	40-49	Female	Yes	No	3	Intermediate	Unknown

Discussion

This QIP aimed to increase OSA screening and referral rates, with the end goal of enhancing early risk detection by implementing a standardized screening protocol in high-risk patients. Using validated tools such as the SBQ improves OSA screening in primary care settings (Kapur et al., 2022). The outcomes of this QIP align with evidence, underscoring that structured protocols lead to enhanced OSA evaluation with an estimated pre-intervention screening rate of 25%, increasing to 53% post-intervention. The SBQ was instrumental in identifying high-risk patients, with 75% total positive screens after implementation. Remarkably, 100% of screened patients aged 30 to 70 years with hypertension, obesity, or both were identified as intermediate-to-high-risk for OSA, reinforcing the well-established link between these conditions. These patients would likely be missed prior to this practice change. Diagnostic referrals improved after

implementation, as 67% of positive-screened patients were referred compared to an estimated 25% pre-intervention, boosting provider engagement. Interestingly, the obesity and hypertension group had the lowest estimated referral rate pre-intervention at only 14% but had the highest post-intervention referral rate of 67%, highlighting the severity of missed detection in the highest-risk group before implementation. Previous QIPs have demonstrated similar findings in primary care settings with improved OSA screening and referral by 30 to 90% with a structured protocol (Miles et al., 2017; Ononye et al., 2019; Tokarczyk, 2019). During the first half of the implementation phase, most eligible patients were still being missed for screening, primarily due to staff forgetfulness, as no reminders existed outside of the algorithm, and the process was new.

Mid-term goals of achieving 50% screening and 40% referral rates were therefore unmet, with screening rates just below 17%. After implementation changes at week five, screening and referral rates significantly increased, demonstrating that staff reminders and targeted patient education aided adherence. During the second half of the implementation phase, between weeks four and eight, only one known eligible patient was not screened, and this was due to refusal. Due to a lack of communication questionnaire and SBQ completion, the other eligible patient's screening status was unknown; another positive-screened patient did not have an associated communication questionnaire completed. Therefore, diagnostic referral in this case was unknown. During stakeholder discussion, staff could not recall whether the completion of an associated SBQ or a communication questionnaire existed.

Although end-term goals of 100% screening and 80% referral rates for positive-screened patients were unmet, the significant increase in screening and referral rates from the first to the second half of implementation is highly positive. Small changes at week five drastically

impacted the implementation outcome, demonstrating the importance of following an evidence-based practice change model. Comparison of pre-and-post-intervention data highlights that the use of standardized screening protocols substantially improves early OSA risk detection and referral rates, underscoring the health benefits for those at high risk.

In terms of the demographics, the vast majority of screened patients were female, which may be due to overlapping issues, including sampling methods, the rate of each sex at the clinic, and differences in healthcare access rates among the sexes. Although there was only one male participant, he produced the highest SBQ score, aligning with National data, highlighting the association between the male sex and the high risk of OSA (Slowik et al., 2024). In terms of diagnoses, 75% of screened patients were obese, correlating with current evidence, underscoring that 40-90% of those diagnosed with obesity have OSA (Rundo, 2019). Half of the participants had a diagnosis of hypertension. Of this group, the majority also had an elevated BMI, reflecting international data that demonstrates a causal relationship between obesity and hypertension, with obesity contributing to the majority of hypertension cases (Shariq & McKenzie, 2020). The demographic results demonstrate the high risk of OSA development in both hypertensive and obese populations, with 75% of patients having an intermediate-to-high risk detection rate based on the SBQ.

Among the only two low-risk patients, one did not qualify based on a diagnosis of hypertension or obesity but instead had the cardinal symptoms of OSA: daytime fatigue and snoring (Slowik et al., 2024). She requested screening after reviewing the education poster in the visit room, further demonstrating the efficacy of patient education on health literacy. The other low-risk patient was younger than 30, which aligns with evidence demonstrating that middle-

aged adults are at particular risk (Slowik et al., 2024). One participant included in the results was older than 70, was female, had both obesity and hypertension, and was at intermediate risk for OSA. This outlier emphasizes that post-menopausal females may be of particular OSA risk, as most recent evidence indicates (Shieu et al., 2022).

Limitations

Limitations to this QIP included sample size, as this diminishes the generalizability of results. Given that eligible participants were of a specific subpopulation and age demographic, this QIP cannot speak to other groups of patients, such as those with other high-risk conditions or patients younger than 30 years or older than 70 years. Another limitation was its formatting and implementation process. Since this clinic's EHR system could not insert reminders or create a digital process for screening, the process relied heavily on paper formatting and human input, requiring multiple people to remember to participate in a chain of events to ensure screening occurred. During the eight-week implementation phase, the team missed 47% of eligible patients. In speaking with staff, forgetting to screen was the most prominent reason for this. Another reason was that the MAs and RNs relied on pre-entered diagnosis codes in the computer instead of using real-time vital sign data during the visit, causing them to miss patients with a BMI ≥ 35 or a blood pressure $\geq$130/80 who lacked a formal diagnosis of obesity or hypertension in the chart. The entire screening process took place during a clinic visit without the capability to fill out questionnaires ahead of time, impacting workflow and decreasing provider buy-in as time-constrained annual visits now became even more burdensome with multiple paper forms to fill out. Since this project's implementation was conducted in paper format, it cannot speak to its efficacy utilizing digital technology. Another concern that decreased provider buy-in and

contributed to a small sample size was reimbursement and time constraints for specific types of annuals. From week zero to week five, stakeholders did not include Medicare Annual Wellness (MAW) visits in the eligibility group. Providers expressed concern about reimbursement, noting that MAW visits are limited to insurance-covered criteria. The aforementioned changes made in week five attempted to address these barriers.

A final barrier was patient buy-in. In speaking with staff, both historically and presently, patients seemed apathetic to the chronic long-term health ramifications of untreated OSA, and even though they were considered high-risk from positive SBQ screens, several questioned why a referral to a sleep study was necessary. This lack of concern emphasizes a potential barrier to health information dissemination to patients and underscores the need for effective education techniques from the beginning of implementation. Although treatment adherence is beyond this QIP's scope, providers noted that many patients diagnosed with OSA struggle with treatment adherence due to its inconvenience, aligning with most recent evidence highlighting that half of OSA patients do not adhere to Continuous Positive Airway Pressure (CPAP) treatment (Shaukat et al., 2022). This multifactorial problem reveals a potential barrier to effective health literacy strategies.

Recommendations

Recommendations for future enhancement of OSA detection include expansion of eligible criteria for larger population size and ensuring other high-risk populations receive screening. The literature highlights several other population groups considered at high risk for OSA development, including those with other chronic health conditions such as atrial fibrillation, diabetes mellitus, heart failure, and stroke (AASM, 2017). Army veterans and people of African

American, Hispanic, and Native American descent are also at higher risk of developing OSA (Lyons et al., 2022). Although the male sex is a prominent risk factor, post-menopausal women appear to be evening out the scores for OSA development. Therefore, this population would benefit from inclusion to improve patient outcomes (Shieu et al., 2022). Given National rising rates of obesity in all age groups and enhanced longevity due to technological advances, the inclusion of persons younger than 30 years and older than 70 years is warranted (Boers et al., 2024). Given the existing barriers related to limited EHR capabilities, leveraging technology to support implementation could help overcome these challenges. Automating reminders and allowing patients to complete the SBQ digitally at home could streamline the screening process and help providers avoid missing eligible patients. Despite the devastating health outcomes of uncontrolled OSA, adherence to diagnosis and treatment continues to be a significant hurdle. Although this is multifactorial, patients' failure to understand the importance of diagnosis and treatment and providers' failure to educate about consequences effectively appear to be top contributors (Shaukat et al., 2022). Successful screening and referral implementation requires a multifaceted education strategy for providers and patients. Although this project did include a stakeholder education seminar, patient education pamphlets, and exam room education posters, future considerations include focusing on identifying risk factors for non-adherence and including Likert scales to determine provider knowledge and attitudes on the importance of OSA risk identification.

Conclusion

Despite overwhelming evidence of the catastrophic health consequences, public safety risks, and economic burden of untreated OSA, the vast majority of cases remain undiagnosed

(Aurora & Quan, 2016). Although the USPSTF 2022 guidelines recommend OSA screening with the use of a validated tool in symptomatic patients and specific high-risk populations such as those with a history of stroke, it does not address all high-risk populations, contributing to the tremendous lack of OSA detection and timely treatment. In Montana, rates of obesity and hypertension, both highly comorbid with OSA, continue to rise at alarming rates, yet there is no State data on OSA prevalence. At the project site, at least 25% of patients aged 30 to 70 years had either hypertension and/or obesity, and yet less than 25% of this population had a formal diagnosis of OSA. This QIP evaluated whether implementing a routine protocol improved OSA screening, risk detection, and diagnostic referral rates in this patient population. Project outcomes demonstrated improved screening rates to 53%, OSA risk detection to 75%, and diagnostic referral to 67%. The project determined that using an evidence-based screening protocol is a successful approach to enhance OSA detection. Furthermore, this QIP underscores the performance of standardized screening protocols, with drastic improvement in OSA risk detection and diagnostic referrals. Expanding criteria and harnessing technological advancements can further optimize early detection, improving patient outcomes and the public health impact of this pervasive illness.

CHAPTER FOUR

ADVANCED NURSING ESSENTIALS REFLECTION

Introduction

Mastering the theory and practice core principles governed by the American Association of Colleges of Nursing (AACN) is integral to completing the Doctorate of Nursing Practice (DNP) degree. Montana State University (MSU) mandates proficiency in ten core competencies prior to graduation in accordance with the AACN. Through these competencies, doctorate-level graduates attain the necessary expertise in education and professional practice (AACN, 2021).

Domain 1: Knowledge for Nursing Practice

Central to DNP education and practice is the ability to critically analyze all aspects that influence the well-being of humans from a foundation rooted in nursing history, which fosters nursing as a science and an art (American Association of the Colleges of Nursing [AACN], 2021). This domain considers the biological sciences and the philosophical, psychosocial, and environmental underpinnings that guide nursing theory and practice and how these sciences influence human development, growth, and illness at every stage of life (AACN, 2021). This core competency highlights the magnitude of the theoretical and clinical knowledge required by the nurse practitioner (NP) to promptly and successfully address patient concerns amidst the daily pressures of clinical environments. Understanding the evolution of nursing science and theories informs the practice of the Doctorate of Nursing Practice (DNP) graduate by shaping the context that fosters all aspects of a person, drawing from liberal arts and medical sciences to understand the self in relation to others better. My coursework helped me integrate

concepts from nursing science, such as human wholeness, healing and well-being, and environment-health relationship, to shape my leadership approach and ethical decision-making in my Quality Improvement Project (QIP) (AACN, 2021).

Coursework focusing on deepening my understanding of different leadership styles and better understanding my leadership style informed how I communicated with stakeholders, ensuring their voices were heard and that their opinions, beliefs, and expertise were included in the implementation of the initiative. This was conducted by having in-person meetings with each stakeholder and utilizing the Johns Hopkins Evidence-Based Practice (JHEBP) model worksheet titled "Stakeholder Analysis." Ethical considerations for the project stemmed from my learning in the NRSG 612 course titled "Ethics, Law, and Policy for Advocacy in Healthcare." Understanding the ethical implications of a healthcare initiative informs safety protocols and ensures the well-being of QIP participants. Drawing from borrowed sciences, such as medicine, ensured that evidence-based tools, such as the STOP-BANG Questionnaire (SBQ), were utilized in the initiative. However, the methodology of implementation and the considerations of how this initiative impacts patients are based on nursing science. Taking the whole person into consideration is at the heart of nursing science. By assessing patients and stakeholders holistically, the QIP implementation process considered the underlying health beliefs, socioeconomic status, and environmental factors that influence individual and system health decisions. Ensuring patients were screened for Obstructive Sleep Apnea (OSA) while providing education on its health benefits and evaluating the clinic's financial impact and team time constraints demonstrates a holistic approach to assessing the QIP's fit and feasibility. Moreover, the data collection tool considers this practice change initiative's psychosocial, environmental,

and ethical considerations, allowing stakeholders and patients to voice concerns regarding the feasibility of such a change. Developing and implementing innovative health strategies grounded in nursing science and evidence-based research will be a cornerstone of my career as a provider. I look forward to collaborating with individuals and teams to integrate these advancements into practice seamlessly.

Domain 4: Scholarship for the Nursing Discipline

Applying traditional research to clinical experience with a focus on evaluating and implementing evidence-based practices is a core component of DNP education (AACN, 2021). The focus on quality improvement initiatives based on rigorous evaluation of evidence requires the DNP to understand how to interpret data, critically appraise evidence, and translate findings into practice. Several courses throughout the last four years have provided opportunities to practice each of these key elements that narrow the research-practice gap, including the courses titled "Evidence-based Practice I and II" (NRSG 604 and 605), Healthcare Informatics (NRSG 610), statistical applications (NRSG 606), and program planning and evaluation, outcomes and quality improvement (NRSG 611), to name a few.

Throughout both evidence-based practice courses, numerous projects and assignments focused on the critical appraisal and application of research, both individually and in group settings. Every week for evidence-based practice, there was an assignment to evaluate guidelines for critically appraising statistical analyses, which focused on the validity, reliability, and statistical significance of different research articles, honing my research skills. In evidence-based practice II, group projects focused on the rigorous evaluation of evidence using evidence tables and matrices to determine the quality of research on varying healthcare topics. I recall two group

projects for program planning and evaluation, which focused on implementing quality improvement initiatives. These projects equipped me with the skills to evaluate research, collaborate on implementing evidence-based changes, assess project outcomes, and effectively communicate findings in a professional written format. Evaluating current and new evidence related to patient care and changes to practice throughout my career as an NP will be crucial. I am prepared to do so because of the courses provided to me throughout my DNP program. Utilizing these skills was pivotal to the creation of an evidence-based QIP.

Without understanding how to conduct a rigorous search for evidence and best practices to implement such research, a project has no grounds for success. Over the last four years, each course has infused an understanding of how to best implement evidence into practice and its impacts on the quality of healthcare and patient outcomes. Successfully implementing a screening protocol for OSA relies on my ability to interpret research findings across diverse settings and patient populations. This understanding led me to identify patients with a history of hypertension and/or obesity as optimal candidates for OSA screening using the validated SBQ. Accurate outcome measurement requires recognizing how SBQ implementation varies across populations. Furthermore, statistical analysis is essential for assessing the applicability of quality improvement measures in practice. My QIP is founded on identifying the best evidence, effectively implementing it, and translating findings into meaningful clinical impact.

Domain 7: Systems-Based Practice

The DNP scope of practice extends beyond direct patient care into systems leadership, addressing the diverse needs of specific patient populations and communities through political, ethical, and economic lenses (AACN, 2021). DNPs advocate for quality patient care and

eliminate healthcare disparities on both micro and macro levels, influencing policy and organizational change while assessing their impact on healthcare practice and outcomes (AACN, 2021). A core competency of the DNP role is evaluating the cost-effectiveness of policy and organizational changes and the ethical considerations of new medical technologies and their impact on healthcare outcomes (AACN, 2021). Advanced nursing leadership involves identifying systemic health challenges and developing solutions by implementing quality improvement initiatives and policy changes grounded in best practices. The DNP drives change by applying systems thinking, economic proficiency, and ethical risk analysis to enhance health outcomes for individuals, organizations, and communities (AACN, 2021).

My DNP program has prepared me well for this advanced leadership role. One example highlighting my ability to advocate for healthcare policies and regulations to enhance value and cost-effectiveness in healthcare is an advocacy letter addressed to Montana State Senators applying current political, cultural, and economic insights on hospice care in Montana to advocate for Medicare policy changes. Integrating evidence-based practices promotes NP referral procedures to enhance care access and drive economic improvements. This assignment demonstrates my ability to analyze system-wide processes to understand outcomes better and advocate for reforming policies to create health equity on micro, meso, and macro levels (Tong & An, 2024). Similarly, my QIP focuses on OSA, utilizing community, state, and global data to drive organizational-level change and expand these improvements across multiple healthcare systems through disseminating knowledge. Financial capacity in healthcare decision-making was explored in the course titled “Financing and Budgeting of Healthcare Systems” (NRSG 613). A multifactorial approach to understanding the complex internal and external structures that drive

healthcare costs and how they influence patient care and health outcomes is critical in creating health initiatives that drive policy change and quality care (AACN, 2021). Understanding how access to healthcare, rising healthcare costs, and quality of care intersect is essential for any quality improvement project as it determines how the project can be implemented and the outcomes. The evidence-based SBQ enhances healthcare access and quality at no cost. However, its implementation is ineffective without clinician reimbursement for screening, referral, or insurance coverage for sleep studies and treatment. Financial management, budgeting, and resource allocation principles will no doubt impact my practice in terms of quality, access, and cost of care for every patient I encounter and influence how any quality improvement initiatives I endeavor to be a part of will be created, implemented, and sustained.

Domain 8: Informatics and Healthcare Technologies

As the world becomes more technologically advanced, so does healthcare practice. Understanding the role of information and communication technologies (ICTs) in healthcare is essential to advanced nursing practice. ICTs allow for enhanced data collection, knowledge development, and expanded dissemination of knowledge, all of which inform healthcare decision-making (AACN, 2021). The NP plays a crucial role in how ICTs are implemented, shared, and understood in healthcare settings. The intersection of ICTs and ethics was explored throughout my coursework and clinical practice, as nearly every clinical setting relies upon ICTs to access clinical guidelines, patient information, and assessment and plan creation. In order to efficiently and effectively provide care today, a provider must be able to access the internet at any given time for up-to-date evidence that guides practice decision-making and patient outcomes. It is my role as the provider to ensure I understand what information I am accessing,

ensure this is accurate and evidence-based, understand the impact of ICTs on workflow and patient health outcomes, and ensure that patient information is protected and utilized appropriately for quality patient care (AACN, 2021). Since the location of my QIP is long-distance, I rely on technology for data collection and communication with stakeholders. It is, therefore, vital to ensure patient information is protected when transferring data and storing patient-sensitive information. Ensuring all data collection is de-identified is of utmost importance. Moreover, ICTs are central to health information dissemination, where most medical and nursing journals now rely on advancing technologies to reach a greater audience. I also plan to use ICTs to disseminate my QIP findings to a more extensive network of healthcare professionals to increase access to quality care for patients nearby.

Conclusion

Completing the DNP degree signifies an advanced understanding and implementation of the AACN core principles. These ten competencies are the cornerstone of higher education achievement and the basis of clinical practice. These competencies are well-woven into the fabric of each course required by MSU for the DNP program. The written and clinical work I have completed over the last four years has demonstrated the achievement of these principles. My work has equipped me with the advanced skills and critical thinking required of a DNP-prepared nurse practitioner. These competencies will surely drive my practice as a provider, forming the basis of my approach to patient care and encouraging ongoing system improvement and collaboration with colleagues and patients. As I transition into the role of a DNP-educated provider, I firmly commit to advancing patient health outcomes, improving care, and enhancing equality to access through quality assurance practices. I feel well prepared to step into practice as

a healthcare leader and provide compassionate, competent, and holistic care, all due to the rigorous program and deep integration of the AACN's core competencies throughout my coursework, clinical experience, and Quality Improvement Project conducted at MSU.

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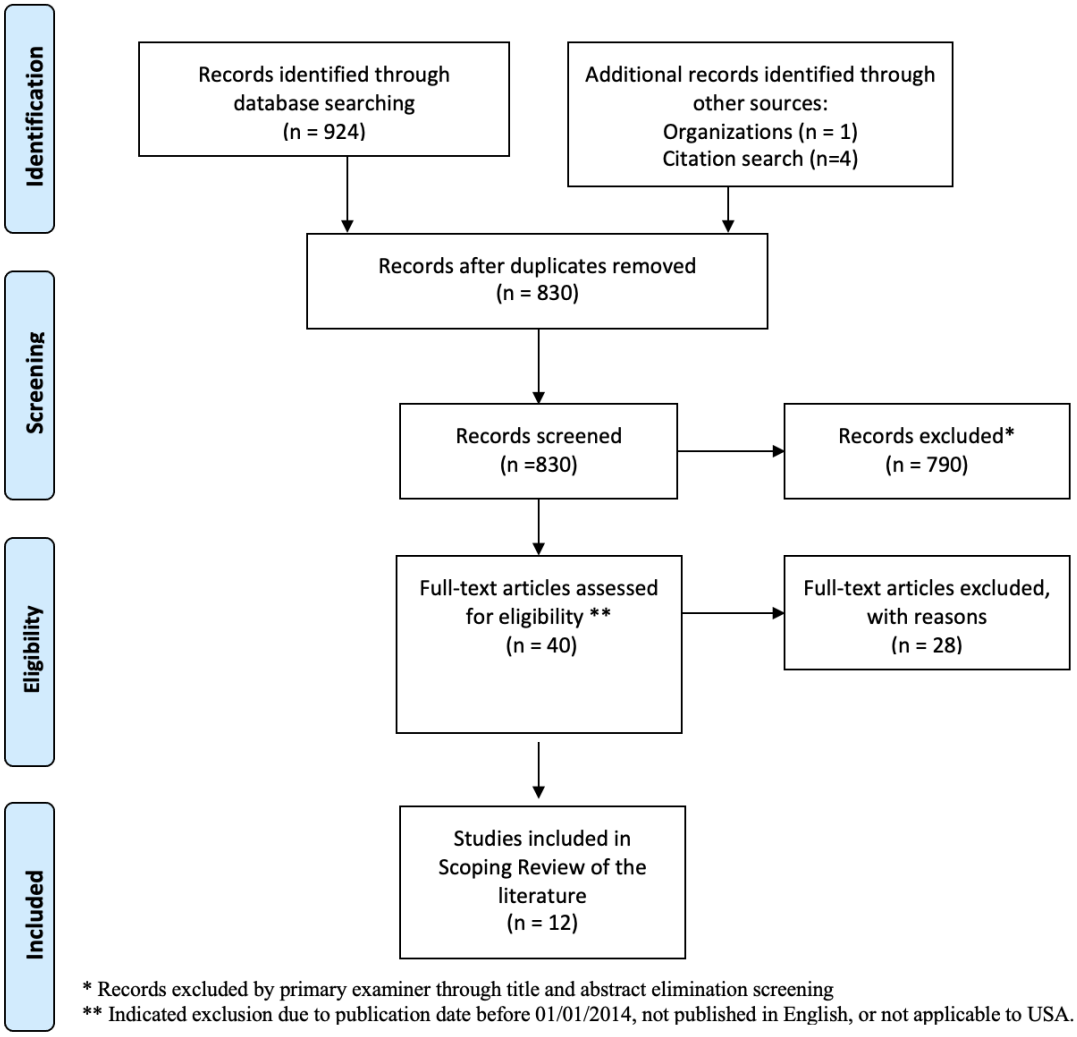
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APPENDICES

APPENDIX A

PRISMA DIAGRAM

Figure 5: Prisma Diagram

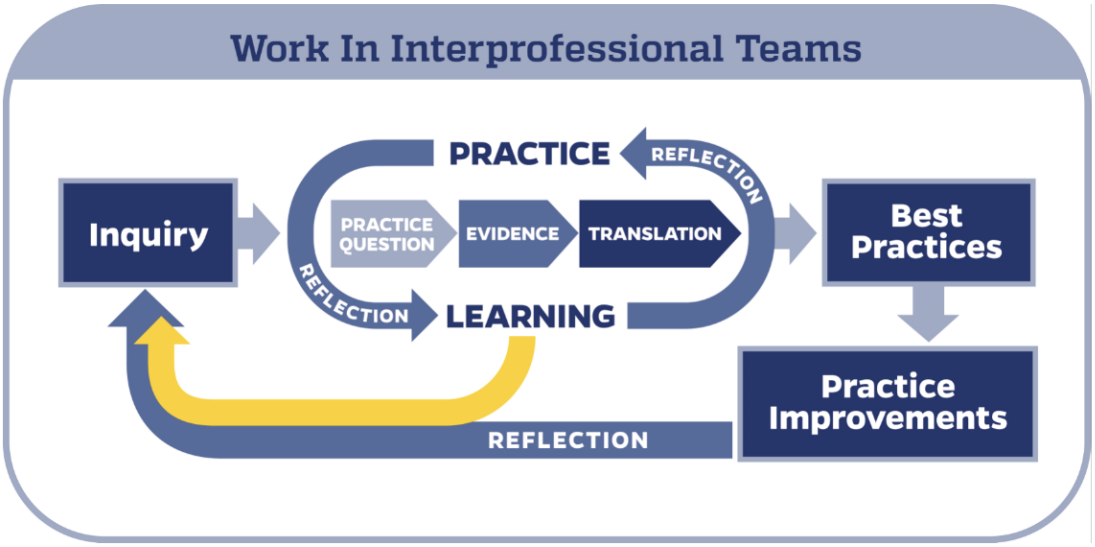


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APPENDIX B

JOHNS HOPKINS EVIDENCE-BASED PRACTICE MODEL

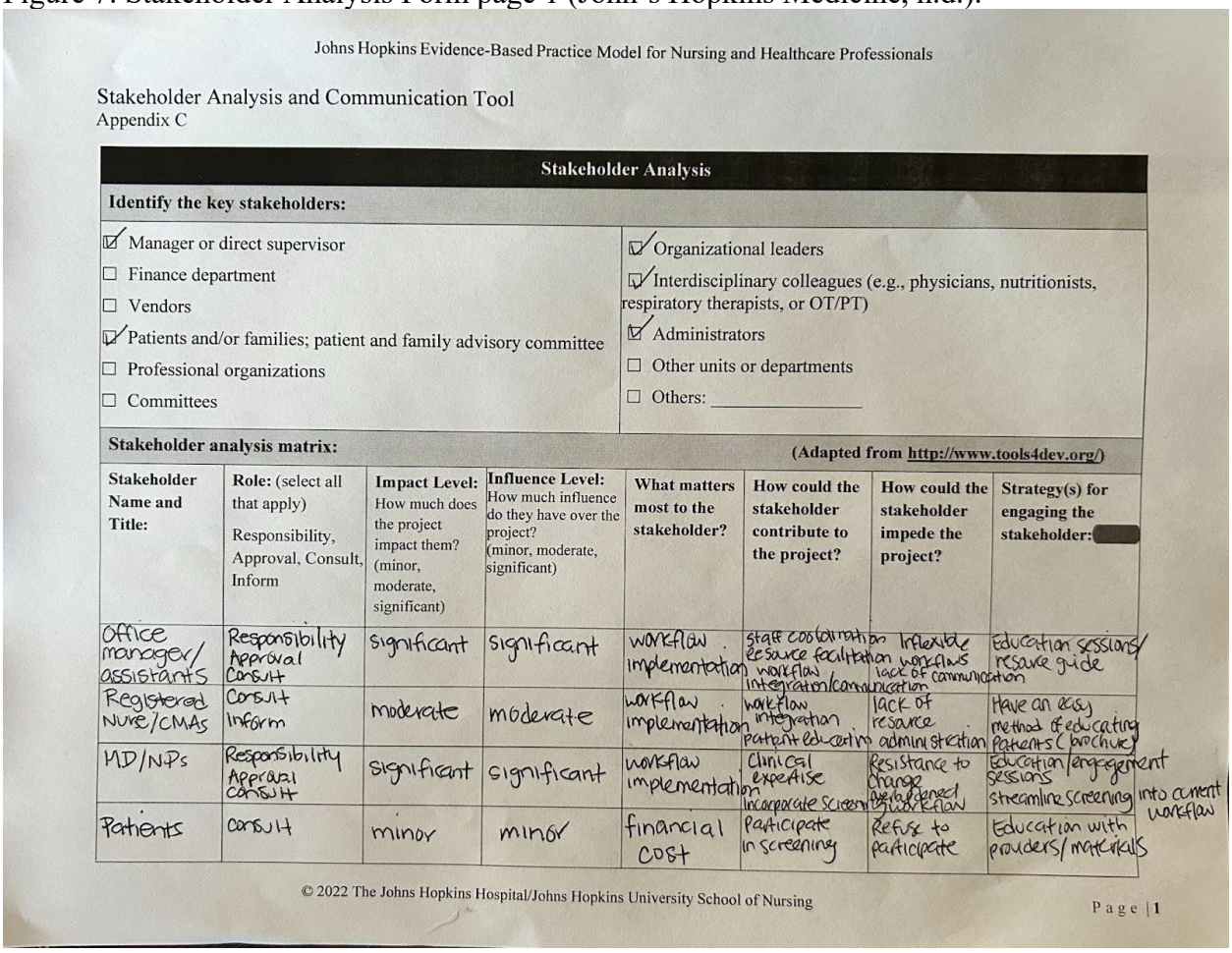
Figure 6: Johns Hopkins Evidence-Based Practice Model



APPENDIX C

STAKEHOLDER ANALYSIS FORM

Figure 7: Stakeholder Analysis Form page 1 (John's Hopkins Medicine, n.d.).



Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals

Stakeholder Analysis and Communication Tool
Appendix C

Stakeholder Analysis

Identify the key stakeholders:

- ☑ Manager or direct supervisor
- ☐ Finance department
- ☐ Vendors
- ☑ Patients and/or families; patient and family advisory committee
- ☐ Professional organizations
- ☐ Committees
- ☑ Organizational leaders
- ☑ Interdisciplinary colleagues (e.g., physicians, nutritionists, respiratory therapists, or OT/PT)
- ☑ Administrators
- ☐ Other units or departments
- ☐ Others: _____

Stakeholder analysis matrix: **(Adapted from http://www.tools4dev.org/)**

Stakeholder Name and Title:	**Role:** (select all that apply) Responsibility, Approval, Consult, Inform	**Impact Level:** How much does the project impact them? (minor, moderate, significant)	**Influence Level:** How much influence do they have over the project? (minor, moderate, significant)	**What matters most to the stakeholder?**	**How could the stakeholder contribute to the project?**	**How could the stakeholder impede the project?**	**Strategy(s) for engaging the stakeholder:**
Office manager/ assistants	Responsibility Approval Consult	significant	significant	workflow implementation	staff collaboration resource facilitation workflow integration/communication	inflexible workflows lack of communication	Education sessions/ resource guide
Registered Nurse/CMAs	Consult Inform	moderate	moderate	workflow implementation	workflow integration patient education	lack of resource administration	Have an easy method of educating patients (brochure)
MD/NPs	Responsibility Approval consult	significant	significant	workflow implementation	clinical expertise incorporate screening	Resistance to change overburdened workflow	Education/engagement sessions streamline screening into current workflow
Patients	consult	minor	minor	financial cost	Participate in screening	Refuse to participate	Education with providers/ materials

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Figure 7 Continued: Stakeholder Analysis Form page 2 (John's Hopkins Medicine, n.d.).

Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals

Stakeholder Analysis and Communication Tool
Appendix C

Communication Planning

Refer to this section to guide your communications to stakeholders throughout and after completing the EBP project.

What is the purpose of the dissemination of the EBP project findings? (check all that apply)

- ☑ Raise awareness
- ☑ Promote action
- ☐ Change policy
- ☑ Change practice
- ☐ Engage stakeholders
- ☑ Inform stakeholders
- ☐ Other:_____

What are the 3 most important messages?

- Obstructive sleep apnea is extremely common yet extremely underdiagnosed
- Regular screening with validated tools can help identify those at-risk.
- PCPs are ideal candidates for screening and management of OSA patients

Align key message(s) and methods with the audience:

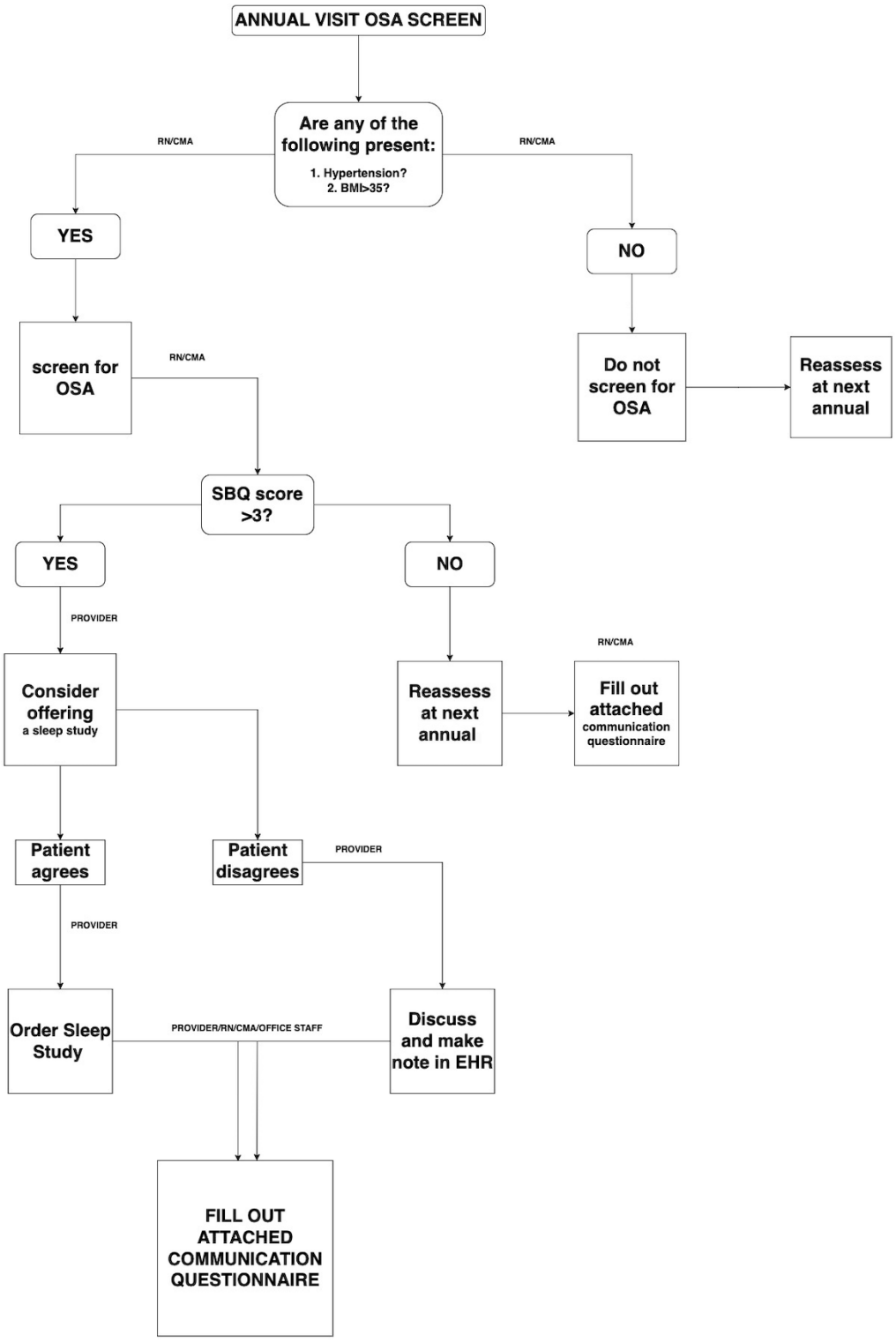
Audience	Key Messages	Method	Timing
Interdisciplinary stakeholders	Creation of an OSA screening protocol promotes health prevention and early detection	Internal dissemination	October, 2024
Organizational leadership	OSA screening protocol will be streamlined into current workflow	Internal dissemination	October - November 2024
Frontline nurses	Education for patients on OSA symptoms and treatment options creates shared decision making	Internal/external dissemination	Oct-Nov. 2024
Departmental leadership	same as above	" "	" "
External community (patients)	OSA is extremely common with detrimental health & financial outcomes. Get screened, tested, and treated	external dissemination	Jan-Feb. 2025
Other			

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APPENDIX D

OSA SCREENING/REFERRAL ALGORITHM

Figure 8: OSA Screening/Referral Algorithm


ANNUAL VISIT OSA SCREEN
Are any of the following present:
1. Hypertension?
2. BMI>35?
RN/CMA
RN/CMA
YES
NO
screen for OSA
RN/CMA
Do not screen for OSA
Reassess at next annual
SBQ score >3?
YES
NO
PROVIDER
RN/CMA
Consider offering a sleep study
Reassess at next annual
Fill out attached communication questionnaire
Patient agrees
Patient disagrees
PROVIDER
PROVIDER
Order Sleep Study
PROVIDER/RN/CMA/OFFICE STAFF
Discuss and make note in EHR
FILL OUT ATTACHED COMMUNICATION QUESTIONNAIRE

APPENDIX E

STOP-BANG QUESTIONNAIRE

Figure 9: STOP-Bang Questionnaire (American Academy of Sleep Medicine [AASM], 2023)

Count on Sleep | Obstructive Sleep Apnea Awareness

The STOP Bang Questionnaire

Is it possible that you have Obstructive Sleep Apnea? Please answer the following questions to determine if you are at risk.

Snoring ?	Do you Snore Loudly (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?	YES	NO
Tired?	Do you often feel Tired, Fatigued, or Sleepy during the daytime (such as falling asleep during driving or talking to someone)?	YES	NO
Observed?	Has anyone Observed you Stop Breathing or Choking/Gasping during your sleep ?	YES	NO
Pressure?	Do you have or are being treated for High Blood Pressure ?	YES	NO
BMI	Body Mass Index more than 35 kg/m2?	YES	NO
Age	Age older than 50 ?	YES	NO
Neck size	Neck size / shirt collar 16 inches / 40cm or larger? (Measured around Adams apple)	YES	NO
Gender	Gender = Male ?	YES	NO

For general population

OSA - Low Risk: Yes to **0 - 2** questions

OSA - Intermediate Risk: Yes to **3 - 4** questions

OSA - High Risk: Yes to **5 - 8** questions

or Yes to 2 or more of 4 STOP questions + male gender
or Yes to 2 or more of 4 STOP questions + BMI > 35kg/m2
or Yes to 2 or more of 4 STOP questions + neck circumference 16 inches / 40cm

This questionnaire is provided for educational purposes only. The STOP-Bang questionnaire is owned by Dr. Frances Chung and UHN. To license the questionnaire for any other use, including clinical use, visit the official questionnaire website, www.stopbang.ca for more information and an interactive version of the questionnaire.

References:

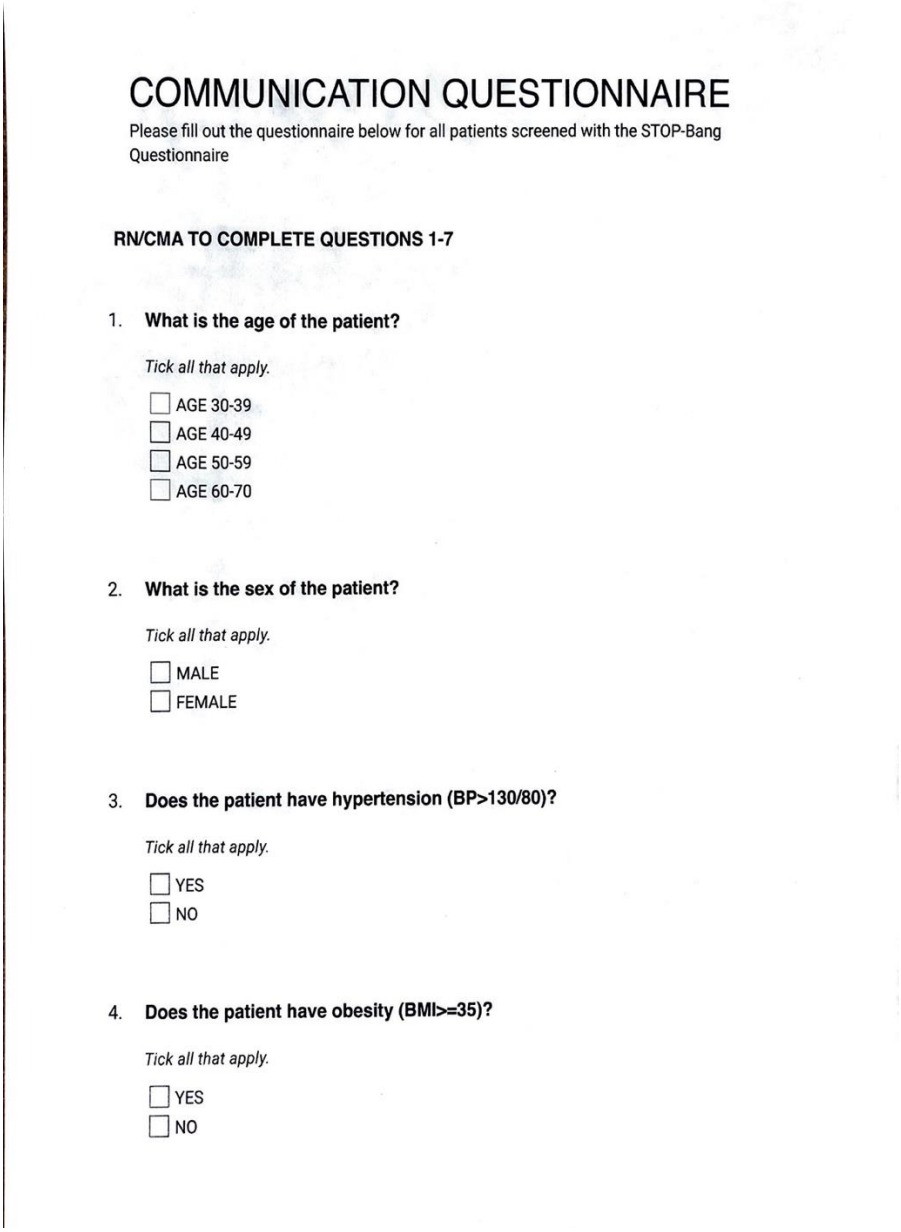
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APPENDIX F

PROVIDER COMMUNICATION QUESTIONNAIRE

Figure 10: Provider Communication Questionnaire page 1



COMMUNICATION QUESTIONNAIRE

Please fill out the questionnaire below for all patients screened with the STOP-Bang Questionnaire

RN/CMA TO COMPLETE QUESTIONS 1-7

1. **What is the age of the patient?**

Tick all that apply.

- ☐ AGE 30-39
- ☐ AGE 40-49
- ☐ AGE 50-59
- ☐ AGE 60-70

2. **What is the sex of the patient?**

Tick all that apply.

- ☐ MALE
- ☐ FEMALE

3. **Does the patient have hypertension (BP>130/80)?**

Tick all that apply.

- ☐ YES
- ☐ NO

4. **Does the patient have obesity (BMI>=35)?**

Tick all that apply.

- ☐ YES
- ☐ NO

Figure 10 Continued: Provider Communication Questionnaire page 2

5. **Was the patient screened using the STOP-Bang?**

Tick all that apply.

- ☐ YES
- ☐ NO

6. **If the patient was eligible but not screened, why not?**

Tick all that apply.

- ☐ I FORGOT
- ☐ PATIENT REFUSED
- ☐ FORM UNAVAILABLE
- ☐ NOT ENOUGH TIME
- ☐ PATIENT ALREADY HAS DIAGNOSIS OF OSA
- ☐ OTHER

7. **Was the STOP-Bang Positive for OSA (>3?)**

Tick all that apply.

- ☐ YES
- ☐ NO

PROVIDER TO COMPLETE QUESTIONS 8-11

8. **Was the patient referred for a sleep study?**

Tick all that apply.

- ☐ YES
- ☐ NO

Figure 10 Continued: Provider Communication Questionnaire page 3

9. **If the patient was not referred, why not?**

Tick all that apply.

- ☐ I FORGOT
- ☐ PATIENT REFUSED
- ☐ UNSURE OF HOW TO REFER
- ☐ NOT ENOUGH TIME
- ☐ PATIENT ALREADY REFERRED
- ☐ OTHER

10. **Was the patient given the OSA education handout?**

Tick all that apply.

- ☐ YES
- ☐ NO

11. **If the patient did not get a handout, why not?**

Tick all that apply.

- ☐ I FORGOT
- ☐ PATIENT REFUSED
- ☐ BROCHURE UNAVAILABLE
- ☐ NOT ENOUGH TIME

OFFICE MANAGER/ASSISTANT TO COMPLETE QUESTIONS 12&13

12. **Was the STOP-Bang uploaded into the EHR?**

Tick all that apply.

- ☐ Yes
- ☐ No

Figure 10 Continued: Provider Communication Questionnaire page 4

14. **If not, why not?**

Tick all that apply.

- [ ] I FORGOT
- [ ] TOOL UNAVAILABLE
- [ ] NOT ENOUGH TIME

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APPENDIX G

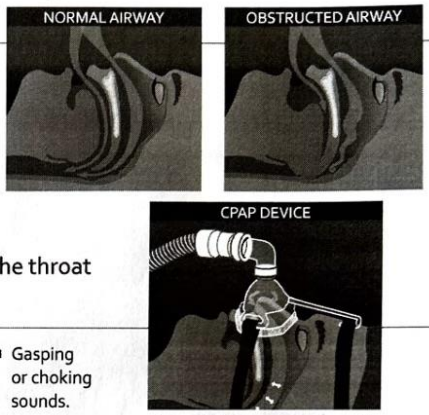
PATIENT EDUCATION HANDOUT

Appendix 11: Patient Education Handout side 1 (American Thoracic Society, n.d.).

American Thoracic Society

PATIENT EDUCATION | *INFORMATION SERIES*

What Is Obstructive Sleep Apnea in Adults?



Obstructive sleep apnea (OSA) is a common problem that affects a person's breathing during sleep. A person with OSA has times during sleep in which air cannot flow normally into the lungs. The block in airflow (obstruction) is usually caused by the collapse of the soft tissues in the back of the throat (upper airway) and tongue during sleep.

Apnea means not breathing. In OSA, you may stop breathing for short periods of time. Even when you are trying to breathe, there may be little or no airflow into the lungs. These pauses in airflow (obstructive apneas) can occur off and on during sleep, and cause you to wake up from a sound sleep. Frequent apneas can cause many problems. With time, if not treated, serious health problems may develop.

OSA is more common in men, women after menopause and people who are over the age of 65. OSA can also occur in children. Also see ATS Patient Information Series fact sheet on OSA in Children. People who are at higher risk of developing sleep apnea include those with:

- enlarged tonsils and/or adenoids
- a family history of OSA
- excessive weight—obesity
- jaw problems such as micrognathia (small jaw) or retrognathia (a pulled back jaw)

What are the symptoms of obstructive sleep apnea?

There are many clues that can make one suspect that you may have OSA. You may not be aware that you have OSA, but these symptoms may be more obvious to a spouse, other family member, or close friend.

Common symptoms you may have during sleep:

- Snoring that is usually loud and bothers other people trying to sleep near you. Snoring can come and go through the night.
- Gasping or choking sounds.
- Breathing pauses observed by someone watching you sleep.
- Sudden or jerky body movements.
- Restless tossing and turning.
- Frequent awakenings from sleep.

Common symptoms you may have while awake:

- Wake up feeling like you have not had enough sleep, even after sleeping many hours.
- Morning headache.
- Dry or sore throat in the morning from breathing through your mouth during sleep.
- Sleepiness during the day.
- Fatigue or tiredness through the day.
- Personality changes, such as mood swings and difficulty getting along with others.
- Problems with poor memory or inability to concentrate.

Can OSA be dangerous?

Lack of sleep can cause you to fall asleep while driving and result in car accidents. OSA can, with time, cause high blood pressure (hypertension), heart disease, stroke, diabetes mellitus, or early death.

How do I know I have OSA?

If you have symptoms of OSA, you need to talk with your healthcare provider. Your healthcare provider can help

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Figure 11 Continued: Patient Education Handout side 2 (American Thoracic Society, n.d.).

you decide if you need a sleep study and whether you should be evaluated further at a sleep center.

OSA is diagnosed by a sleep study (polysomnogram). A sleep study is often done at a sleep center where you will be scheduled to test sleep overnight. Alternatively, a home sleep apnea text may also be used to diagnose OSA. During a sleep study, your breathing, heart rate, and oxygen levels will be monitored. Also see ATS Patient Information Series fact sheet on Sleep Studies.

How is obstructive sleep apnea treated?

Sleep apnea can be effectively treated, and there are a number of ways to do so. The choice of treatment will depend on the reason for and severity of the sleep apnea. If your OSA is from being overweight, weight loss may cause the apnea to go away completely. Additional information about weight loss and OSA will be available soon at www.thoracic.org/patients. As alcohol can suppress breathing and make OSA worse, avoid alcohol for at least 4 hours before going to bed. Sleep apnea is often worse when a person sleeps on his or her back. If you sleep on your back, you can use a pillow or some other strategy to force yourself to sleep on your side. Some people sew a tennis ball into their pajama bottoms to remind them not to turn on their back.

Continuous **P**ositive **A**irway **P**ressure (CPAP) is a device commonly ordered to treat OSA. CPAP is a machine that works like a compressor to blow air into a mask that is worn snugly over the nose and/or mouth or in the nostrils (nasal pillows) during sleep. The flow of air acts like a splint to keep the upper airway from collapsing. This helps prevent obstruction and the apnea from occurring. The air pressure is adjusted to a setting that best controls the apnea. Often a person will also notice much less snoring when wearing CPAP. Also see ATS Patient Information Series fact sheet on CPAP in OSA.

There are other devices that can work for some people. For some, a surgery can be done to treat OSA. The type of device or surgery will depend on what has cause the apnea. Some oral appliances or devices that are worn in the mouth during sleep may keep your airway open. Most oral devices work by either bringing the jaw forward or keeping the tongue from blocking the throat. Oral appliances are most likely to help a person who has mild sleep apnea and who is not overweight. These devices are usually custom-made and fitted under the supervision of a specialized dentist or oral surgeon who works with these problems. Also see ATS Patient Information Series fact sheet on Oral Appliances for OSA.

When the tonsils or adenoids are causing the throat to be blocked, surgery can be done to take out the tonsils (tonsillectomy) and/or adenoids (adenoidectomy). Surgery may also be helpful for people with jaw problems. Other surgeries for OSA either clear out tissue from the back of the throat, reposition the tongue forward, or implant a nerve stimulator to cause the tongue to move forward during sleep. These surgeries are not, however, as effective as CPAP to control OSA and are usually reserved for people who fail CPAP.

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Rx *Action Steps*

- ✔ Talk with your healthcare provider if you have symptoms of obstructive sleep apnea
- ✔ Ask people who are around you when you sleep if they have heard loud snoring or have seen you have apnea spells
- ✔ Ask your healthcare provider if you need a sleep study
- ✔ Exercise regularly and work to lose weight if you are overweight
- ✔ Avoid alcohol, particularly just prior to sleep

Doctor's Office Telephone:

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For More Information:

American Thoracic Society
- www.thoracic.org/patients/
  - OSA in Children
  - Sleep Studies
  - CPAP in OSA
  - Oral Appliances
  - PAP Troubleshooting

American Academy of Sleep Medicine
https://sleepfoundation.org/sleep-disorders-problems/sleep-apnea

American Sleep Apnea Association
https://www.sleepapnea.org/learn/sleep-apnea/obstructive-sleep-apnea/

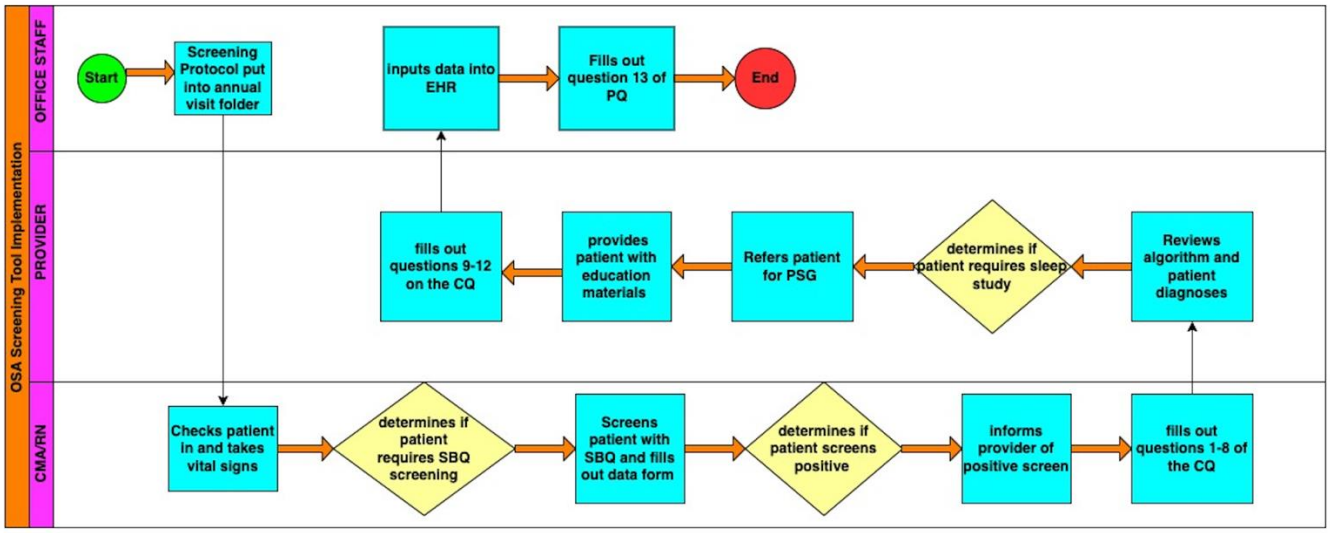
National Heart Lung and Blood Institute
http://www.nhlbi.nih.gov/health/health-topics/topics/sleepapnea/

This information is a public service of the American Thoracic Society. The content is for educational purposes only. It should not be used as a substitute for the medical advice of one's healthcare provider.

APPENDIX H

SWIM LANE DIAGRAM

Appendix 12: Swim Lane Diagram


OSA Screening Tool Implementation
OFFICE STAFF
PROVIDER
CMA/RN
Start
Screening Protocol put into annual visit folder
inputs data into EHR
Fills out question 13 of PQ
End
fills out questions 9-12 on the CQ
provides patient with education materials
Refers patient for PSG
determines if patient requires sleep study
Reviews algorithm and patient diagnoses
Checks patient in and takes vital signs
determines if patient requires SBQ screening
Screens patient with SBQ and fills out data form
determines if patient screens positive
informs provider of positive screen
fills out questions 1-8 of the CQ

APPENDIX I

EDUCATION POSTER

Figure 13: Education Poster

