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# Improving the Screening and Care of Hospitalized Adults with Obstructive Sleep Apnea Through Standardized Workflow Processes

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# Improving the Screening and Care of Hospitalized Adults with Obstructive Sleep Apnea Through Standardized Workflow Processes

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*Abstract*

**BACKGROUND:** Adults can be screened for obstructive sleep apnea in acute care settings using the validated STOP-BANG questionnaire. Healthcare providers can treat patients with confirmed or suspected obstructive sleep apnea to reduce risk for complications during hospitalization or after surgery.

**PURPOSE/ RELEVANCE TO HEALTHCARE QUALITY:** To determine if the standardization of obstructive sleep apnea screening and patient care workflows improves process efficiency saving nursing time and healthcare expenses.

**METHODS:** Quality improvement project included an organizational assessment of healthcare system setting to define clinical problem; determined appropriate evidence-based interventions; and implemented strategies guided by quality improvement models.

**INTERVENTION:** Updated inpatient units to STOP-BANG questionnaire used by surgical services and educated surgical center staff how to prevent obstructive sleep apnea screening repetition.

**RESULTS:** Adopted STOP-BANG questionnaire on all inpatient units (N=70, 700%. Reduced screening repetition 9% ($p>0.05$) in the surgical center.

**CONCLUSIONS/ IMPLICATIONS:** The screening workflow and EHR updates initiated the standardization of OSA processes within the healthcare system. Further evaluation is needed to determine the impact interventions have on process efficiency and cost savings.

**Key Words:**

obstructive sleep apnea, OSA, STOP-Bang Questionnaire, process improvement

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***Introduction***

Obstructive sleep apnea (OSA) is the most common sleep-related breathing disorder[1]. OSA is associated with increased risk for overall mortality and comorbidities such as hypertension, cardiovascular disease, and stroke[2]. Surgical patients with untreated OSA are at increased risk for hypoxia due to medications which cause further respiratory suppression including sedatives, anesthesia, or muscle relaxants[3]. When patients are hospitalized, healthcare providers have the opportunity to screen for OSA and manage the disorder when diagnosed.

OSA can be treated with positive pressure therapy which includes continuous positive airway pressure (CPAP) and bilevel positive airway pressure (BiPAP) devices[4]. CPAP therapy is the first-line treatment for OSA and is effective at treating the breathing disorder, and improves blood pressure and quality of life, and reduces cardiovascular and thrombotic events[4]. BiPAP therapy is recommended as an alternative treatment modality for OSA when CPAP is not tolerated, but CPAP is recommended over BiPAP for routine treatment of OSA[5].

Polysomnography remains the gold standard for diagnosing OSA, although screening tools can provide a more practical option for identifying those at risk in acute care settings[6,7]. There are multiple screening tools available to assess patients' risk for OSA including the STOP and STOP-BANG questionnaires. The STOP questionnaire assesses patient reported snoring, tiredness, observed apnea, and high blood pressure. The STOP-BANG questionnaire (SBQ) includes information from STOP and the following objective measurements: body mass index, age, neck circumference, and gender[8].

There is no national practice guideline recommending the use of a specific tool to screen for OSA[6]. However, the SBQ is recognized as the tool with the highest sensitivity for detecting OSA risk and severity[6]. When compared to polysomnography, the SBQ displayed high

performance in detecting all severities of OSA, along with moderate-to-severe and severe OSA in surgical patients[9]. Literature indicates that patients with confirmed OSA or those identified as high-risk by the SBQ, are at increased risk for perioperative and postoperative complications, ICU admission, readmission, and longer length of stay[7,10,11,12,13]. Although further research is needed, the SBQ is the most widely used and validated tool for the screening OSA in surgical patients[7]. Therefore, the SBQ may be the most appropriate screening tool for identifying OSA risk and severity in adult patients who are hospitalized or undergoing surgery. This quality improvement project aimed to evaluate and standardize the processes involved in the screening and care of hospitalized patients with confirmed or suspected OSA.

## *Methods*

### Context

#### *Setting*

A large non-profit healthcare system in an urban Midwest community was concerned about inefficient workflow involved in the screening and care of hospitalized patients with confirmed or suspected OSA. This project focused in one of the satellite hospitals in the system, an acute care facility with 291 inpatient beds[14]. The three settings within the satellite hospital included an orthopedic medical/surgical (OMS) unit, a surgical center (SC), and a surgical optimization center (SOC).

The OMS unit is a 22-bed unit that employs 46 RNs who care for both orthopedic surgical and general medical/surgical patients. All patients undergoing surgery are admitted through the SC which employs 20 RNs who admit patients to the surgical services which includes pre-operation, the operating room, and the post-anesthesia care unit. Some patients are also seen in the SOC prior to admission through the SC. The SOC is an outpatient clinic which

employs 2 RN nurse navigators who with their team attempt to reduce risk and improve patient outcomes following surgery.

*Organizational Assessment*

An organizational assessment was conducted to identify the current state of the problem and to critically appraise opportunities for improvement. The Six-Box model was used to diagnose the organizational structure and guide the four data collection methods used to diagnosis the clinical problem: observation, reading, interviews, and surveys[15]. Observation of RN screening practices and provider ordering trends were made during chart audits. The organization's OSA policy draft was reviewed. The OMS clinical nurse specialist and unit managers were interviewed, and floor RNs were surveyed on process knowledge, perceptions, and practices. The Promoting Action on Research Implementation in Health Services (PARIHS) Framework was used to evaluate the phenomenon of interest, inefficient OSA screening and management of care[16].

The assessment identified several new issues. First, there was no policy to standardize OSA screening or care. Second, there were two OSA screening tools used within the system: 1) the inpatient unit used the STOP questionnaire, and 2) surgical services used the SBQ. The two screening tools were not linked in the EHR and some settings made it difficult for RNs to view when a screening tool was already completed on a different unit. Third, surgical patients could be screened for OSA up to three times: 1) during admission to the inpatient units, 2) previously during admission to the SC, and 3) during the pre-operative evaluation in the SOC. Fourth, the EHR did not notify SOC and SC providers of high-risk SBQ scores. Finally, when a patient received a high-risk score on the STOP tool during admission to the OMS unit, an alert with suggested OSA treatment orders were sent to the ordering provider although is sent to a location

within the EHR with low provider visibility, so the OSA order set was often missed. The healthcare organization defines a SBQ score of ≥5 or a STOP score ≥2 as high risk for OSA. A patient is also considered high risk if they answer, 'yes' to one or both of the pre-screening questions; 'Do you have sleep apnea?' and 'Do you use a CPAP/ Bi-PAP?'

The system values efficient use of healthcare resources and waste prevention, therefore, cost savings needed to be evaluated. It was estimated it takes 3 minutes to complete a SBQ, which costs approximately $1.64 in nursing time and resources[17]. Through the organizational assessment it was determined SC staff repeated SBQ screenings in approximately 3,210 patients previously screened by the SOC each year. This was equivalent to 9,360 minutes of nursing time or $5264.40 in expenses a year.

A survey was also emailed to RNs on OMS unit to evaluate inpatient OSA screening and practice, and perceived barriers. There was a 28% (n=39 of 137) response rate. Results indicated variation in reported RN practice and perceptions of OSA care processes. Patient adherence to CPAP therapy was a barrier to care, with 41.7% (n=15 of 36) of the RNs reporting patients used CPAP approximately half the time. RNs also reported mask comfort and fit, use of home device, and compliance impacted patient CPAP use during hospitalization.

**Interventions**

The project intervention focused on standardizing the OSA screening and patient care workflow to improve efficiency. The Plan, Do, Study, Act (PDSA) and Define, Measure, Analyze, Improve, Control (DMAIC) models guided the timing of implementation strategies[18,19]. Implementation strategies for the project were derived from the Expert Recommendations for Implementing Change (ERIC) project[20].

First a local needs assessment was conducted to help define the need to standardize the OSA screening and care workflows. This included stakeholder interviews and a chart audit of patients discharged from the OMS unit. A formal implementation blueprint was developed to outline the current and ideal OSA care workflows (see Appendix A and B). In collaboration with the project advisory board, necessary EHR changes were also identified and outlined in a blueprint (see Appendix C). Proposed changes were presented to the organization's acute care and EHR oversite committees. The oversite committees approved the proposed changes; however, they determined all inpatient units should be updated to the SBQ rather than just the OMS unit as originally proposed. As system-wide education needed to occur, the education committee indicated a RN educator needed to implement a formal education plan to reach RNs on all 70 inpatient units.

Additional implementation strategies were used to address OSA screening repetition in patients previously screened by the SOC. The project manager worked with the SC unit supervisor to identify and train two charge RNs as change champions. The project advisory board aided in the development of an educational handout and a cognitive aid screening algorithm (see Appendix D). The project manager attended four team huddles and provided brief education to RNs on the clinical problem and need to not repeat SBQ in patients screened by SOC within 4 weeks as outlined in educational handout. Education uptake was determined through the delivery of a brief verbal survey to a sample of RNs following each huddle. The change champions kept a log of RNs who attended education huddles and provided education to RNs who were unable to attend. EHR audit was conducted pre- and post-implementation. Feedback was provided to unit supervisor and change champions throughout implementation.

### Study of the Interventions

Prior to implementation EHR audit included patients (N=48) discharged from the OMS (January 1-7, 2020). The audit aimed to further define the clinical problem with the goal of repeating once the RN educator completes the inpatient SBQ education implementation. To determine the impact of the staff education on OSA screening repetition on patients admitted to the SC, prior to implementation an EHR audit on patients (N=169; January 2-8, 2020) was conducted and then repeated on patients (N=147) one-week after implementation.

### Measures

Measures included patient characteristics (age, gender, preexisting OSA diagnosis, place of origin, and encounter type), screening (RN adherence, repetition frequency, score discrepancies, high risk scores), OSA order sets (ordered and initiated), and RN documentation (patient CPAP use and adherence). In addition, the percentage of RNs who attended the education in-service and educational uptake was measured. Finally, the percentage of STOP-BANG adoption and details from provider interviews were also measured.

### Analysis

Analysis included quantitative and qualitative data. Quantitative approach used descriptive statistics, target outcomes, and fiscal analyses. Qualitative approach used a thematic analysis.

### Ethical Considerations

The institutional review board determination the project was quality improvement prior to data collection. All data were de-identified.

## *Results*

### OMS EHR Audit Prior to Implementation

*Patient Characteristics*

Patient mean age was 64 (standard deviation [SD] 10.5) years; and 65% (n=31 of 48) were female and 35% (n=17 of 48) were male. In total, 38% (n=18 of 48) of the patients had a preexisting OSA diagnosis documented in the EHR. SOC conducted an OSA assessment in 44% (n=21 of 48) of the patients prior to admission for surgery through the SC. There were 46% (n=22 of 48) who were not seen by the SOC prior to admission for surgery through the SC. The final 10% (n=5 of 48) were admitted through the emergency department and transferred to OMS.

*Screening*

A total of 103 OSA screenings were completed on the 48 patients between the three clinical settings; with 100% (N=48) screened at least once. Of those patients, 27% (n=13 of 48) were screened for OSA three times; 60% (n=29 of 48) were screened twice; and 13% (n=6 of 48) were screened once.

Both the SOC and SC use the SBQ tool. Thirteen patients were screened in both the SOC and SC. However, the scores did not always match: 54% (n=7 of 13) of the SBQ scores matched and 46% (n=6 of 13) did not.

Half (50%; n=24 of 48) of the patients screened were found to be high risk and half (50%; n=24 of 48) were found to be low risk for OSA. Notaby, 44% (n=8 of 18) of the patients with preexisting OSA diagnoses answered ‘no’ to the prescreening questions ‘Do you have sleep apnea?’ and ‘Do you use CPAP/ Bi-PAP?’ It was also noted that 75% (n=6 of 8) of those who answered “no’ to those two questions received a high risk score, and the remaining 25% (n=2 of 8) received a low risk score despite the preexisting OSA diagnoses in their EHR.

*OSA Order Set*

Of the 24 patients with a high risk score, 62% (n=15 of 24) received the OSA order set orders while 38% (n=9 of 24) did not. Of the 9 high risk patients that did not receive the OSA order set: 44% (n=4 of 9) were previously evaluated; 33% (n=3 of 9) were not evaluated by the SOC prior to admission through the SC; and the remaining 22% (n=2 of 9) were admitted to OMS from the emergency department. There was one additional patient (4%; n=1 of 25) with a low risk SBQ score of 4 who also received OSA order set orders. The SOC provider who placed the order, documented that the patient was considered high risk despite the low risk score and no documented history of OSA.

Of the 16 patients who had OSA order sets ordered 94% (n=15 of 16) were initiated upon admission to the orthopedic medical/surgical unit. Of the 16 patients with OSA order sets: 80% (n=12 of 15) included CPAP orders and 73% (n=11 of 15) included orders to position on side to sleep during periods of sleep. In addition, 80% (n=12 of 15) had orders for head of bed to be greater than 30 degrees during periods of sleep; and 87% (n=13 of 15) included continuous pulse oximetry orders. Finally, 87% (n=13 of 15) included discharge criteria orders; and none included cardiac monitoring, oxygen desaturation study, or BiPAP orders.

*CPAP Therapy*

Of the 12 patients who had orders for a continuous positive airway pressure (CPAP) machine, 83% (n=10 of 12) of RNs documented CPAP use, while 17% (n=2 of 12) had no CPAP use documented in the EHR.

RNs documentation on use of CPAP machines indicated 100% (N=10) of patients used CPAP during their inpatient stay, however 40% (n=4 of 10) of patients refused CPAP at least one night while 60% (n=6 of 10) used their CPAP every night while hospitalized.

## STOP-BANG Adoption

Prior to implementation 0% (n=0 of 70) inpatient units in the healthcare system used the SBQ. The healthcare organization leadership agreed to adopt the SBQ on all inpatient units (N=70), a post-implementation adoption rate of 700%.

## Intervention Measures

### *Education*

All (100%; N=20) surgical center RNs attended education on the reduction of SBQ screening repetition in SOC patients. Of those, 40% (n=8 of 20) attended education provided during team huddles; and 60% (n=12 of 20) were educated by the project change champions.

### *Educational uptake*

Following team huddle education, a sample (N=7) of RNs were asked two questions to measure education uptake: “Where in the chart do you look to see if the SBQ has been completed by the SOC?” and “The SBQ must have been completed in the last _ weeks in order to skip during admission?” All RNs (100%; N=7) answered the two survey questions correctly, demonstrating effective education uptake.

## SC EHR Audit Prior to and After Implementation

### *Participant characteristics*

The mean age of the patients prior to implementation was 58.5 (SD 16.1) years and 58.4 (SD 15.8) years after. Prior to implementation, 45% (n=76 of 169) were male and 55% (n=93 of 169) were female; compared to 44% (n=64 of 147) male and 56% (n=83 of 147) female after implementation. There were 31% (n=52 of 169) of patients who had a preexisting OSA diagnosis documented in the EHR prior to implementation as compared to 25% (n=37 of 147) after.

Prior to implementation, 50% (n=84 of 169) of patients had outpatient surgery and 50% (n=85 of 169) were admitted inpatient following surgery. Of those who required admission, 46% (n=39 of 85) were admitted to the OMS unit and the remaining 54% (n=46 of 85) were admitted to other inpatient units. After implementation, 51% (n=75 of 147) of patients had outpatient surgery and 49% (n=72 of 147) were admitted inpatient following surgery. Of those who required admission, 19% (n=14 of 72) were admitted to the OMS unit and 81% (n=58 of 72) were admitted to other inpatient units. Patients were evaluated by the SOC prior to admission for surgery through the SC 20% (n=34 of 169) of the time prior implementation compared to 31% (n=45 of 147) after.

*Screening repetition*

The STOP-BANG screening was repeated by SC RNs in 71% (n=24 of 34) of patients previously screened by the SOC prior to implementation compared to 62% (n=28 of 45) after. A 9% (p=0.44) decrease in screening repetition (p>0.05).

**Budget**

The 9% reduction in screening repetition by SC RNs during the one week period evaluation after implementation was equivalent to 280 (of 3,120) unnecessary SBQs prevented annually. Which equates to 840 minutes of nursing time or $459.2 cost savings for the SC. Overall project expenses included paid time of project team members which outweighed cost savings, resulting in cost mitigation.

**Interviews**

Four providers, a primary care nurse practitioner, sleep medicine physician assistant, SOC nurse practitioner, and hospitalist, were interviewed about communication that occurs prior to admission and at discharge. First, providers were asked how they alert or are alerted when a

patient is identified as high risk for OSA during a primary care pre-operation appointment. Of the four providers, 100% indicated the OSA diagnosis can be found in the EHR problem list and 75% (n=3 of 4) also reported patient risk for OSA can be found in the pre-operation note from the primary care provider. Second, providers were asked how they receive or provide communication at discharge when a patient is identified as high risk for OSA during hospitalization. Of the four, 100% (N=4) indicated patients are recommended to follow-up with a primary care provider following discharge and 50% (n=2 of 4) indicated high risk for OSA is indicated in the patient discharge note.

## *Discussion*

### Summary

This quality improvement project identified the inefficiencies that exist in the current processes involved in the screening and care of hospitalized adults with suspected or confirmed OSA. This project initiated standardization of patient care and EHR workflow, focusing on transitioning inpatient units to the SBQ and reducing OSA screening repetition in the SC.

OSA screening repetition between the SOC, SC, and OMS unit wastes RN time and associated costs and resources. Inefficient workflows within the EHR contributed to poor communication of OSA screening completion between units. Updating the inpatient and surgical services to the same screening tool (SBQ) will improve communication among providers and RNs within the EHR. Implementation of the SBQ will also support more accurate screening of OSA risk in hospitalized adults.

The next steps for OSA screening and care process standardization involves the RN educator conducting education sessions with inpatient RNs on the SBQ and updated workflow. Due to the SBQ score discrepancies between screenings repeated on the same patient, it was

recommended that the RN educator also review proper SBQ use and encourage adherence to the updated screening workflow. Once RNs are educated, the inpatient EHR will be updated with the SBQ tool used by surgical services. The OMS chart audit would need to be repeated to measure the impact of these interventions on process efficiency. It is also recommended that additional EHR updates be made to prompt communication of high risk SBQ scores to providers so that necessary treatment measures can be initiated.

**Interpretation**

In an effort to promote standardization, this project influenced the system-wide adoption of the evidence-based STOP-BANG screening tool. Consequently, all inpatient units will also receive education on how to prevent screening repetition. The potential cost savings generated by the reduction of screening repetition in the SC could be multiplied exponentially once process standardization is implemented throughout all 70 inpatient units.

Further evaluation is needed to determine the impact of transitioning all inpatient units to the SBQ and how the updated screening workflow impacts process efficiency and cost savings. Further evaluation is also needed to address the gaps in communication between primary care, acute care, and sleep medicine providers at admission and discharge; and to define and address current practices and barriers of OSA patient education and treatment adherence.

**Limitations**

The current SARS-CoV-2 pandemic and student project timeline placed time constraints on intervention implementation which led to small a sample size during implementation. The project results have limited generalizability to other populations due to the small sample sizes, inability to evaluate statistical differences for numerous variables, and data collection with tools that have not been studied for validity or reliability.

## Conclusions

The standardization of OSA screening and patient care processes have the potential to improve workflow efficiency and contribute to healthcare system cost savings. The updated processes also have the potential to improve the identification and treatment of patients with confirmed or suspected OSA during hospitalization. Continued implementation and assessment will determine the impact of these interventions on practice and cost.

## *Other Information*

### Funding

No funding was provided for this project.

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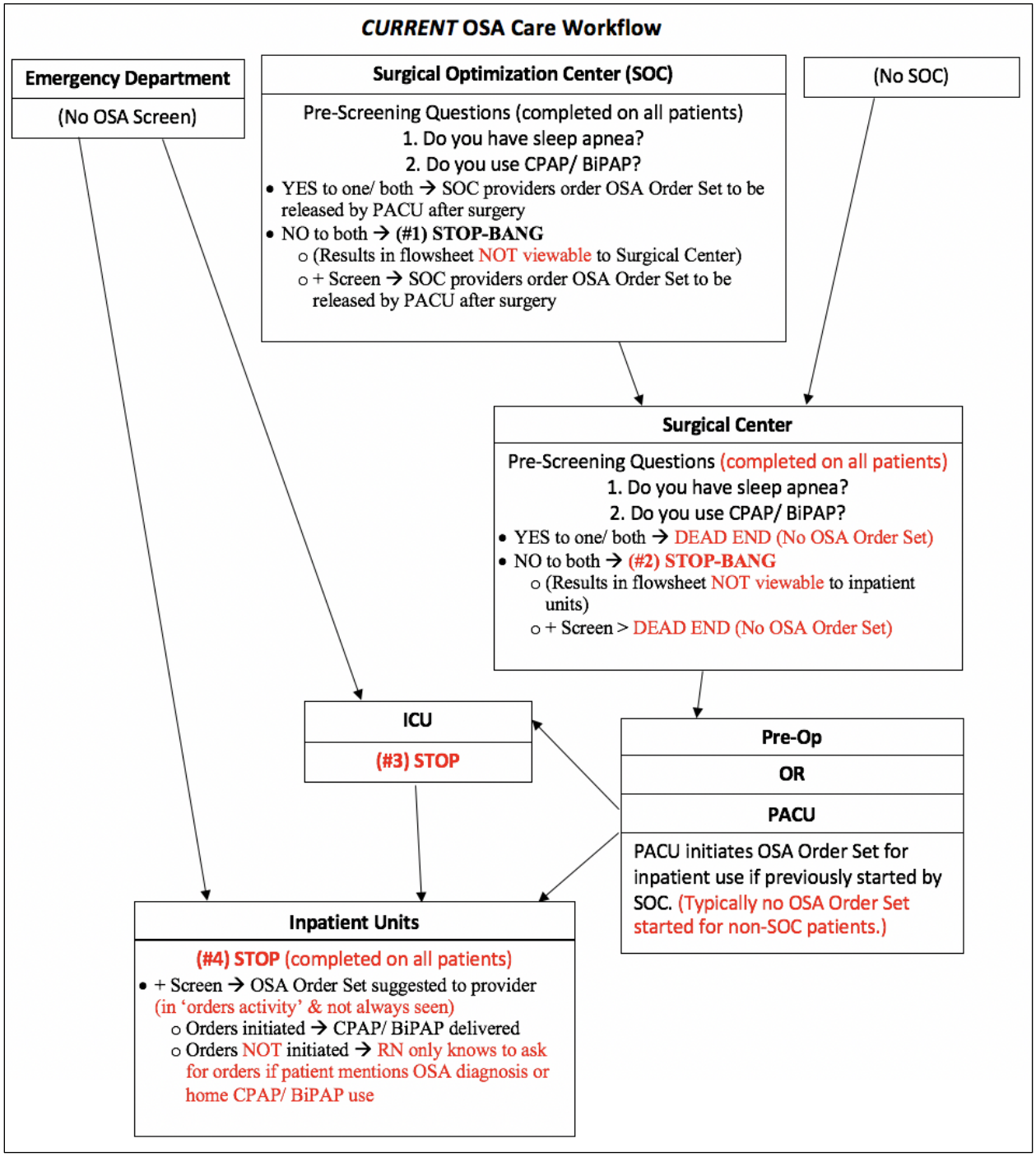
# Appendices

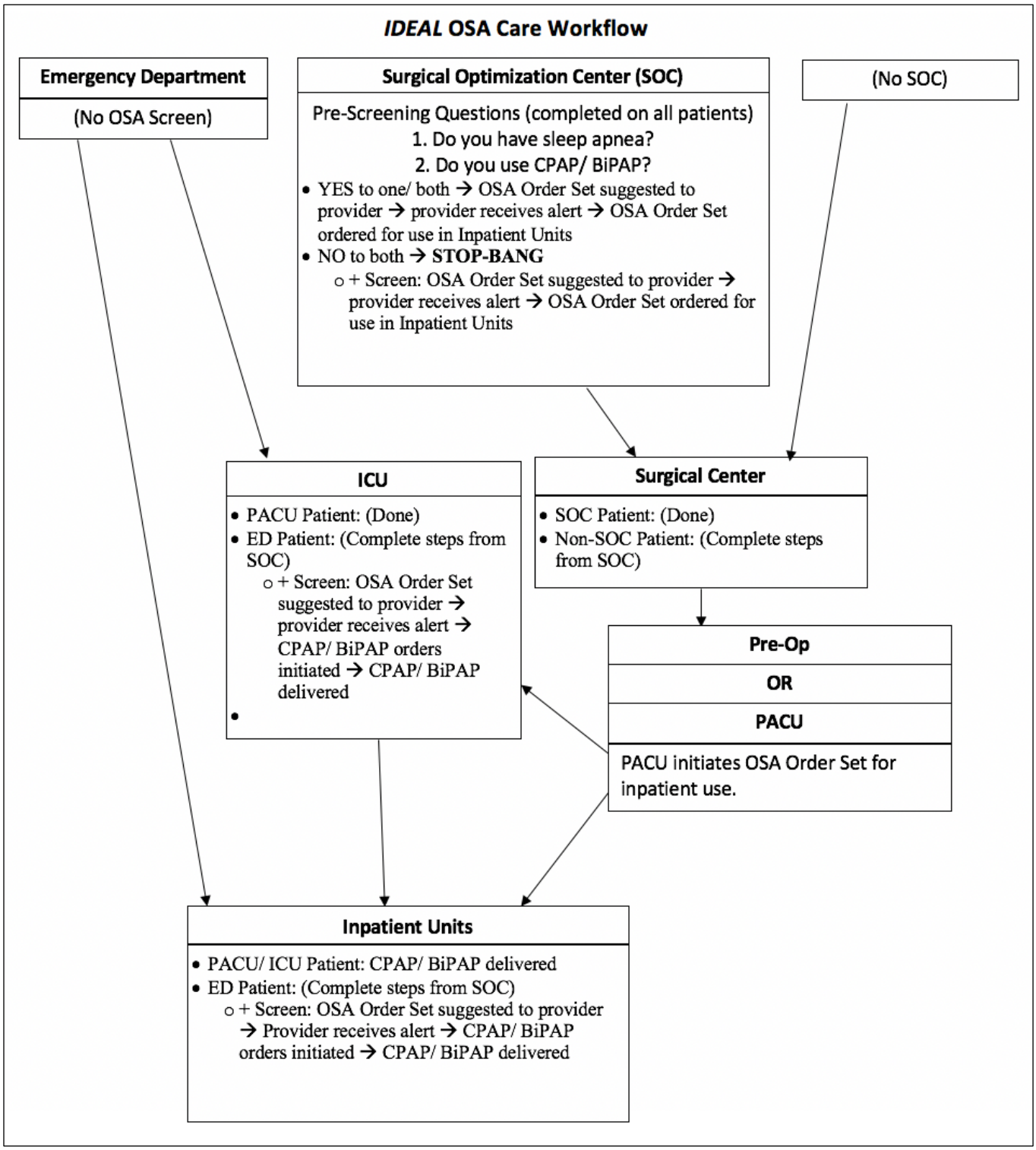
## Appendix A

*Current obstructive sleep apnea (OSA) care workflow.*



## Appendix B

*Ideal obstructive sleep apnea (OSA) care workflow.*



## Appendix C

*Proposed electronic health record (EHR) workflow solutions.*

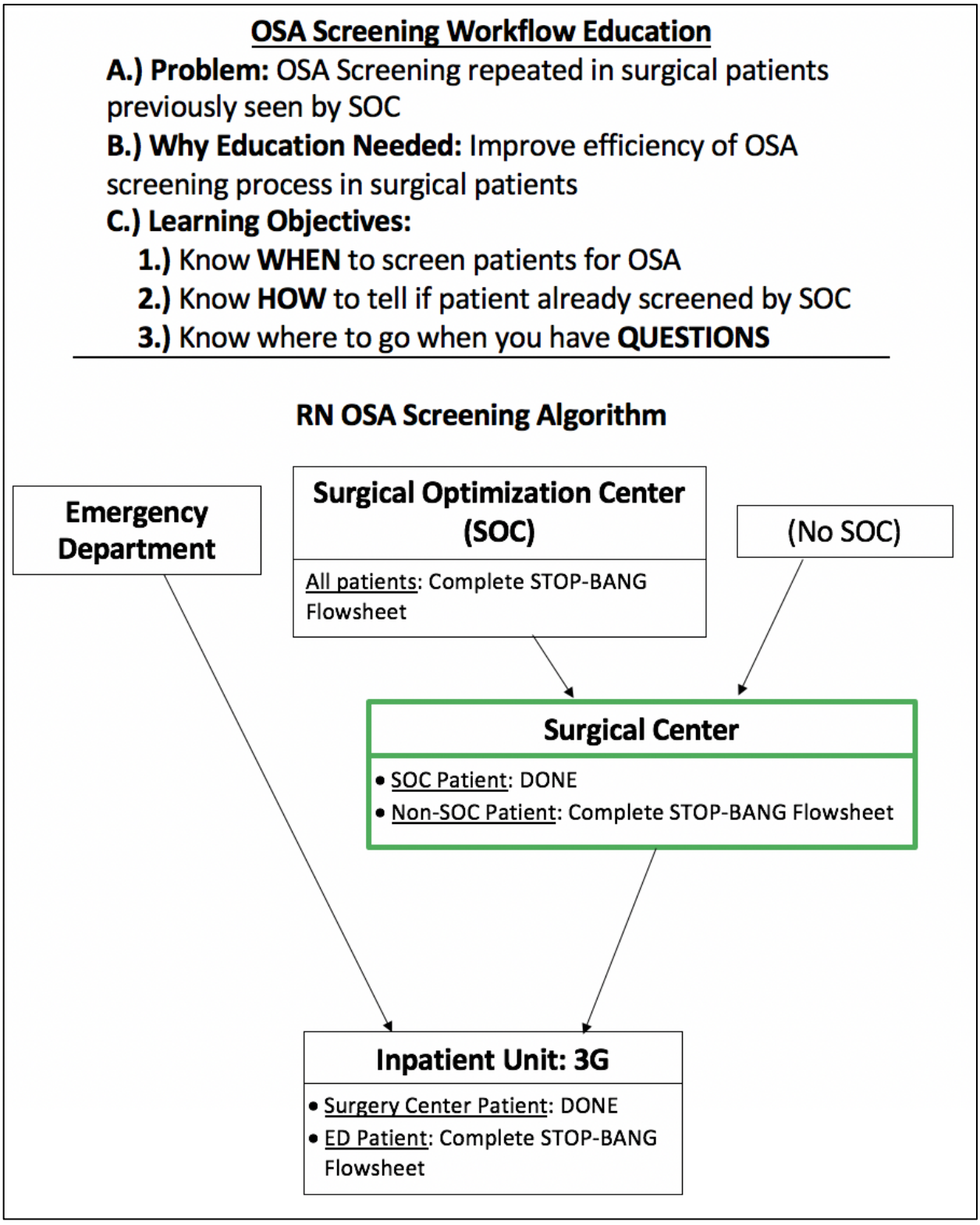
**Proposed EHR Workflow Solutions**

| Location | Problem | Solution |
|---|---|---|
| Surgical Optimization Center (SOC) | (None) | (None) |
| Surgical Center (SC) | SOC pre-screening questions and STOP-BANG results not viewable to Inpatient RNs. | • **Teach SC RNs how to turn on 'show last filed value' in EHR Nurse Navigator so they can view results of pre-screening questions and STOP-BANG previously completed by SOC.** |
| | STOP-BANG repeated on patients previously seen by SOC. | • **Teach SC RNs not to repeat pre-screening questions and STOP-BANG if completed by SOC in ≤4 weeks.** |
| | Nothing happens if patient answers 'yes' to pre-screening questions: Do you have sleep apnea? Do you use CPAP/BiPAP? Or if STOP-BANG score ≥5 (positive screening). (DEAD END). | • 'Yes' to one/ both prescreening questions or Score ≥5 causes the OSA Order Set to be suggested to SC provider who orders appropriate orders for admission.<br>• Place ticket to IT for this to send alert to SC provider. |
| Inpatient Units | Use STOP instead of STOP-BANG. | • **Adopt STOP-BANG Questionnaire flowsheet utilized by SOC and SC.** |
| | STOP repeated on patients previously screened by SOC/ SC. | • Teach inpatient RNs to only screen ED patients. |
| | OSA Order Set is suggested to an area of the EHR where providers only go to release admission orders. | • Place ticket to IT for this to send alert to inpatient provider. |

***Bolded solutions implemented during this DNP project.**
*Nonbolded solutions recommended as implementation next steps for problems identified during this DNP project.

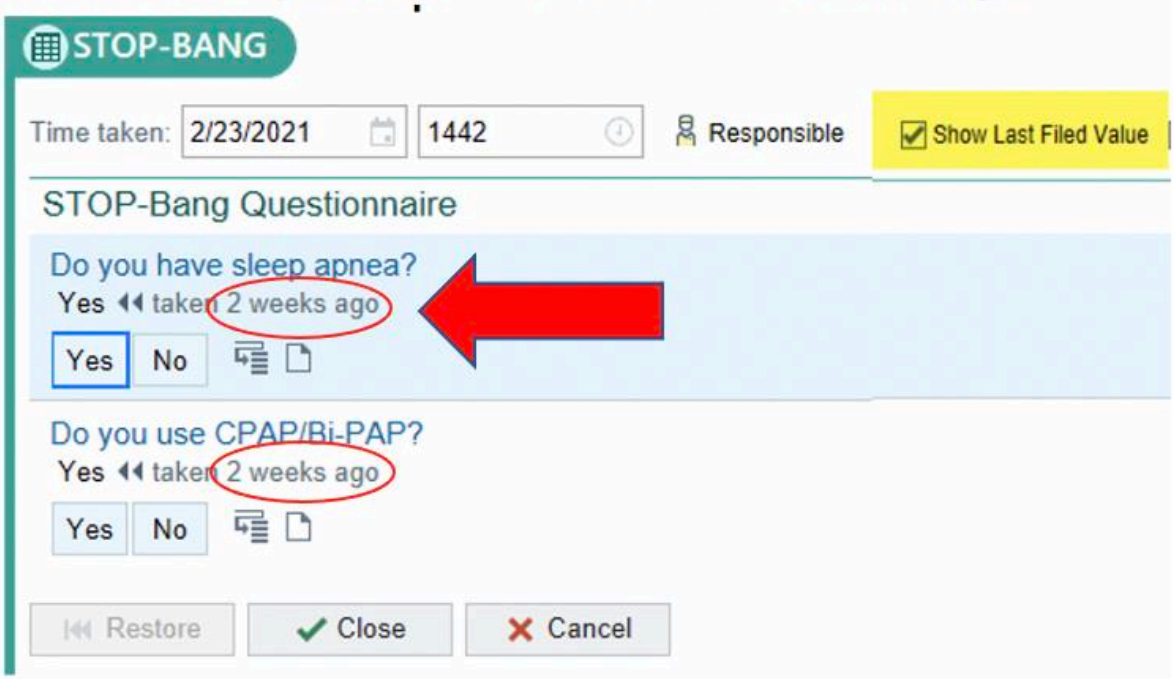
**Appendix D**

*RN educational handout and cognitive aid.*

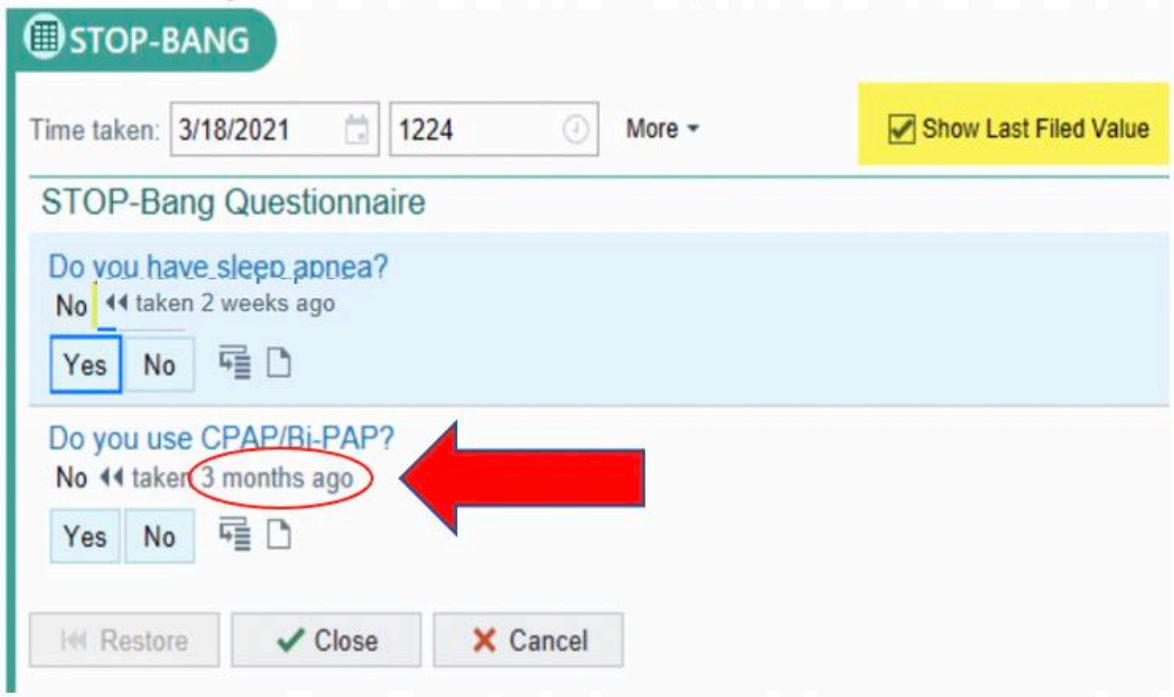


**Nurse Navigator**

1. Select 'Show Last Filed Value'
2. Do **NOT** complete STOP-BANG if taken **≤4 weeks ago**




3. Complete if Question #1/#2 **BLANK** or **taken >4 weeks ago**



# Obstructive Sleep Apnea Care in Hospitalized Adults


Elizabeth Henschel

DNP Project Defense

April 22, 2021

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  - Organizational Mentor

# Objectives for Presentation

1. Review the clinical problem.
2. Review the organizational assessment and evidence-based interventions from literature review.
3. Review project plan.
4. Discuss results of quality improvement project, practice implications, and organizational next steps.
5. Discuss application of DNP Essentials.

# Introduction

- Obstructive sleep apnea (OSA) is associated with increased risk of comorbidities and mortality (Redline, 2017).
- Untreated OSA is associated with increased risk for hypoxia in surgical and post-surgical settings (Fassbender et al., 2016).
  - 82-93% of surgical patients with OSA have not been diagnosed prior to surgery (Fassbender et al., 2016).
  - $149.6 billion annual economic burden for United States (Frost & Sullivan, & American Academy of Sleep Medicine [AASM], 2016).

# ORGANIZATIONAL ASSESSMENT

# Setting and Stakeholders

**Setting:**

- A large healthcare system.
- Urban Midwest community.
  1. Cardiothoracic surgical (CTS) unit.
  2. Orthopedic medical/ surgical (OMS) unit.

# Diagnostic Model: Six-Box

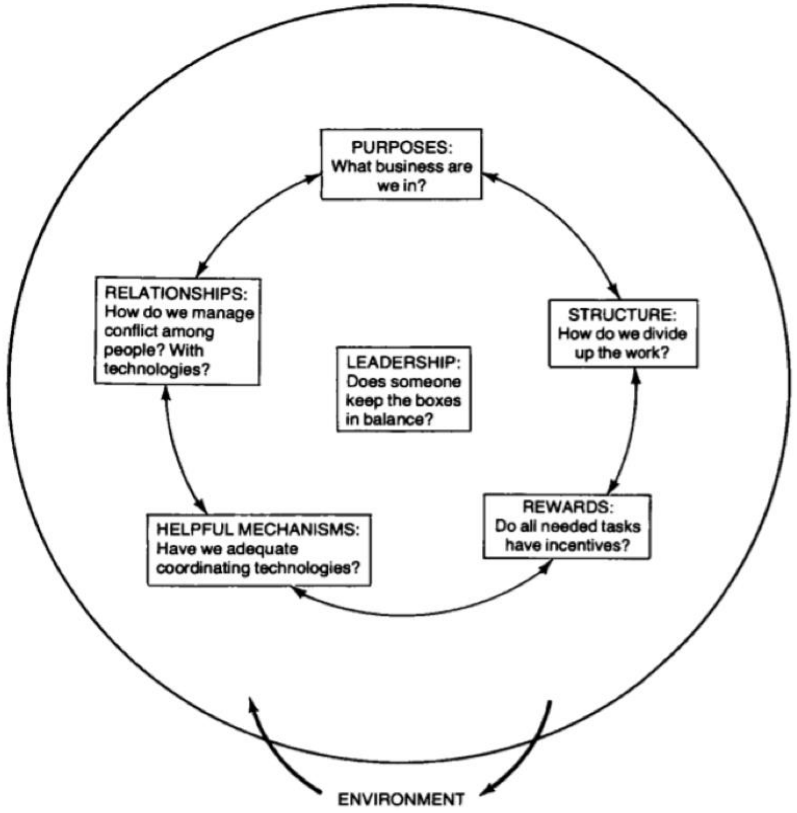



**Figure 1. The Six-Box Organizational Model**

(Weisbord, 1976)

**Framework Factors:**

1. Purpose
2. Structure
3. Rewards
4. Mechanisms
5. Relationship
6. Leadership

# Current State: RN Survey

- Obstructive Sleep Apnea (OSA) Screening Practices:
  - 40.5% always screen, 35.1% never screen.
- Continuous Positive Airway Pressure (CPAP) Order and Delivery:
  - 5.4% order always placed, 20.8% within 2 hours of admission or transfer.
  - 41.7% CPAP delivered within 2 hours of order.
- Documentation:
  - 47.2% always document CPAP use, 62.9% document in vitals.
  - 44.4% never document patient education, 81% document in education.
- Perception of Patient CPAP Usage:
  - 41.7% indicated patients use CPAPs about half the time.
  - Factors impacting use: home mask, comfort, compliance, other.
- Perception of Changes Needed to Improve Care:
  - Staff/ patient education, ordering/ delivery process, inpatient options, other.

*Variation in reported RN practices and perceptions of OSA processes.*

# Knowledge Gained

- Two OSA screening tools in use:
  1. Inpatient: STOP questionnaire (SQ).
  2. Surgery: STOP-BANG questionnaire (SBQ).
- OSA screening is repeated up to three times.
- RNs require further education on screening.
- Providers often miss order set suggestion.
- Altered patient CPAP/ BiPAP adherence.

# SWOT Analysis (Moran et al., 2020)

| Strengths | Weaknesses |
|---|---|
| • Large healthcare system<br>• Staff committed to excellent patient care<br>• Strong CTS staff survey response (35.2%)<br>• Staff familiar with both SBQ and SQ tools | • No system policy<br>• Inefficient EHR workflow<br>• Patients screened for OSA multiple times<br>• Two OSA screening tools<br>• Poor OMS staff survey response (15%) |
| **Opportunities** | **Threats** |
| • EHR already contains necessary screening and documentation tools<br>• Support from Clinical Practice Council<br>• Nursing staff desires process improvement | • COVID-19 health crisis<br>• Lack of staff incentives<br>• Altered patient adherence with CPAP/ BiPAP use<br>• Multi-setting process |

# LITERATURE REVIEW

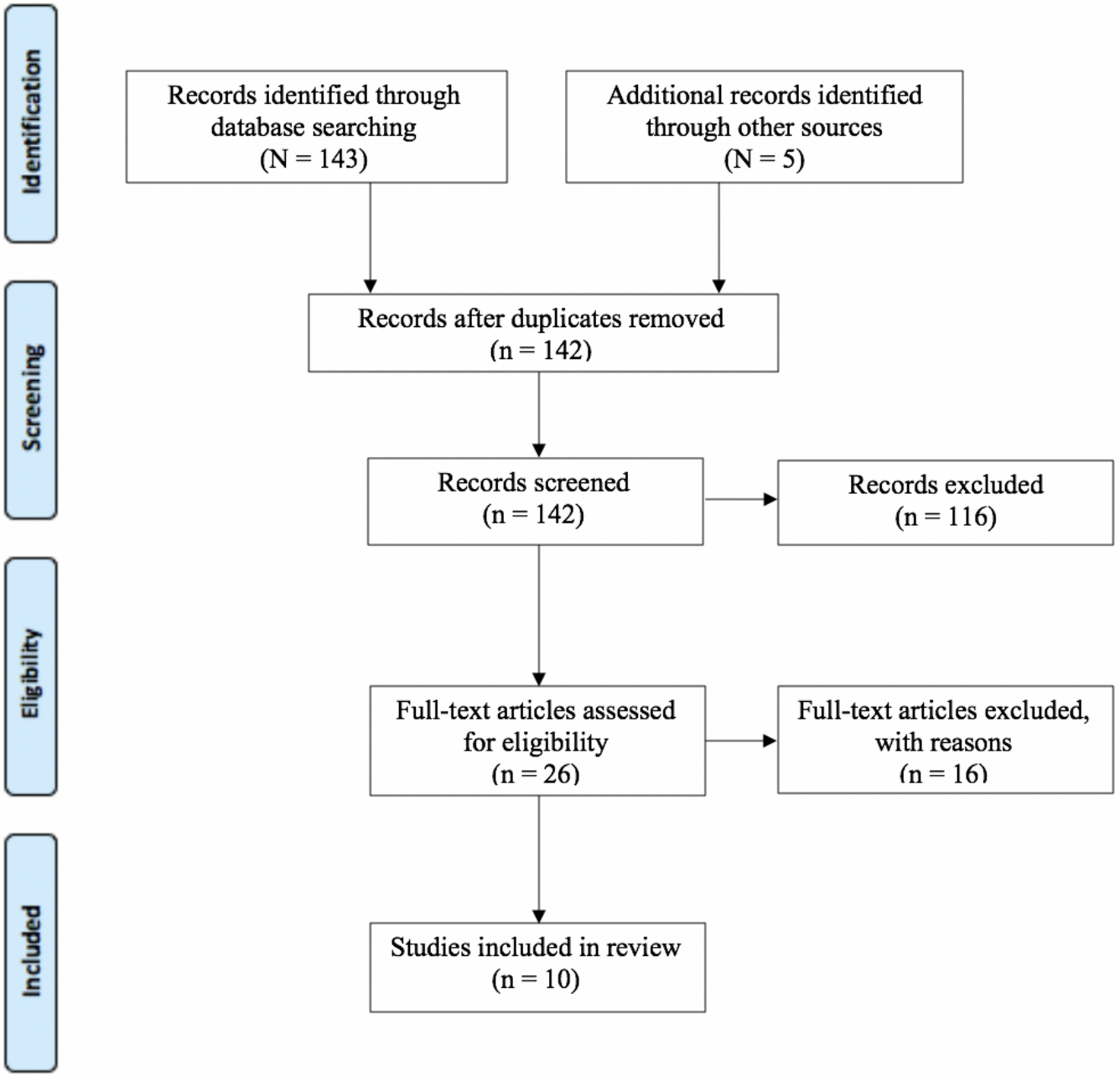
# Literature Review

- Aim:
  - Evaluate the ability of OSA screening tools to identify risk, severity, and associated complications in hospitalized adults.
- Focus:
  - Determine if SQ or SBQ is more effective.
- Method:
  - Rapid systemic review.
  - Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009).
  - PubMed, CINAHL, Cochrane Library.
- Inclusion/ Exclusion Criteria:
  - Population, intervention, comparison, and outcome.

Keywords: “sleep apnea, obstructive AND mass screening OR health screening AND STOP OR STOPBANG OR STOP-BANG”.

# PRISMA Figure

(Moher et al., 2009).



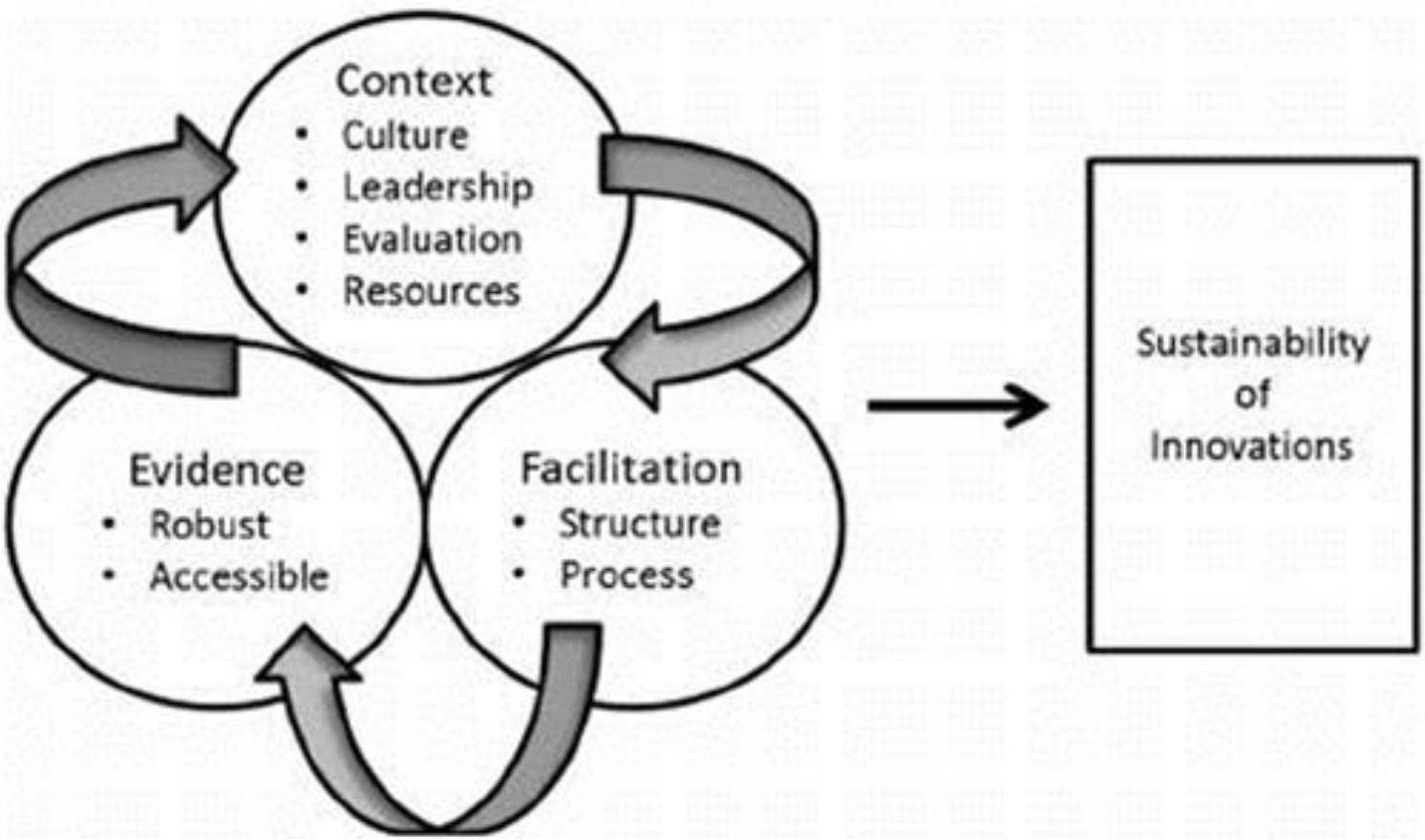
# Synthesis of Results

- STOP Questionnaire:
  - Displays higher overall specificity (Amra et al., 2018).
- STOP-BANG Questionnaire:
  - Most widely used and validated OSA screening tool (Corso, 2018).
  - Most accurate tool for detecting all severities of OSA ($p<0.05$) (Chiu, 2017).
  - High performing screening tool in surgical populations (Nagappa, 2015).
  - High-risk scores are associated with higher incidence of postoperative complications and longer length of stay (Corso, 2018; Dimitrov, 2016; Nagappa, 2017a; Nagappa, 2017b).
- Further research is needed to develop more accurate screening tools and to determine how screening tools compare in predicting postoperative complications (Kapur, 2017; Dimitrov, 2016).

# Clinical Practice Question

- Will the development of standardized workflow processes improve OSA screening and care of hospitalized adults?

# Phenomenon Framework: PARIHS



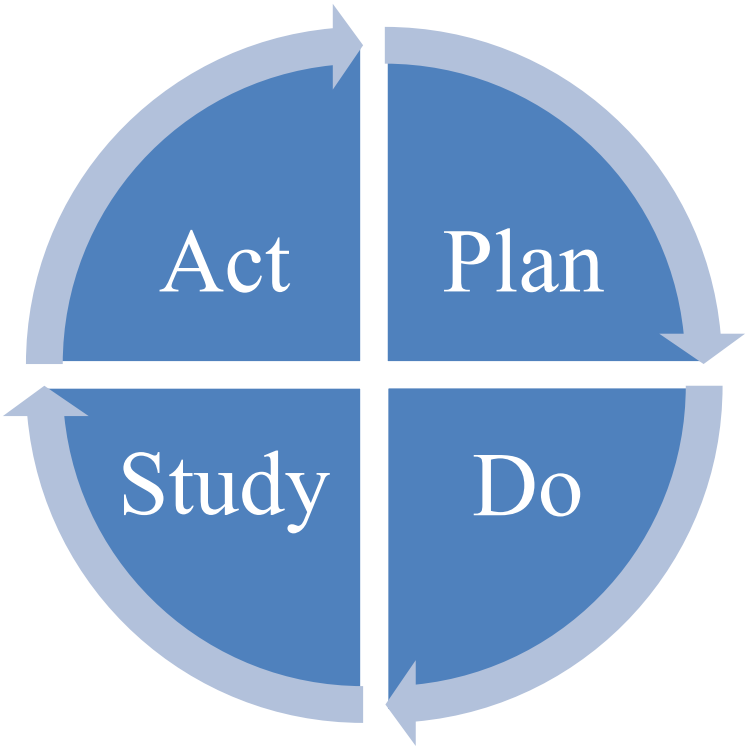

(Rycroft-Malone, 2004).

# PROJECT PLAN

# Project Purpose and Objectives

- Purpose: Initiate quality improvement process
- Objectives:
  1. To form team of stakeholder project champions.
  2. To modify electronic health record and develop cognitive aid.
  3. To educate RNs and providers on the standardized process and cognitive aid.
  4. To evaluate the standardized process in the surgical services and OMS unit and adjust as needed.
  5. To develop and implement a sustainability plan.

# Project Design

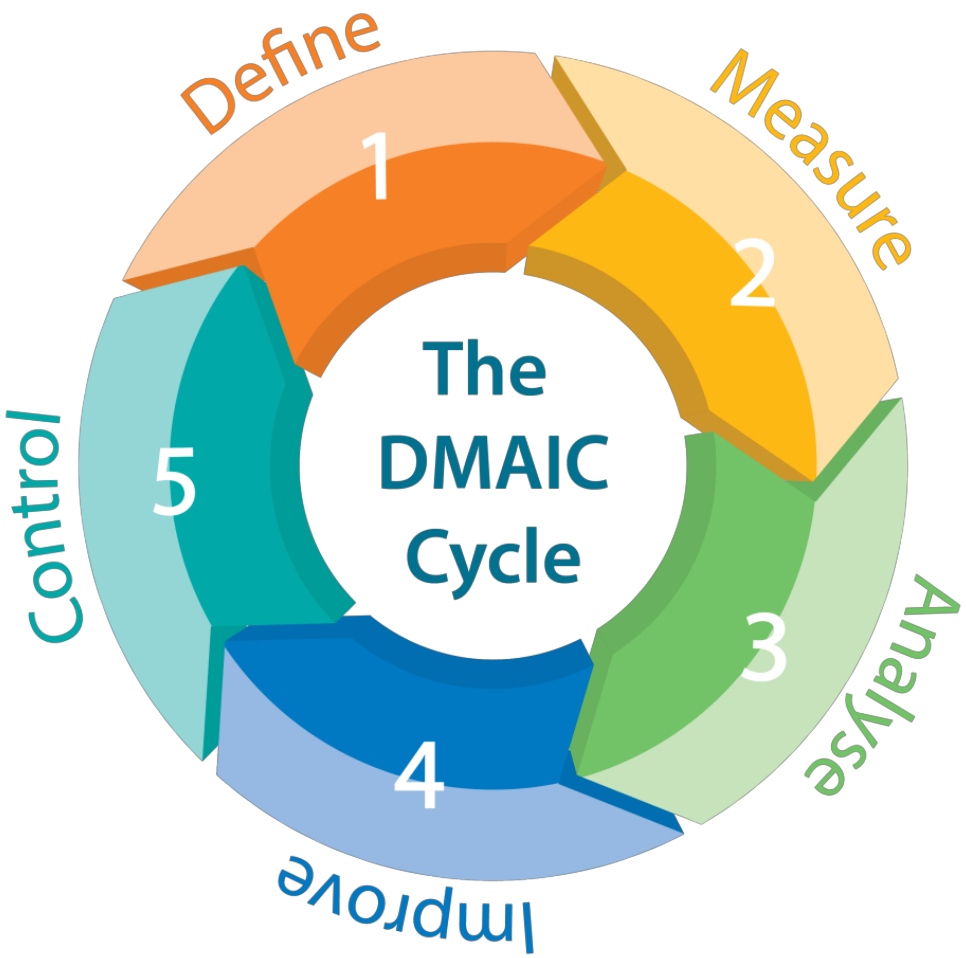



- Quality Improvement Project
  - Address weaknesses in current OSA screening and care management processes.
  - Standardize processes to improve efficiency.
- Two cycles of the Plan, Do, Study, Act (PDSA) (IHI, 2017)
  - Plan: project proposal.
  - Do: intervention implementation.
  - Study: collect and evaluate data.
  - Act: adapt and sustain interventions.

# Settings & Participants

- Setting:
  - Satellite hospital of large healthcare system in urban Midwest community
    - 291-beds
    - Short term acute care facility
  - Orthopedic Medical/ Surgical (OMS) Unit
    - 22-bed unit
  - Surgical Optimization Center (SOC)
    - Outpatient clinic
    - Screens and addresses risk before surgery
  - Surgical Center (SC)
    - Admits patients to surgical service
- Participants:
  - RNs (58)
    - OMS: 46
    - SOC: 2
    - SC: 20

# Implementation Framework: Lean Six Sigma DMAIC




(TQM International, 2019)

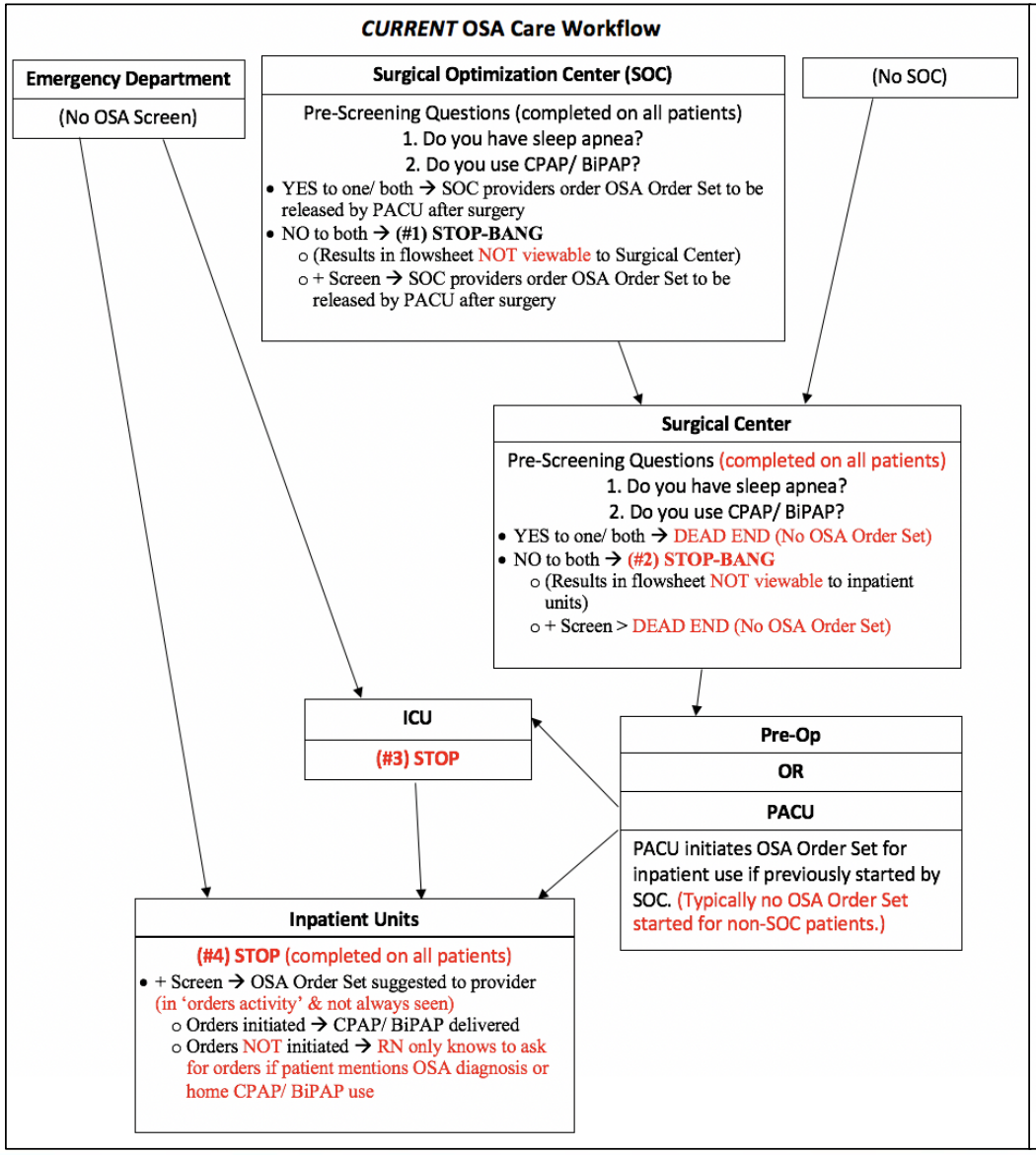
# IMPLEMENTATION STRATEGIES

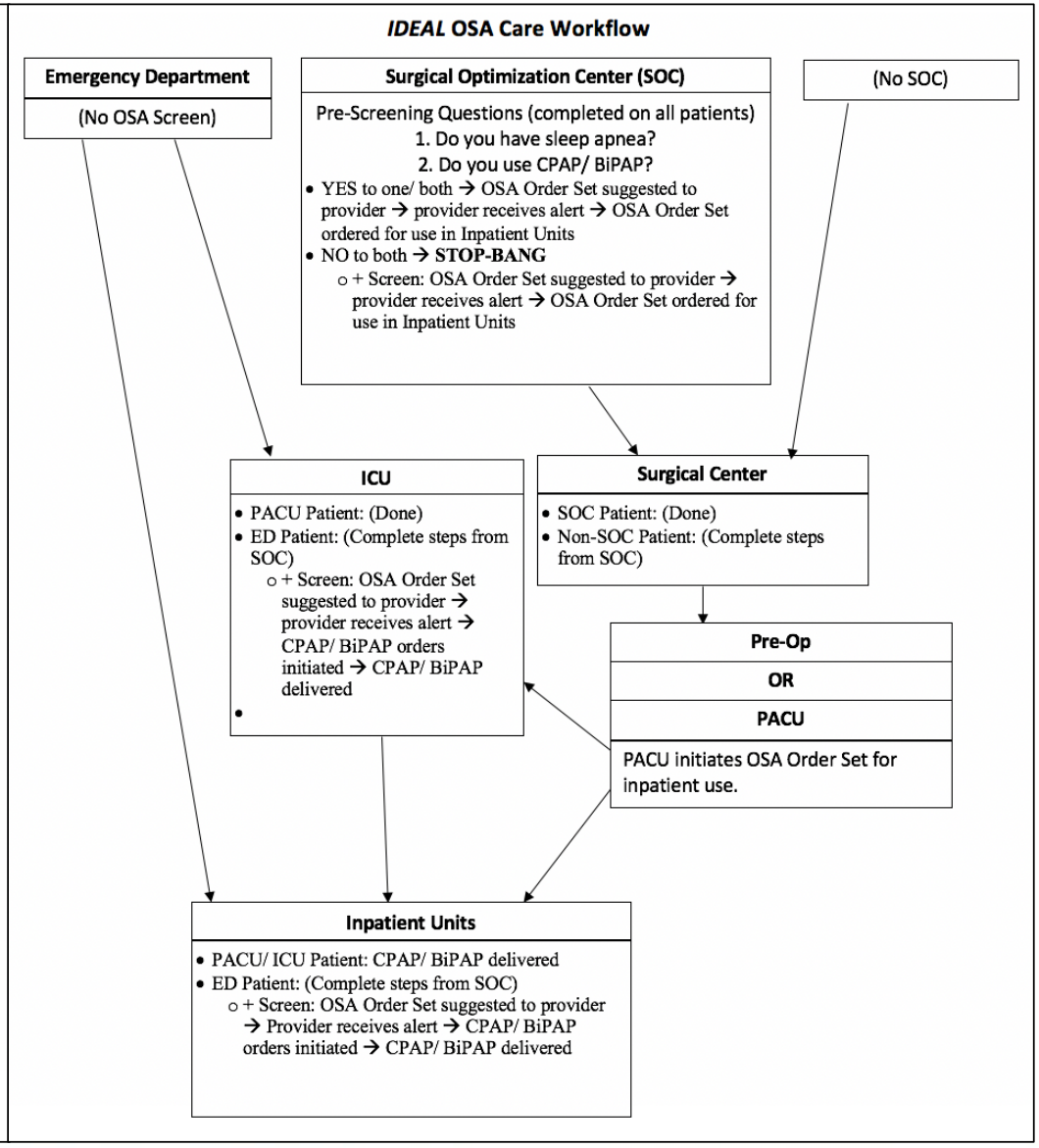
# Implementation Strategies Overview

- PDSA: Plan (Institute for Healthcare Improvement [IHI],. 2017).
- DMAIC: Define, Measure, Analyze (Ahmed, 2019).

| PDSA | DMAIC | Implementation Strategies (Powell et al., 2015) | When |
|---|---|---|---|
| Plan | Define | Conduct local needs assessment. | 1/2020-6/2020 |
| | | Identify and prepare champions. | 11/2020; 2/2021 |
| | | Develop a formal implementation blueprint. | 9/2020-10/2020 |
| | | Develop educational materials. | 12/20/20; 2/1/21 |
| | Measure | Audit and provide feedback. | 1/2021-3/2021 |
| | Analyze | Assess for readiness and identify barriers and facilitators. Address barriers. | 1/2020-5/2020; 1/2021-3/2021 |
| | | Use advisory boards and workgroups. | 11/2020; 1/2021 |

# Workflow Diagram/ Blueprint



# Workflow Diagram/ Blueprint

**Proposed EHR Workflow Solutions**

| Location | Problem | Solution |
|---|---|---|
| Surgical Optimization Center (SOC) | (None) | (None) |
| Surgical Center (SC) | SOC pre-screening questions and STOP-BANG results not viewable to Inpatient RNs. | • **Teach SC RNs how to turn on 'show last filed value' in EHR Nurse Navigator so they can view results of pre-screening questions and STOP-BANG previously completed by SOC.** |
| | STOP-BANG repeated on patients previously seen by SOC. | • **Teach SC RNs not to repeat pre-screening questions and STOP-BANG if completed by SOC in ≤4 weeks.** |
| | Nothing happens if patient answers 'yes' to pre-screening questions: Do you have sleep apnea? Do you use CPAP/BiPAP? Or if STOP-BANG score ≥5 (positive screening). (DEAD END). | • 'Yes' to one/ both prescreening questions or Score ≥5 causes the OSA Order Set to be suggested to SC provider who orders appropriate orders for admission.<br>• Place ticket to IT for this to send alert to SC provider. |
| Inpatient Units | Use STOP instead of STOP-BANG. | • **Adopt STOP-BANG Questionnaire flowsheet utilized by SOC and SC.** |
| | STOP repeated on patients previously screened by SOC/ SC. | • Teach inpatient RNs to only screen ED patients. |
| | OSA Order Set is suggested to an area of the EHR where providers only go to release admission orders. | • Place ticket to IT for this to send alert to inpatient provider. |

***Bolded solutions implemented during this DNP project.**
*Nonbolded solutions recommended as implementation next steps for problems identified during this DNP project.

# Educational Handout/ Cognitive Aid

## OSA Screening Workflow Education

**A.) Problem:** OSA Screening repeated in surgical patients previously seen by SOC

**B.) Why Education Needed:** Improve efficiency of OSA screening process in surgical patients

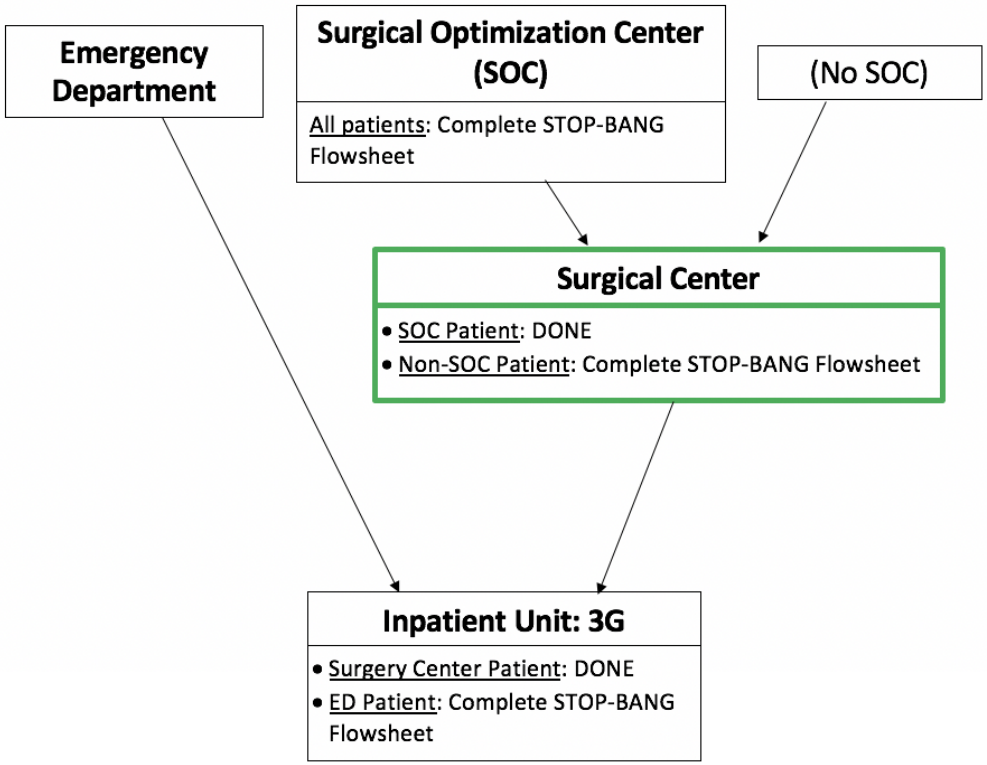
**C.) Learning Objectives:**

1.) Know **WHEN** to screen patients for OSA

2.) Know **HOW** to tell if patient already screened by SOC

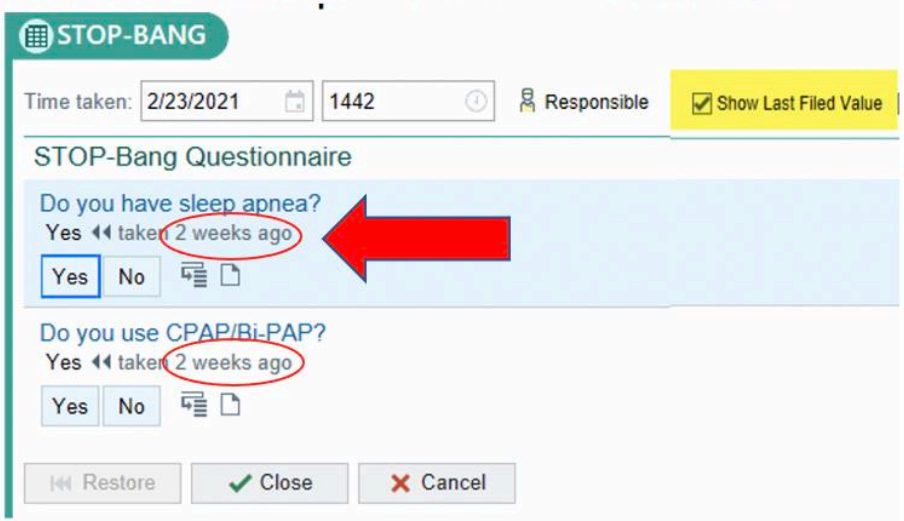
3.) Know where to go when you have **QUESTIONS**

### RN OSA Screening Algorithm

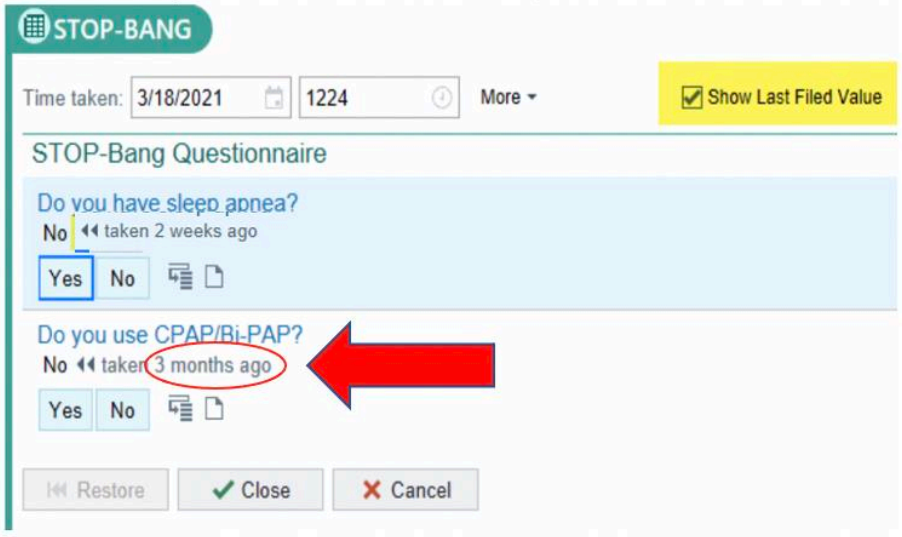



## Nurse Navigator

1. Select 'Show Last Filed Value'
2. Do **NOT** complete STOP-BANG if taken **≤4 weeks ago**




3. Complete if Question #1/#2 **BLANK** or **taken >4 weeks ago**



# Implementation Strategies Overview

- PDSA: Do (Institute for Healthcare Improvement [IHI],. 2017).
- DMAIC: Improve (Ahmed, 2019).

| PDSA | DMAIC | Implementation Strategies (Powell et al., 2015) | When |
|---|---|---|---|
| Do | Improve | Change record system. | 2/2021-3/2021 |
| | | Conduct educational meetings. | 3/22/21-4/2/21 |
| | | Distribute educational materials. | 3/22/21-4/2/21 |
| | | Conduct educational outreach visits. | 3/22/21-4/2/21 |
| | | Provide local technical assistance. | 3/22/21-3/26/21 |
| | | Facilitation. | 3/22/21-4/2/21 |

# Implementation Strategies Overview

- PDSA: Study (Institute for Healthcare Improvement [IHI],. 2017).
- DMAIC: Control (Ahmed, 2019).

| PDSA | DMAIC | Implementation Strategies (Powell et al., 2015) | When |
|---|---|---|---|
| Study | Control | Purposely reexamine the implementation. | 3/22/21-3/26/21 |
| | | Audit and provide feedback. | 3/29/21-4/2/21 |

# Implementation Strategies Overview

- PDSA: Act (Institute for Healthcare Improvement [IHI],. 2017).
- DMAIC: Control (Ahmed, 2019).

| PDSA | DMAIC | Implementation Strategies (Powell et al., 2015) | When |
|---|---|---|---|
| Act | Control | Summarize and disseminate results | 3/22/21-4/12/21 |

# Evaluation & Measures

| Topic | Concept | How Measured | When Measured | Who Measures |
|---|---|---|---|---|
| **Implementation Strategies** | Audit and provide feedback | Discussion; EHR audit | Pre/ post-intervention (November 2020; January-March 2021) | Student |
| | Identify change champions; RN and provider | Discussion | Pre intervention (November 2020; March 2021) | Student, Unit Managers, Providers |
| | Change record system | Discussion; EHR | Pre-implementation (November 2020; February 2021) | Student, CNS, RN informaticist, EHR super user/ IT |
| | Develop and distribute educational materials; huddles/ provider meetings | Survey | (December 2020; March 2021) | Student |
| | Develop a formal implementation blueprint. | Discussion | Pre-intervention (December 2020) | Student, Unit Managers |
| | Use advisory boards and workgroups | Discussion | Pre/ post-intervention (November 2020; January 2021) | Student |
| | Purposely reexamine the implementation | Discussion; EHR audit | During/ post-intervention (March 2021) | Student, Unit Managers |
| **Patient Outcomes** | STOP/ STOP-BANG Score | EHR audit | Pre/ post-intervention (January-March 2021) | Student |
| | CPAP use during admission (adherence) | EHR audit | Pre/ post-intervention (January-March 2021) | Student |

# Evaluation & Measures (continued)

| Topic | Concept | How Measured | When Measured | Who Measures |
|---|---|---|---|---|
| **System Outcomes** | Patient place of origin (ED, SOC, non-SOC) | EHR audit | Pre/ post-intervention (January-March 2021) | Student |
| | Number of repeated OSA screenings | EHR audit | Pre/ post-intervention (January-March 2021) | Student |
| | STOP/ STOP-BANG completion rates | EHR audit | Pre/ post-intervention (January-March 2021) | Student |
| | STOP/ STOP-BANG scores | EHR audit | Pre/ post-intervention (January-March 2021) | Student |
| | OSA Order Set released/ CPAP or BiPAP ordered for patients with positive screens (score ≥5) | EHR audit | Pre/ post-intervention (January-March 2021) | Student |
| | Use of cognitive aid | Survey | Post-intervention (not measured) | Student |
| | Staff completion of education | Log | Post-intervention (March 2021) | Manager/ Charge RN |
| | Education knowledge uptake | Random sample | Post-education (March 2021) | Student |
| **Policy** | Adoption of new workflow into inpatient unit standard of practice | Discussion; Standard of Practice (SOP) policy | Post-intervention | Student, Unit Managers |

# Data Analysis

- Statistical plan: comparison of pre- and post-intervention data.
  - Quantitative data:
    - Descriptive statistics.
    - Target Outcomes.
    - Fiscal analyses.
  - Qualitative data:
    - Thematic analysis.

# Ethical Considerations

- Collected data was deidentified and stored on organization's secure network.
- Only project team had access to secure data folder.
- Organization IRB Determination obtained.
- No conflicts of interest present.
- HIPAA guidelines followed.

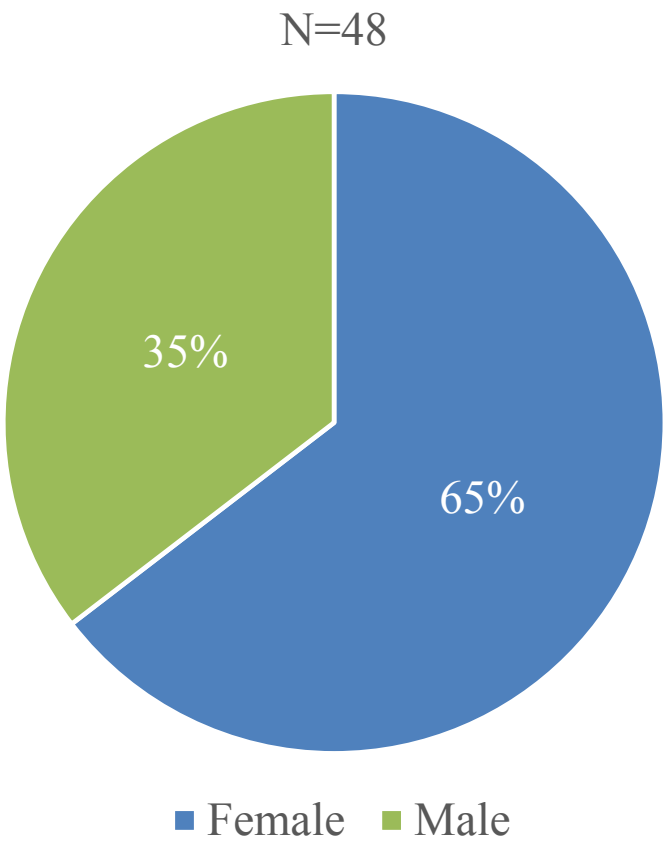
# RESULTS & SUSTAINABILITY

# OMS Unit Chart Audit Results (N=48)

- Patient characteristics.
- Obstructive Sleep Apnea (OSA) Screening.
  - RN Adherence.
  - Repetition Frequency.
  - SBQ Score Discrepancies.
  - High Risk for OSA.
- OSA Order Sets.
- Continuous Positive Airway Pressure (CPAP).
  - RN Documentation.
  - Patient Adherence.

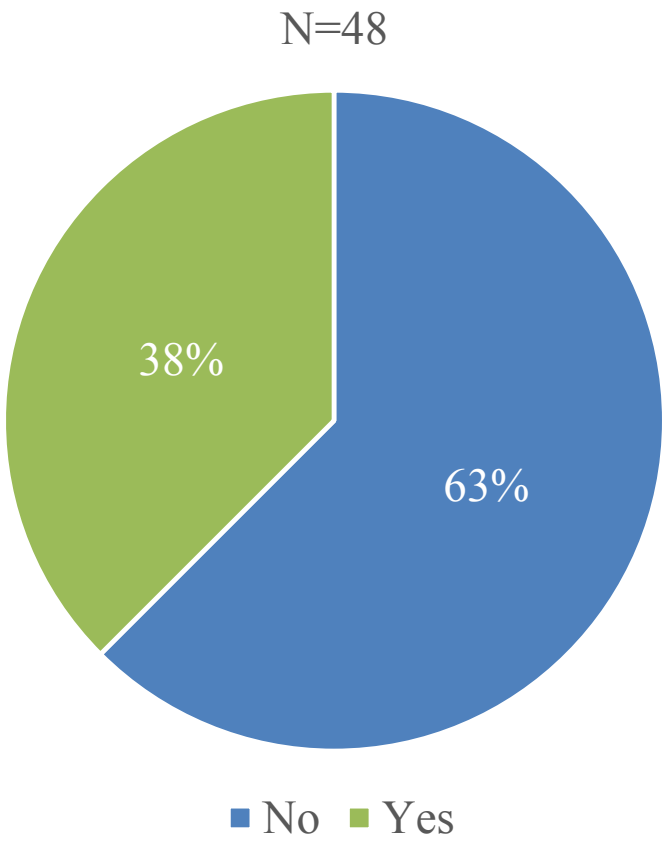
# Results: Patient Characteristics

- Gender Identification.



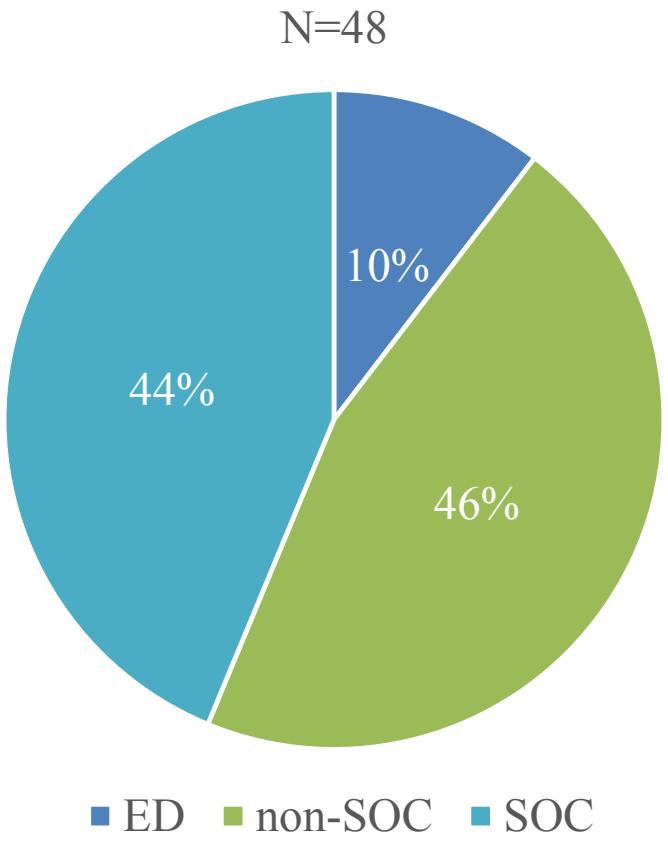
# Results: Patient Characteristics

- Preexisting OSA Diagnosis.

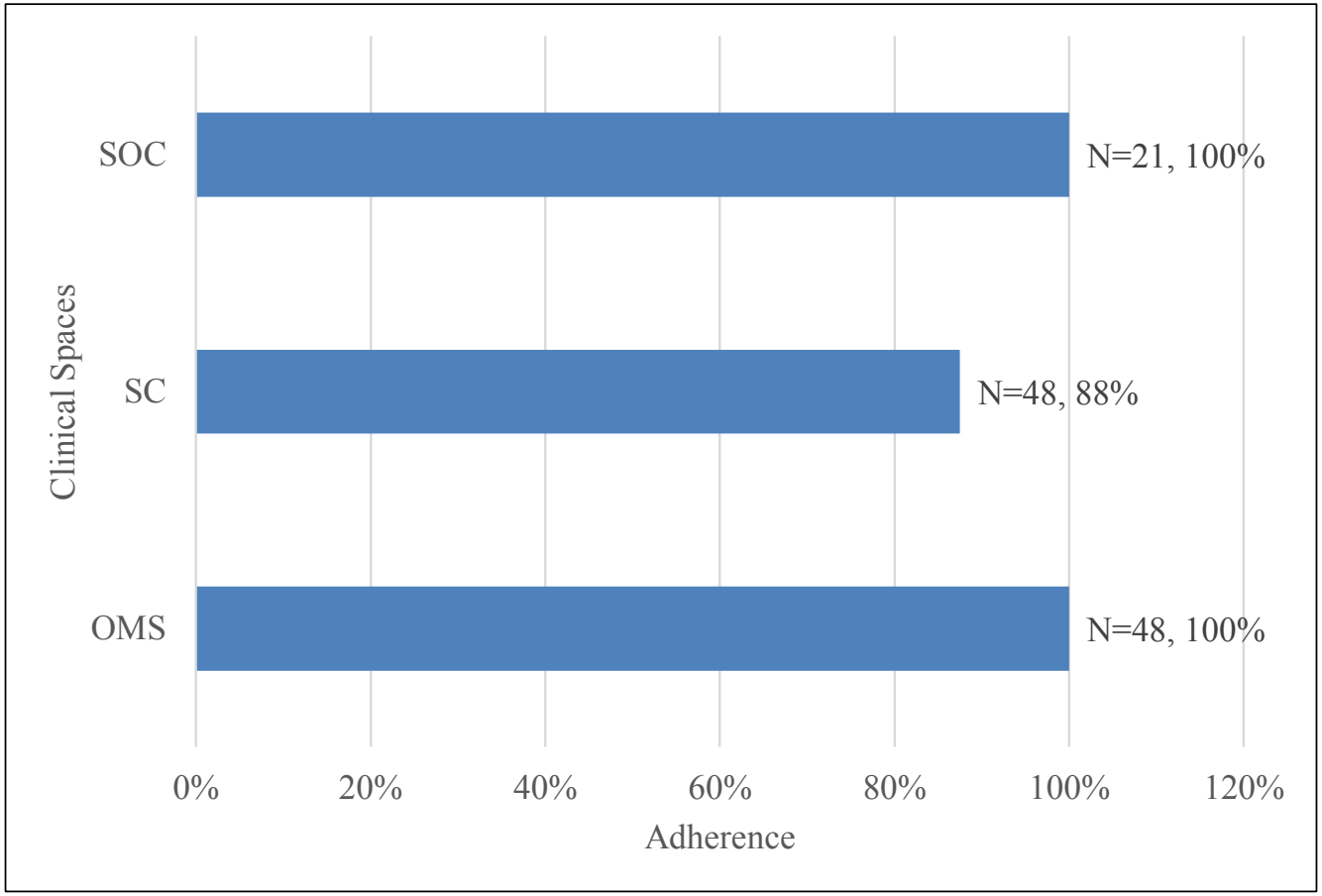


# Results: Patient Characteristics

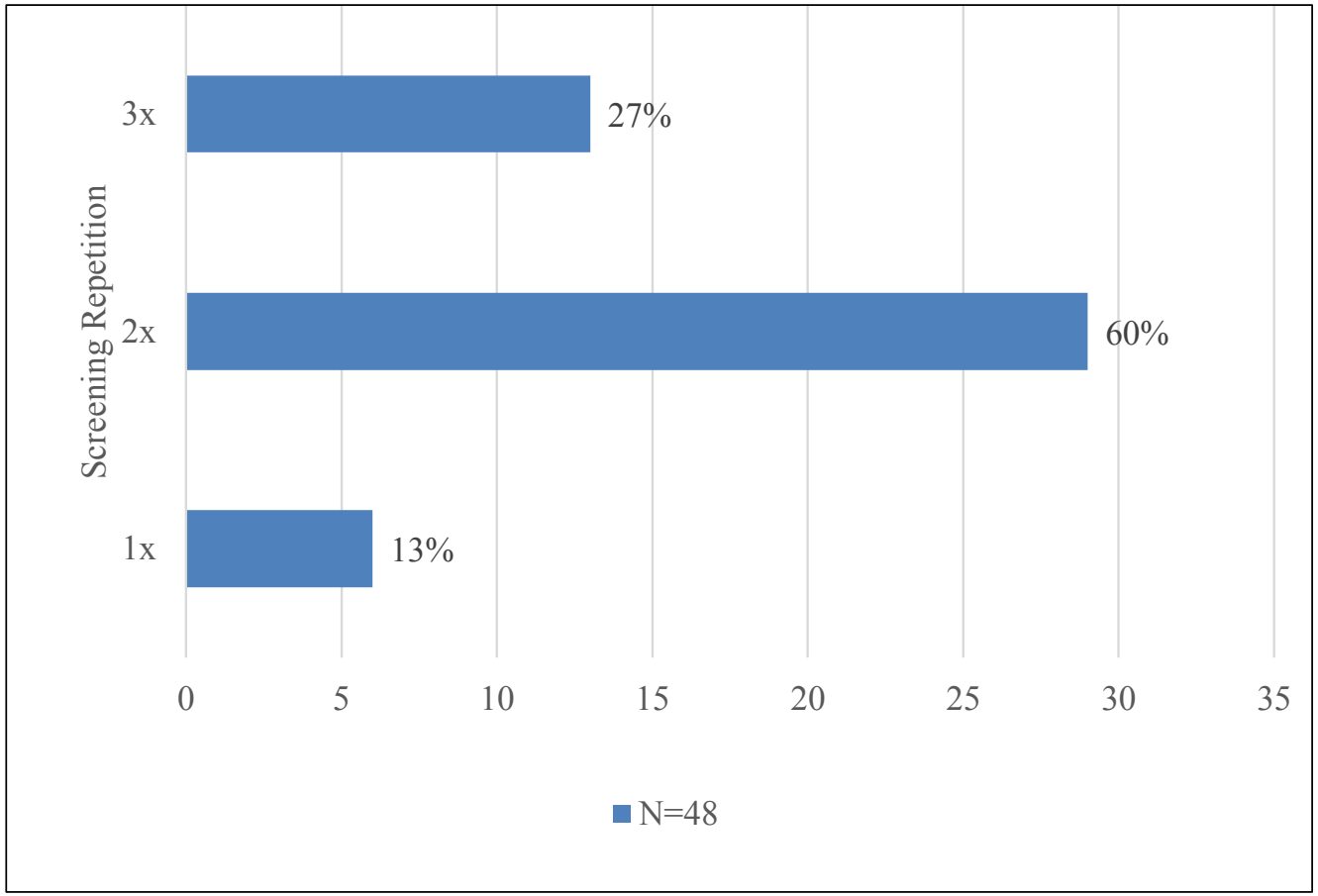
- Place of Origin.



# Results: RN Screening Adherence

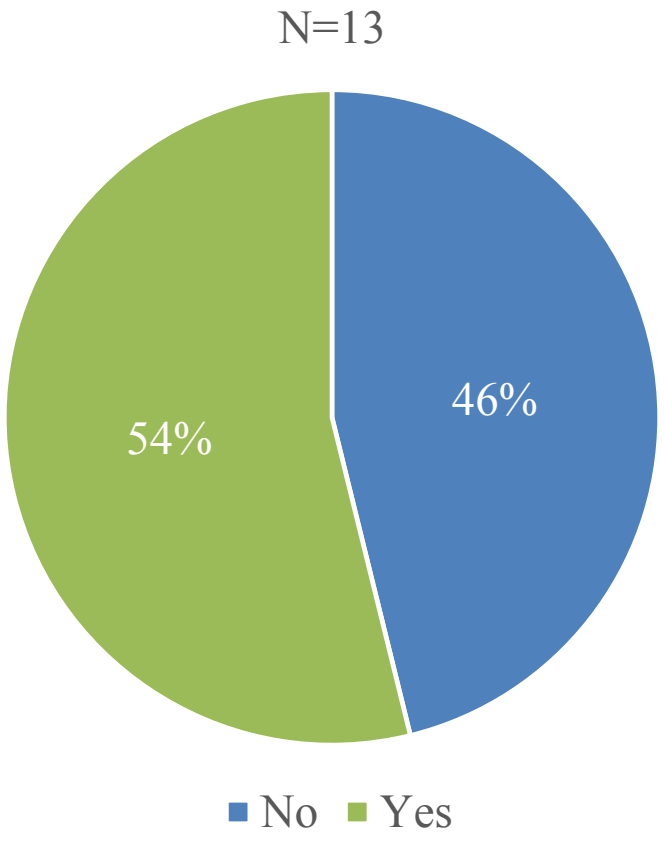


# Results: Screening Repetition Frequency



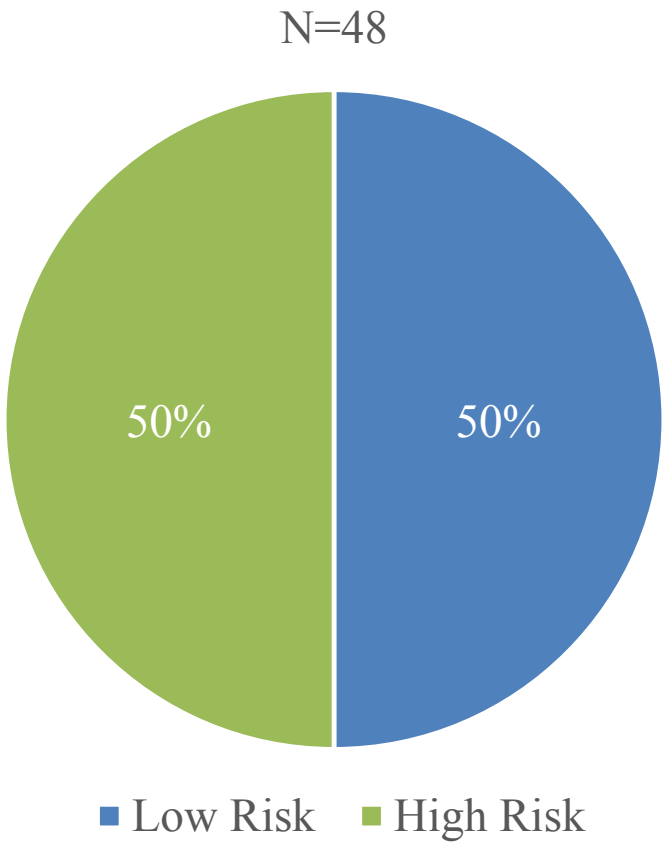
# Results: Mismatched Screening Scores

- STOP-BANG scores match.



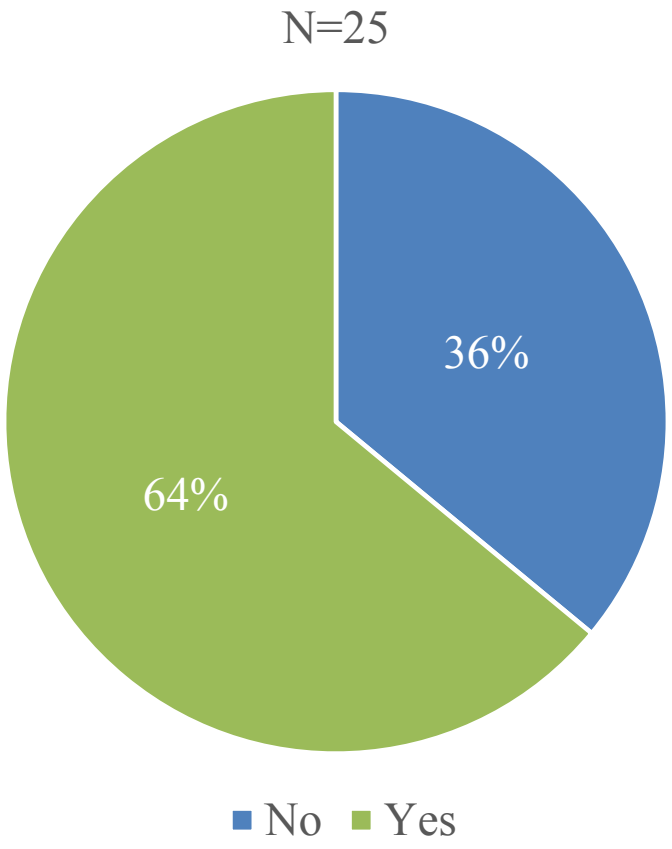
# Results: OSA Risk

- Risk Stratification for OSA.



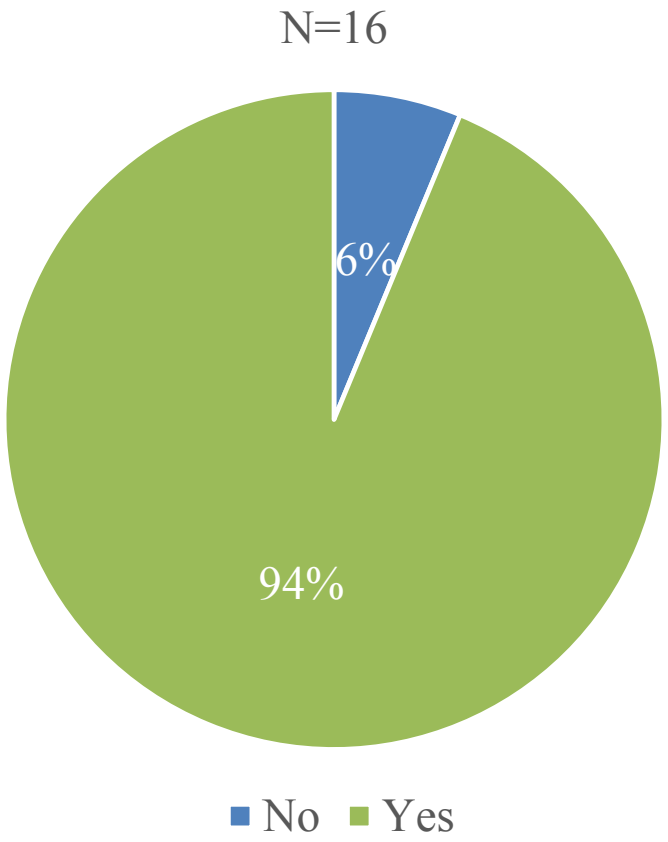
# Results: OSA Order Sets

- OSA Order Sets – Ordered.



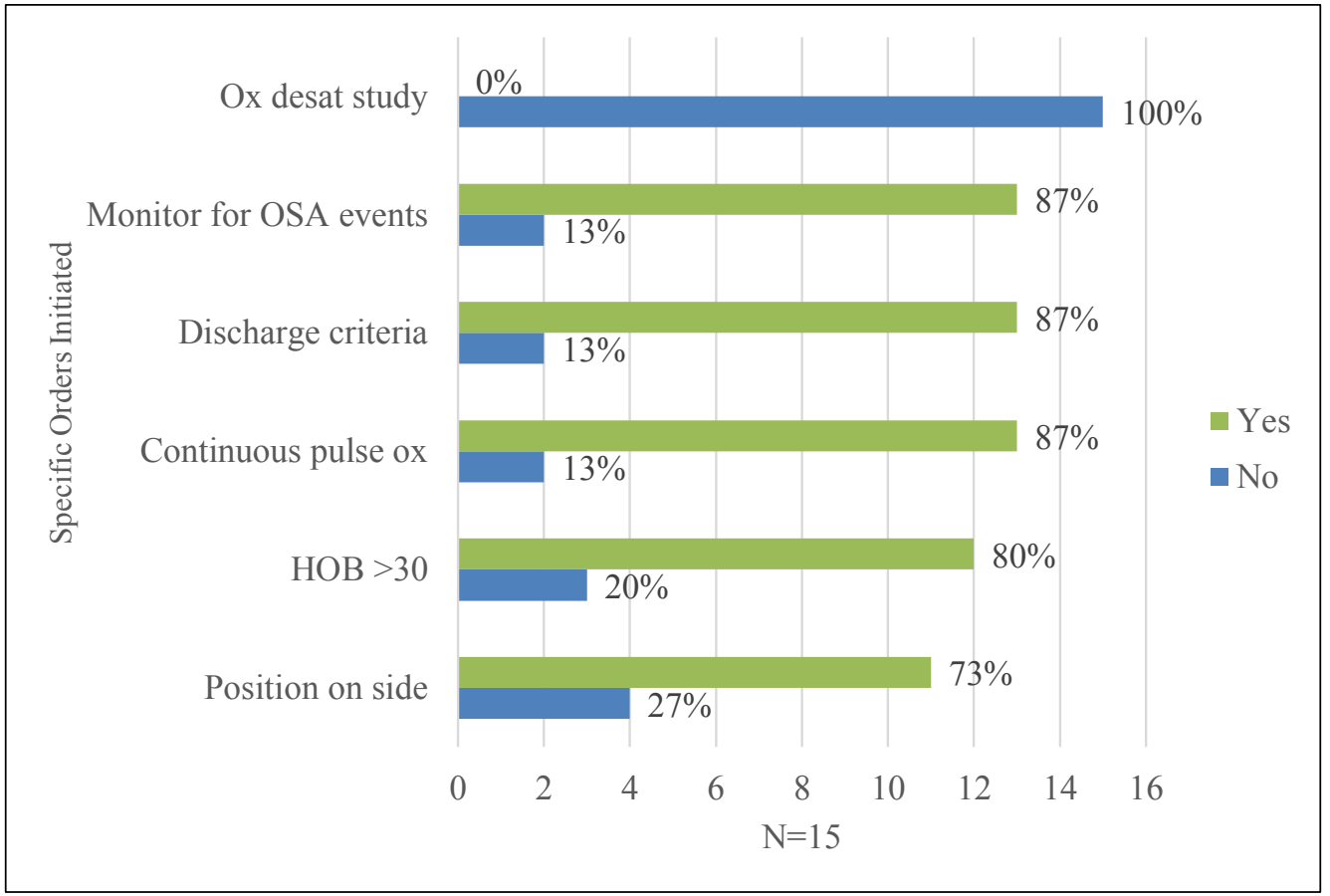
# Results: OSA Order Sets

- OSA Order Sets – Initiated.



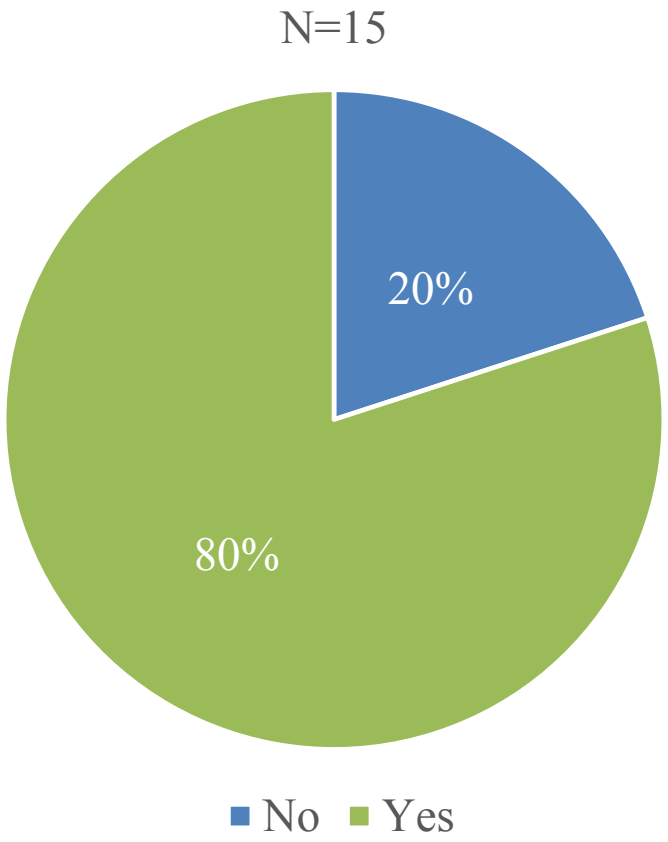
# Results: OSA Order Set

- OSA Order Set – Specifics.



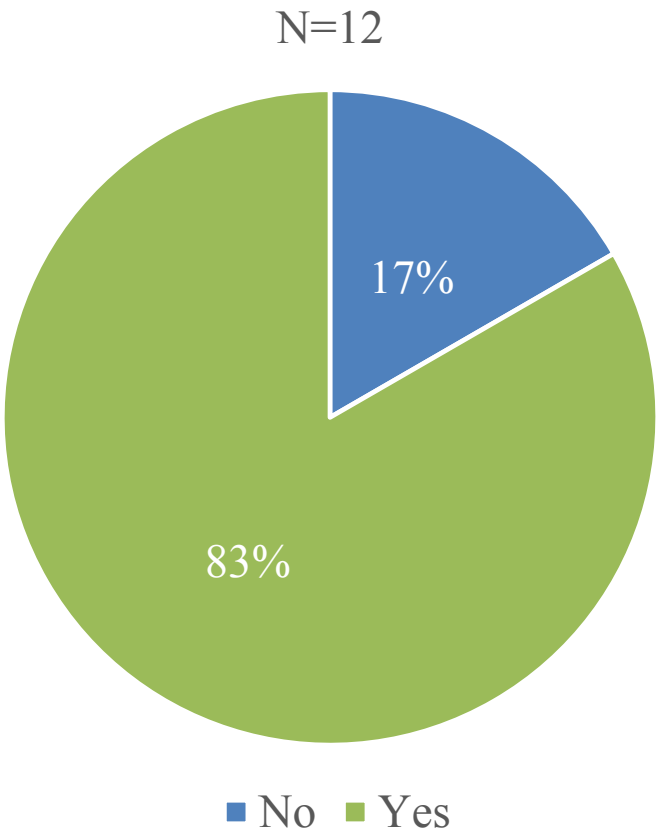
# Results: OSA Order Set

- OSA Order Set – Specifics: CPAP.



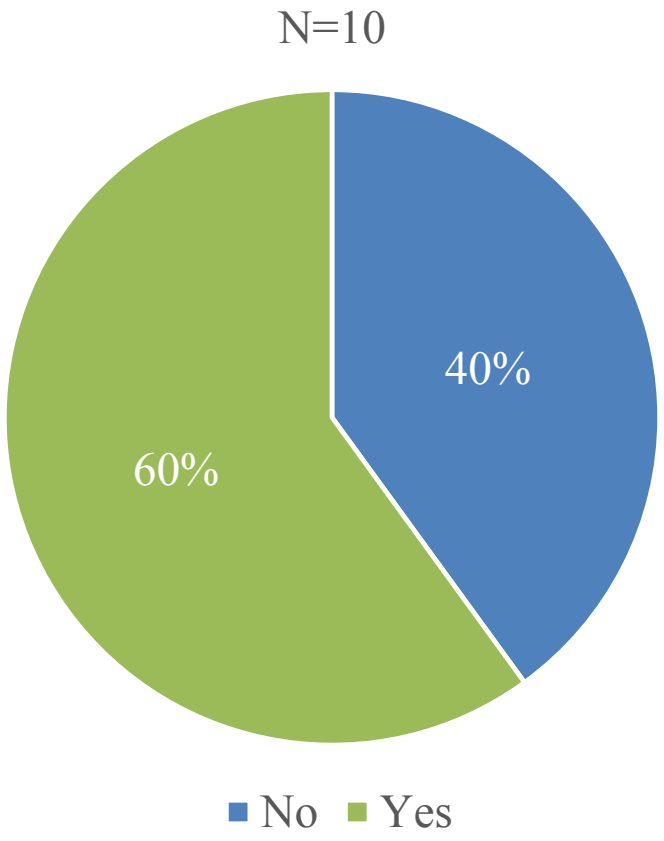
# Results: CPAP RN Documentation

- CPAP Use Documented.



# Results: CPAP Patient Adherence

- Patient adherence to CPAP use during hospitalization.

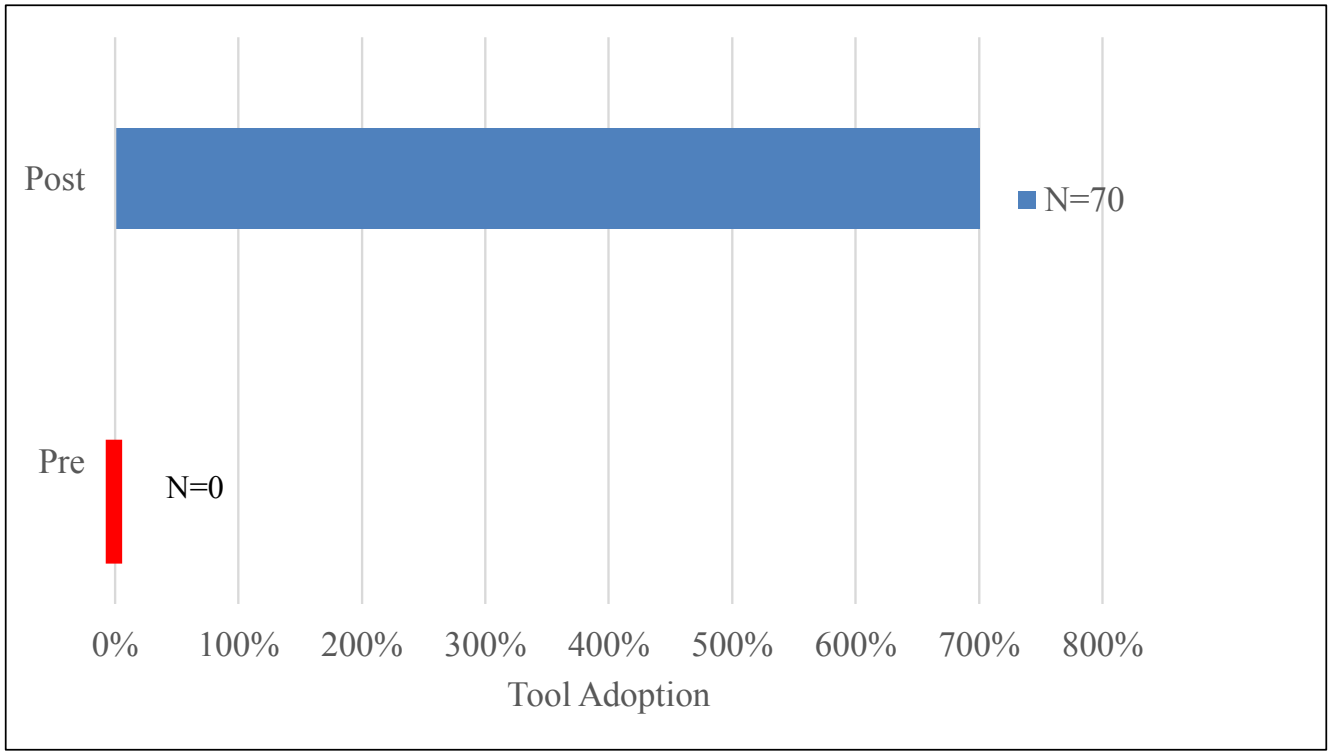


# Intervention Implementation Results

- Adoption of STOP-BANG Questionnaire.
- Intervention Measures.
  - Implementation Strategy.
  - Chart Audit.
- Interviews.
  - Communication between acute care and ambulatory providers.

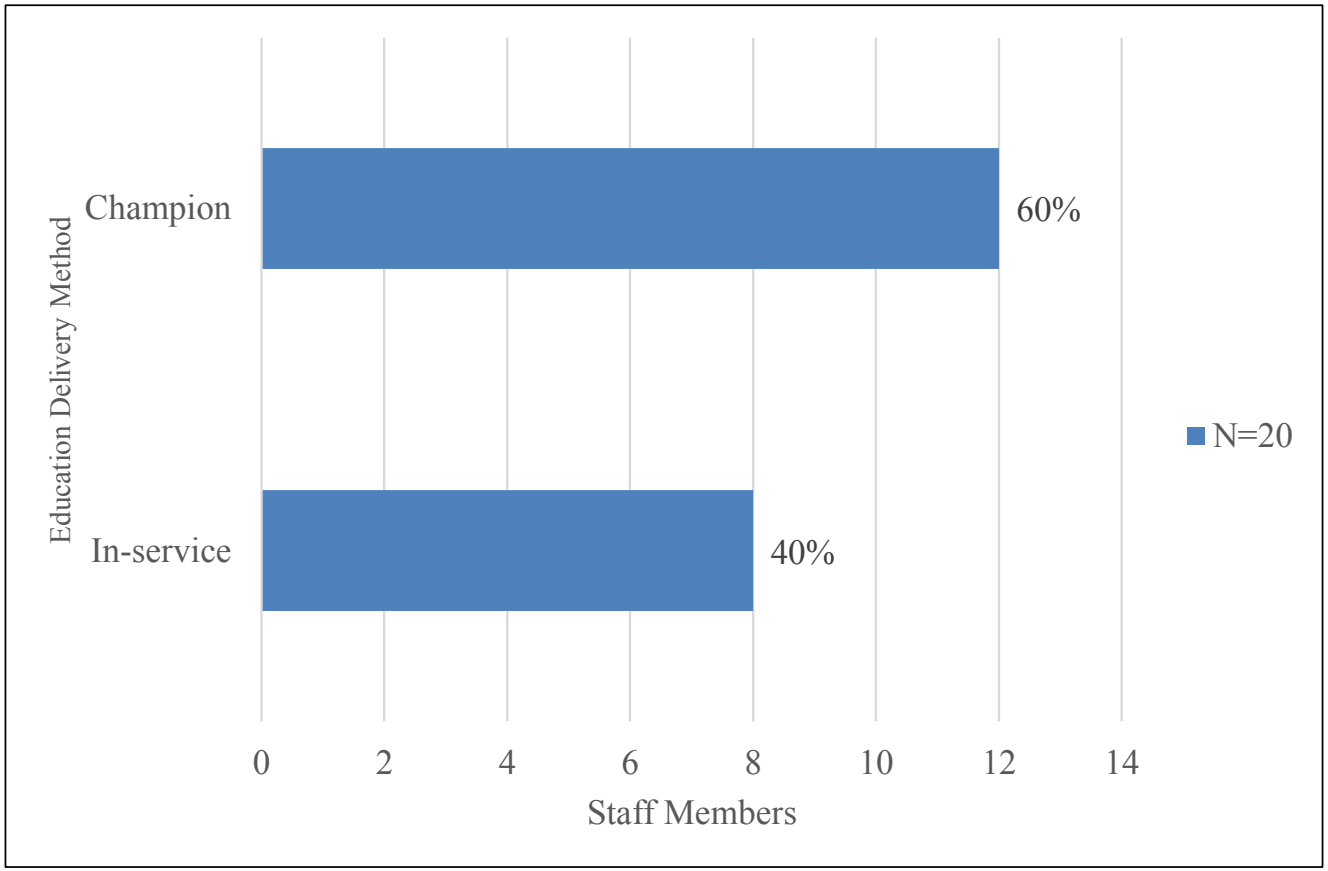
# Results: Adoption of STOP-BANG

- System-wide transition from STOP to STOP-BANG.
- Adoption Rate: 700%.



# Results: Intervention Measures

- RN education: 100% staff educated



# Results: Intervention Measures

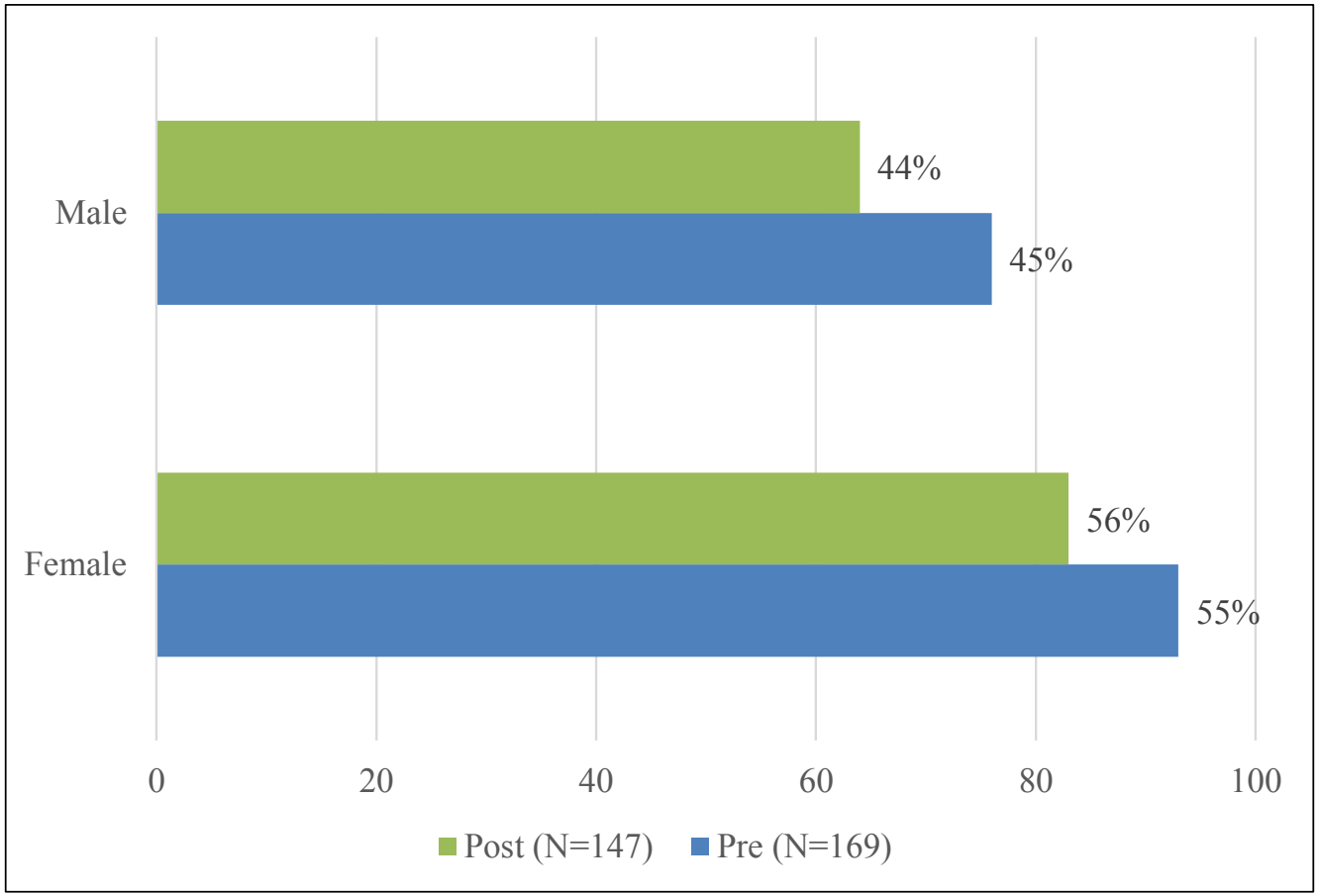
- Education uptake: Sample group (survey).
  - Question 1: Where in the chart do you look to see if the STOP-BANG has been completed by the SOC?
    - Answer: Nurse navigator.
  - Question 2: The STOP-BANG must have been completed in the last _ weeks in order to skip during admission?
    - Answer: 4 weeks.

# Results: Surgical Center Chart Audit

- Participant Characteristics
  - Demographics
  - Preexisting OSA diagnosis
  - Surgery Encounter Type
  - OMS Admission
  - Place of Origin
- Screening Repetition

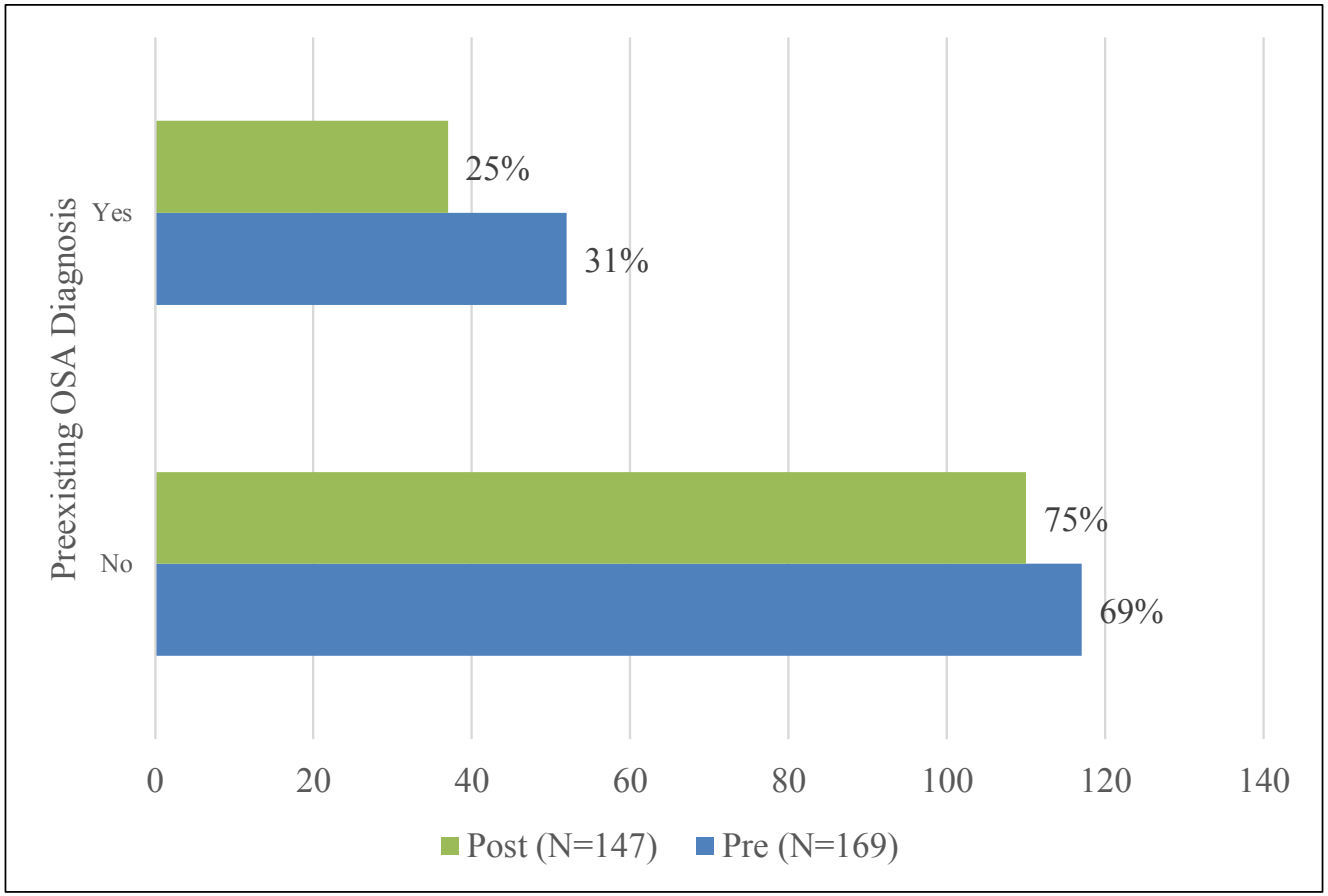
# Results: Patient Characteristics

- Gender Identification



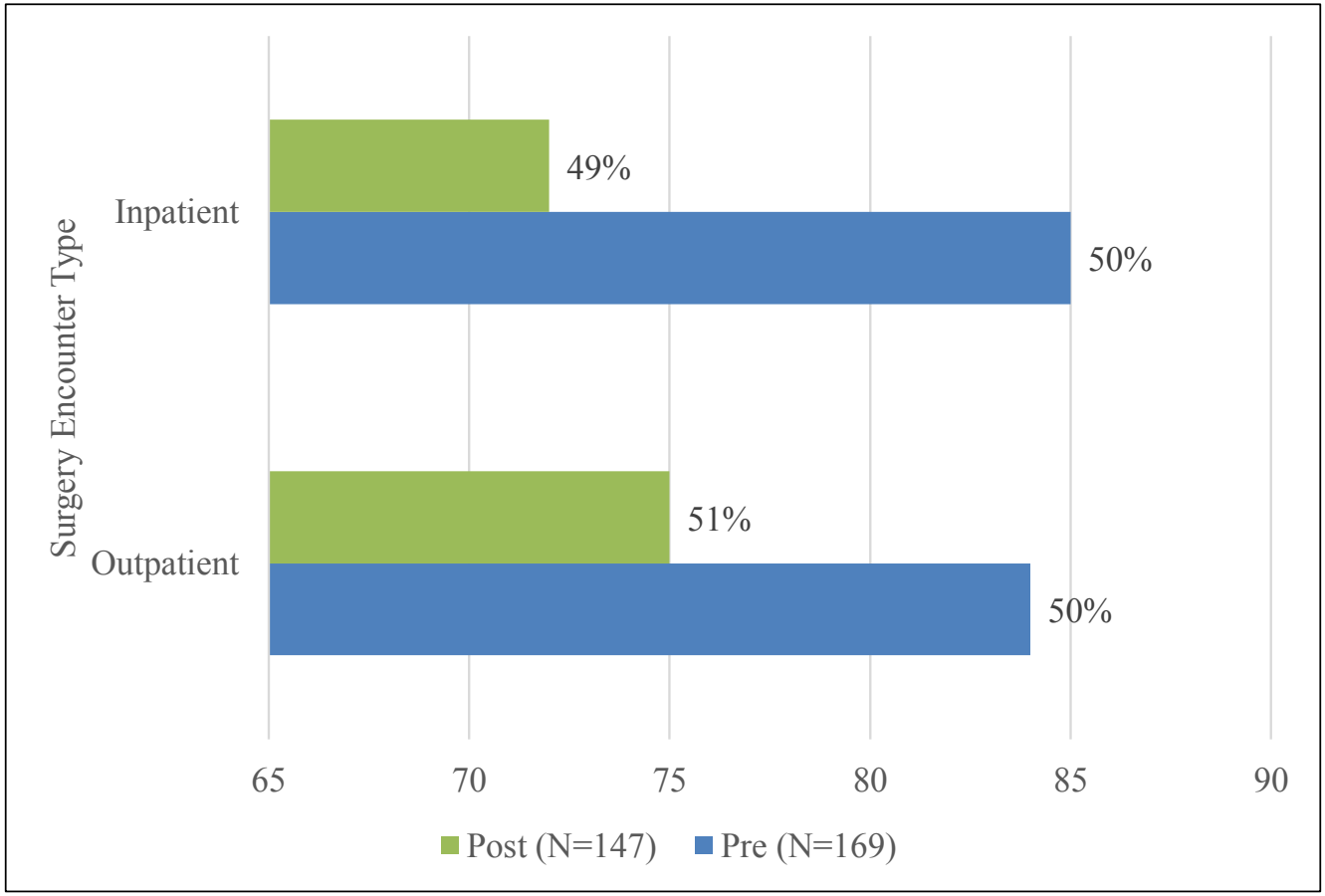
# Results: Patient Characteristics

- Preexisting OSA Diagnosis



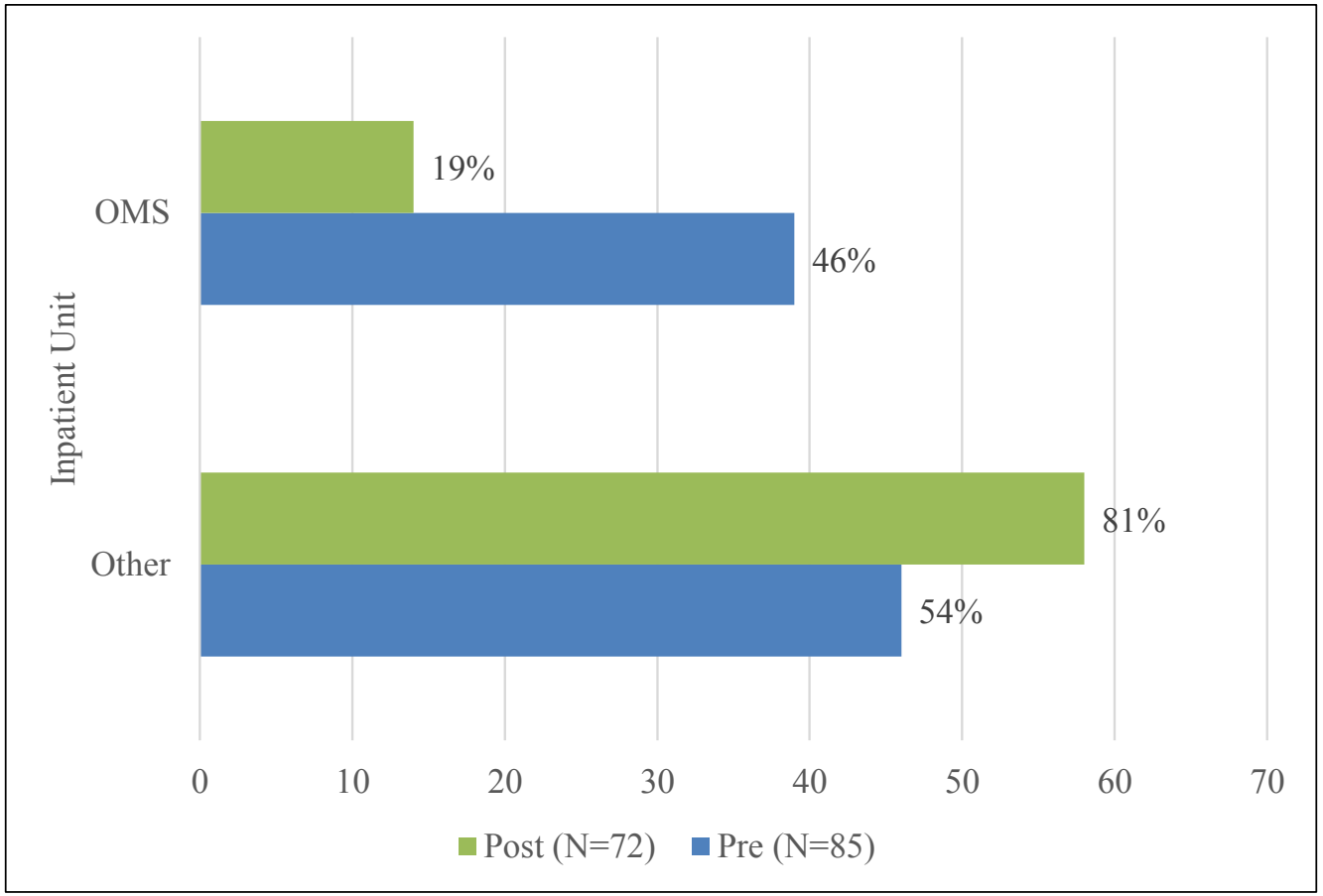
# Results: Patient Characteristics

- Outpatient surgery versus inpatient admission



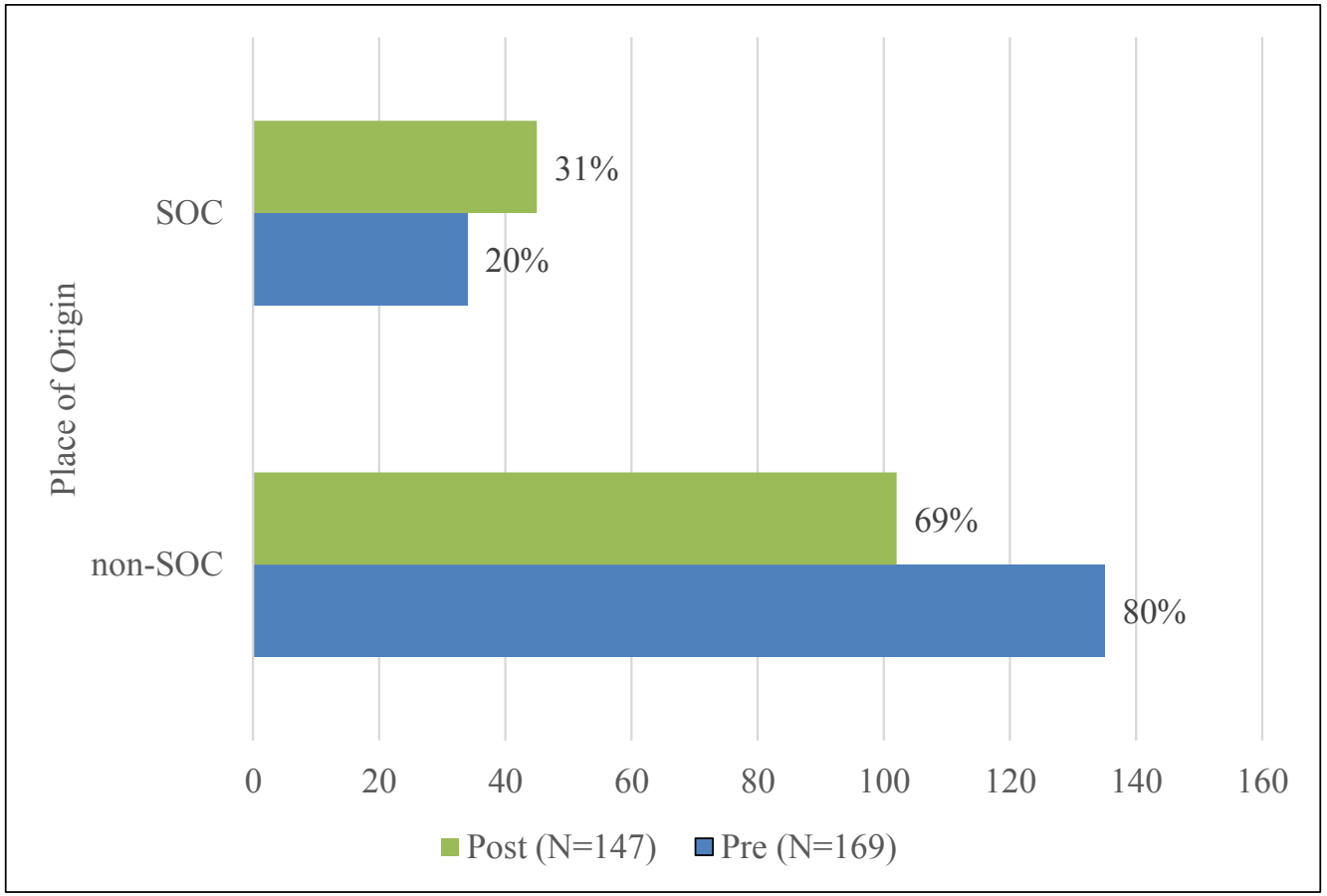
# Results: Patient Characteristics

- Orthopedic Medical/ Surgical Unit Admissions



# Results: Patient Characteristics

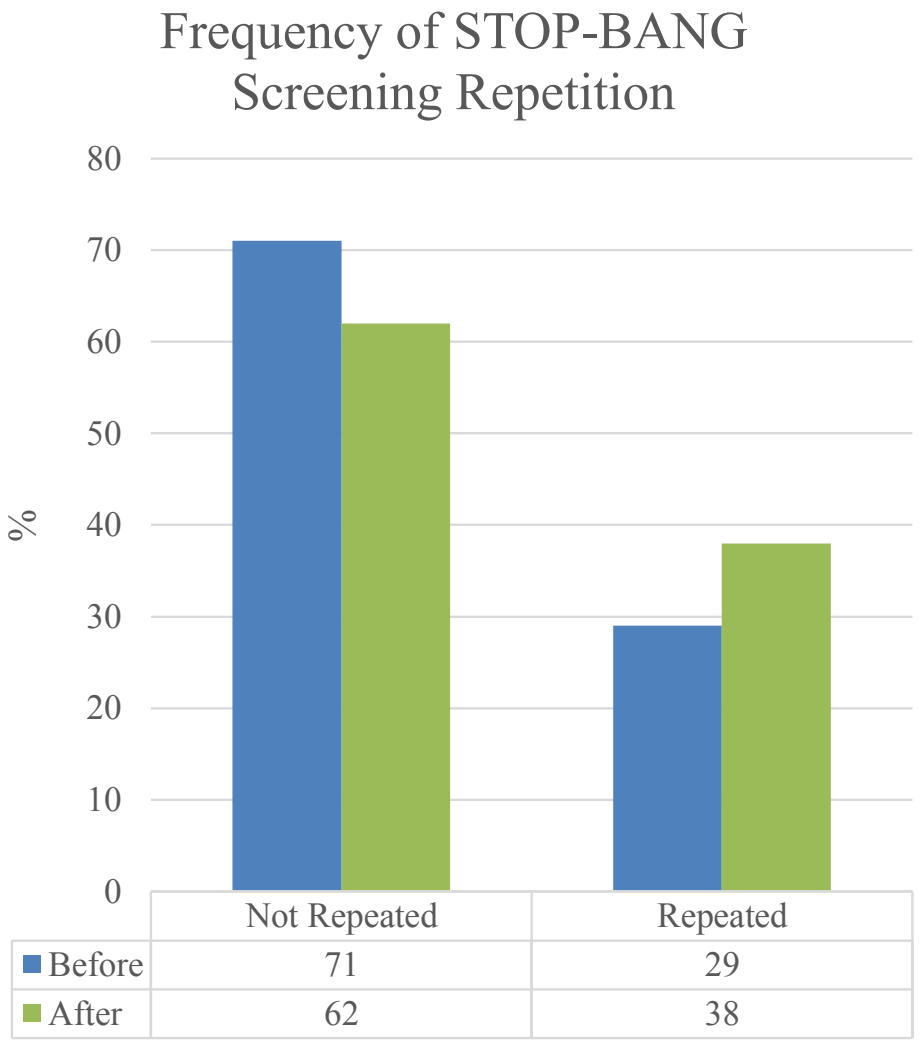
- Place of Origin



# Results: Screening Repetition

- Frequency of STOP-BANG Screening Repetition

| STOP-BANG Screening Repetition | | | | |
|---|---|---|---|---|
| | % (n) | | | |
| | Pre- | Post- | Change | p-Value |
| Not Repeated | 29% (10) | 38% (17) | 9% | 0.44 |
| Repeated | 71% (24) | 62% (28) | -9% | |



# Budget & Resources

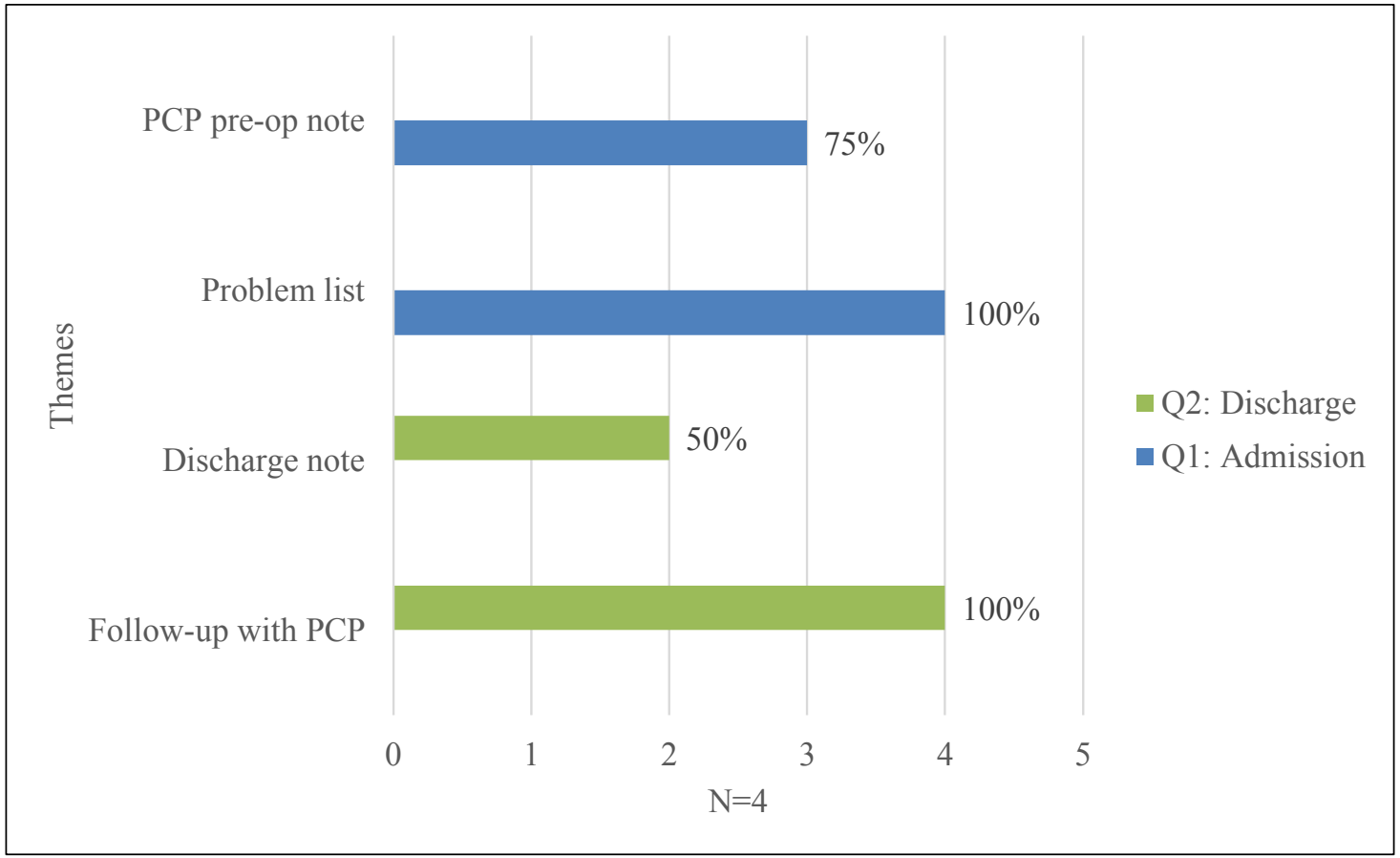
| Cost Mitigation if OSA screening workflow is made more efficient | |
|---|---|
| 1 OSA Screening | $1.64 |
| 280 unnecessary OSA Screenings prevented | $460 |

| Expenses for Implementation of Project | |
|---|---|
| Project Manager $30/hour, 450 hours | $13,500 |
| Site mentor meetings $45/hour, 20 hours | $900 |
| Unit Manager/ Supervisor facilitation $50/hour, 2 hours | $100 |
| RN education $32.26/hour 20 RNs, 5 minutes each | $54 |
| Supplies | $2 |
| Total Expenses | $14,556 |

| Cost Mitigation of 280 Unnecessary OSA Screens Prevented | -$14,096 |
|---|---|

# Results: Provider Communication

- Provider interviews.



# Timeline Overview

**Plan**

1/2020: Recognition of inefficient OSA care processes, local needs assessment.

**Do**

1/2020-6/2020: Organizational assessment, literature review.

**Study**

8/2020-10/2020: Developed formal implementation blueprint.

**Act**

9/2020-11/2020: Project proposal defense and approval.

**Plan**

1/2021- 2/2021: Gain buy-in, advisory board, address barriers, identify change champions, chart audit.

**Do**

3/2021: Develop updated educational flier, educate RNs, provide technical support.

**Study**

3/2021: Reexamine implementation, post-implementation chart audit.

**Act**

3/2021-4/2021:Summarize and disseminate results, final project defense.

# Discussion

- Identified inefficiencies in current obstructive sleep apnea (OSA) screening and care processes.
- Initiated standardization of staff and electronic health record (EHR) workflows.
- System-wide adoption of evidence-based STOP-BANG screening tool.

# Limitations

- Limitations on time for implementation.
- Limited statistical analysis available.
- Clinically significant findings.
- Validity and generalizability.

# Implications for Practice

- Identify need to evaluate and standardize practice processes.
- Further studies needed.
  - Gaps in communication at admission and discharge
  - Define current patient education practices
  - Barriers to patient CPAP adherence

# Conclusions

- Implementation strategies.
  - PDSA and DMAIC models.
- Data collection and analysis.
  - Insight on current practice which will guide future
- STOP-BANG
  - System-wide adoption.
  - Reduction in screening repetition.

# Sustainability Plan

- Organizational leader stakeholder prioritizing and supporting continued use (Hailemariam et al., 2019).
- Maintenance of workforce skills through continued training, booster training sessions, supervision, and feedback (Hailemariam et al., 2019).
  - Chart audits completed by charge RNs and managers.
  - Report average minutes saved each month.
  - Incentivize care workflow adherence.
- Agency priorities and/or program needs are aligned with new evidence-based intervention (Hailemariam et al., 2019).
  - Outline new OSA screening and ordering processes into official unit-based Standard of Practice polices for staff to reference.
  - Update system-wide OSA Care policy draft and finalize.

# Next Steps

1. Transition all inpatient units to STOP-BANG Questionnaire.
   - RN educator educates all inpatient staff .
   - Electronic health record (EHR) update.
2. Obstructive Sleep Apnea (OSA) Order Set EHR Updates.
   - Develop mechanism to alert providers to release OSA order sets for patients with high risk STOP-BANG scores.
3. Update Practice Policy.
   - Nursing Assessment Policy.
   - System-wide OSA Policy.

# Dissemination

- Organization Leadership and Committees.
  - Acute Care Clinical Practice Council.
  - Request for Education Committee.
  - Nursing and Allied Health EHR Oversite Committee.
- Virtual meeting with organization stakeholders and project team members to inform on project outcomes.
- Journal of Healthcare Quality.
- Scholar Works.
- Formal Defense presentation.

# DNP Essentials

# DNP Essentials Reflection

**Essential I: Scientific Underpinnings for Practice**

- Application of frameworks to increase understanding of the project's central phenomenon.
- Completion of a literature review using the PRISMA framework.
- Selection of evidence-based interventions to address the identified clinical problem.

**Essential II: Organizational and Systems Leadership**

- Development of a care delivery plan which meets the needs of the patient population and the health care staff whom care for them.
- Use of advanced communication skills to lead quality improvement efforts.
- Development and analysis of budgets for practice initiatives.

**Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice**

- Use of analytic methods within a literature review and organizational assessment.
- Evaluation and analysis of 18 project measures.
- Project findings disseminated publicly and within the organization.

**Essential IV: Information Systems and Technology**

- Use of technology to evaluate a care delivery within health care system.
- Use of technology to communicate with stakeholders, create a project budget, and to develop and distribute educational materials to staff.

# DNP Essentials Reflection

**Essential V: Advocacy for Health Care Policy**

- Critical analysis of current OSA care policy drafts within the organization.
- Advocacy for nursing staff regarding the OSA screening process.

**Essential VI: Interprofessional Collaboration**

- Collaboration and communication with quality improvement specialist, RN informaticists, inpatient and outpatient providers, surgical center RNs and management, and statistician.
- Lead the quality improvement project and acted as a bridge between clinical spaces.

**Essential VII: Clinical Prevention and Population Health**

- Evaluation of a current screening and care delivery models and determined appropriate interventions needed.
- Project addressed the population of interest: hospitalized adult patients with confirmed or suspected OSA.

**Essential VIII: Advanced Nursing Practice**

- Developed and sustained professional relationships with individuals involved in the project.
- Education and guidance of nursing leadership and staff through complex health processes and quality transitions.
- Demonstration of advanced clinical judgment, systems thinking, and accountability in the development and implementation of evidence-based interventions.

# Summary

- Untreated obstructive sleep apnea (OSA) is associated with increased risk for complications in surgical setting.
- Current OSA care processes are inefficient and make it difficult to adequately identify and treat OSA in hospitalized adults.
- STOP-BANG is the most validated screening tool.
- Implementation strategies used to address relationships between people, tasks, and technologies.
- Workflow standardization initiated to improve efficiency of OSA screening and care processes.
- Strategies recommended to promote sustainability.

# Handouts

1. Synthesis of Literature Review Results
2. Evaluation and Measures
3. Current OSA Care Workflow
4. Ideal OSA Care Workflow
5. EHR Workflow Solutions
6. SC RN Staff Educational Handout and Cognitive Aid
    1. RN OSA Screening Algorithm
7. OSA Screening Workflow Educational Handout
    1. Measuring Neck Circumference
    2. Obstructive Sleep Apnea Screening, STOP-BANG Questionnaire

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