# The Dangers of Obstructive Sleep Apnea and Post-Surgical Care

Jared Burkholder and Justin Locke

James Madison University

## What is happening?

According to the American Sleep Apnea Association (2011),

"Sleep apnea is an involuntary cessation of breathing that occurs while the patient is asleep…people with untreated sleep apnea stop breathing repeatedly during their sleep, sometimes hundreds of times during the night and often for a minute or longer. In most cases the sleeper is unaware of these breath stoppages because they don't trigger a full awakening… left untreated, sleep apnea can have serious and life-shortening consequences: high blood pressure, heart disease, stroke, automobile accidents caused by falling asleep at the wheel, diabetes, depression, and other ailments."

In a study by Ramachandran et. al, (2010) the researchers found that,

"Obstructive sleep apnea is a prevalent condition in patients presenting for surgery. It is estimated that up to 24% of middle-aged males and 9% of middle-aged females may have OSA, over 80% of whom are undiagnosed. Few patients undergo preoperative polysomnography or have OSA treatment plans such as continuous positive airway pressure (CPAP), bi-level positive airway pressure (BiPAP), surgery for OSA, or tracheotomy."

In 2005 reports of complications relating to lack of treatment for undiagnosed obstructive sleep apnea (OSA) began to rise at hospitals throughout the nation. It was found that these patients who had OSA and were not properly treated after forms of surgery that required anesthesia were dying due to respiratory failure. The medication was too strong for the respiratory system to handle in addition to the strains being placed upon it because of the undiagnosed OSA. More specifically, the larger amounts of anesthesia that was being given to patients during the recovery

period, did not allow enough signals to the brain in order to wake the patients up for them to be able to start breathing again. (W. Cale, personal communication, February 28th, 2012)

Experts in the field of sleep medicine, specifically Dr. William Cale at the Rockingham Memorial Hospital Center for Sleep Medicine, began to take notice of this rapidly increasing problem. Patient death is a concern for any hospital system and it is natural that a needs analysis be conducted to try and find the root cause of the problem. Steps have been taken by doctors across the country in order to create a system to identify patients who pose a high risk of sleep apnea. If these patients are successfully identified, then proper treatment and monitoring post-surgery can occur to prevent unnecessary deaths. In particular, Dr. William Cale and his team aim to educate the necessary members of the surgical staff on the dangers of undiagnosed OSA, the use of a "stop-bang" form to identify high risk patients, and the proper treatment and monitoring of OSA patients before and after surgery. Dr. Cale's team has assumed that the surgical teams within Rockingham Memorial Hospital are not fully aware of this potentially deadly problem and are therefore unable to take necessary precautions. The team's ultimate goal is to begin the process of creating awareness throughout the hospital staff so that no further deaths occur due to complications resulting from undiagnosed OSA.

## Literature Review

### *The importance of screening patients for OSA before surgery*

OSA is not an uncommon problem in hospital settings. As stated before, "it is estimated that up to 24% of middle-aged males and 9% of middle-aged females may have OSA, over 80% of whom are undiagnosed" (Ramachandran et. al, 2010). It can be a daunting challenge for hospitals to take the necessary precautions to avoid OSA complications when over 80% of

individuals who have OSA are undiagnosed. This problem is especially significant when attempting to identify patients before surgery. It is important to implement screening so that resources can be corrected allocated before, during, and after surgery to ensure the safety of these patients. Gali et. al, (2007) state that,

"Death and cardiorespiratory complications have been associated with OSA during the postoperative period, and some have advocated intensive monitoring be used for most patients with OSA. In a retrospective study, patients undergoing hip and knee replacements with OSA were found to have a 24% incidence of complications compared with 9% of those without OSA, including cardiac events, complications requiring transfer to and ICU, and respiratory events requiring support such as continuous positive airway pressure or intubation" (p.585).

Gali et. al (2007) proposed a study that aimed to successfully identify OSA patients prior to having surgery so that necessary precautions could take place post-surgery to avoid any complications resulting from OSA. They first chose to use the Flemons et. al formula for identifying patients high-risk and low-risk of OSA. This tool gives a sleep apnea clinical score (SACS) and any values of 15 or higher indicates a likelihood of OSA (positive predictive value of 73%). The researchers chose to implement this tool in the post anesthesia care unit (PACU) of a hospital. Their goal was to determine whether combining preoperative evaluation with PACU observations of the same patients would predict oxygen desaturations within the first 24 to 48 hours after surgery. In particular, the researchers chose to measure whether patients had any of the following events post-surgery: bradypnea (< 8 respirations/minute), apnea (complete cessation of breathing for > 9 seconds), desaturations of < 90% while being measured on pulse oximeter, or pain-sedation mismatch (high pain score with a high sedation score). These events were to be recorded by the PACU nurses at 30, 60, and 90 minute intervals. Also, an oxygen

desaturation index (ODI) was calculated for each patient. ODI was defined as, "the number of desaturations per hour of recording, and a desaturation was defined as a decrease in saturation of 4% or greater for 10 seconds or more" (p.584). Therefore, a higher ODI meant that patients were losing at least 4% of their oxygen volume for at least 10 seconds. It can be implied that this is due to OSA. Using the SACS and PACU results, patients were grouped into three separate categories. Group 1 patients were at a low risk of OSA (SACS < 15). Group 2 patients were at a high risk of OSA (SACS > 15). Group 3 patients had a high risk of OSA (SACS > 15) and had recurring PACU events. The researchers also collected data on whether any of the groups of patients experienced unplanned intensive care unit (ICU) admissions. These admissions included, "patients who were not sent directly to the ICU from the PACU, but, instead were those who, at the discretion of the treating physician, required ICU admission at other times in the hospitalization" (p. 584). The researchers screened a total of 2206 patients and of these, 1923 had low SACS, 251 had high SACS, and 22 were excluded due to missing information. They found that the frequency of unplanned ICU admission for patients with low SACS was 0.5% compared with 8.8% for those with high SACS and that this result was significantly different ($p < 0.001$). Also, the researchers found that the percentage of patients with ODI > 10 following PACU discharge differed significantly across the three groups. Group 1 had an ODI > 10 of 12%, Group 2 had 37%, and Group 3 had 57%. The incidence of ODI > 10 was significantly higher for groups 2 and 3 compared with group 1 ($p = 0.017$ and $p = 0.001$). This meant that those patients identified as high risk (Group 2) and high risk with PACU events (Group 3) had greater than 10 events where the level of oxygen in their bodies dropped more than 4% for at least 10 seconds.

There are several important conclusions that can be drawn from the research done Gali et. al (2007). First of all, their research points to the fact that a simple screening tool can positively predict ICU admissions for patients who are at high risk of OSA. Patients with a high SACS had an 8.8% unplanned ICU admission compared to 0.5% for low-risk patients. This is important in a hospital setting because it would open up the opportunity for hospitals to allocate more resources to the ICU based on the expected influx of patients resulting from this implemented screening. More importantly though, was the result that patients who were identified as high-risk and high-risk with PACU events had significantly more events involving oxygen desaturation most likely resulting from their undiagnosed OSA. This is a major safety concern for hospital staff and would require closer monitoring and a different selection of post anesthesia care for these patients. The researchers discuss the different effects that analgesics have on patients depending upon their risk of OSA. They state that, "fewer patients with a high SACS and who had postoperative regional analgesia had recurrent PACU events, as compared with those patients who had high SACS but no postoperative regional analgesia" (p. 587).

*Possible methods for preventing postoperative OSA complications*

Obstructive sleep apnea (OSA) is a prevalent condition that increases the risk for a patient to stop breathing especially when combined with anesthesia for surgery. Scholars estimate that "24% of middle-aged males and 9% of middle-aged females have OSA, which 80% of these cases are undiagnosed" (Ramachandran et. al., 2010, p. 414). With a large percentage of OSA patients being undiagnosed, there have been several cases of perioperative morbidity as a result of respiratory compromise. Several screening tools have been developed to help doctors know when a patient may be at high risk for having undiagnosed OSA. However, these screening tools cannot predict which patients will have postoperative respiratory complications. There has

been little research on practical techniques for managing postoperative OSA patients. Ramachandran suggests that the first 24 hours after surgery are high risk for the patient to develop respiratory complications and there is a substantial increase during this time for patients with a high risk of OSA. Due to complex post-operative requirements for high risk OSA patients, "respiratory therapist (RT) could substantially improve the patients' clinical management in the immediate postoperative period" (Ramachandran et. al., 2010, p. 414). Ramachandran and his team developed an automated alert system to notify the RT of high risk OSA patients.

Ramachandran and his team conducted an observational study of all adult patients going in for surgery at the University Hospital in Ann Arbor, Michigan. Exclusions included individuals under eighteen and incomplete documentation. The team collected documentation of preoperative, intraoperative, and postoperative data. Although the data analysis is retrospective, the data collection done by medical staff was done prospectively.

In 2007, the department implemented an automated notification system to notify the Respiratory Therapist (RT) of patients with diagnosed OSA or screened for high risk of OSA. Initially the RT was notified before the patient went into surgery so that they could meet with the patient, inspect their CPAP machine, and go over the settings. This was changed, and the RT was alerted when the patient was assigned a bed after the surgery. The RT arrives before the patient gets there in order to inspect the CPAP/BiPAP machine and consult with the anesthesiologist about the need for mechanical veneration or oxygen.

Ramachandran's team noted that the hospital in Michigan that they were working with reported 7,422 surgeries in their electronic record. Of those, 766 (10% of all surgeries) were documented or suspected of having OSA. 228 (or 30% of the 766) of the patients required

postoperative CPAP/BiPAP machines. Of the 228 patients that needed CPAP/BiPAP machines, 177 used them at their home, and 147 brought the machines on the day of the surgery (i.e. 30 people who use the machine at home did not bring their machine in). In addition to the 30 patients who did not bring their machines, 51 patients were put on CPAP/BiPAP resulting in the hospital's machines being used 81 times during the study period. This resulted in an average of 7.4 automated alerts per day with a range of 2-18 patient visits per day. There is no written protocol for instituting CPAP/BiPAP so local standards were used and this included using the patients' home CPAP/BiPAP settings. If a patient did not take a sleep study, and therefore did not have a CPAP/BiPAP setting, they were treated as Intensive Care Unit (ICU) patients. After two months of the study, the researchers switched from the preoperative model to the postoperative model. In the preoperative model, the RT was having difficulty meeting with all the patients and not all the information was available before the surgery. In the postoperative model, the RT could better plan out their day and more efficiently review each patient's details prior to their arrival in post-surgery care. Between 2001 and June 2007, 36 patients had complications and were found unresponsive. 5 of those patients died due to acute respiratory complications. Since June 2007, when the alert system started, there have been no cases of sudden-onset acute respiratory complications.

This was an observational study not designed to look for an outcome, but instead it showed the need for automated alerts to the RT so that they could assist with the patients' postoperative recovery. The immediate postoperative care period presents challenges for the respiratory system especially in patients with OSA. It is imperative for interdisciplinary communication between the anesthesiologist and the RT to occur as the care unit transitions from one-on-one monitoring to the lower levels of monitoring. An interesting finding in this study

involves the use of CPAP/ BiPAP machines on patients who were not previously diagnosed with OSA. This further shows how the RT presence can help the patients in post-surgery care.

First, this study was limited in the fact that it was not designed to identify differences in postoperative outcomes but instead to develop and explore the system of perioperative care in patients at the highest risk of OSA. Second, the study did not collect data on CPAP adherence; deeply sedated patients are treated by other methods that require the attendance of the RT. Finally, there were no cases of sudden onset acute respiratory compromise after the implementation of the perioperative RT system and the hospital-wide opioid policy. Ramachandran (2010) states that, "the finding of improved outcomes is unlikely to be related to one aspect of the change in management, but, rather, it reflects the success of a multimodal multidisciplinary approach to the complex clinical requirements of high-risk patients" (p. 418).

## What should be happening?

The ultimate goal is for RMH to have no deaths attributed respiratory failure resulting from OSA. To achieve this goal the ideal situation is for all medical care professionals at RMH to attend the presentation on OSA, screen all surgery patients before surgery using the StopBang tool, monitor high risk post-surgery patients using the PACU tool, and take appropriate measures to maintain patients health.

To develop a plan for dealing with OSA, RMH created task force of doctors and nurses researched OSA and looked into what other hospitals are doing to reduce deaths in the perioperative period. The task force tried not to reinvent the wheel so they borrowed a compilation of best practice procedures from other hospitals and modified them sothe practices would work for RMH.

Dr. William Cale, MD who is a registered pulmonologist and director of the RMH sleep center worked with a design team to develop a presentation on OSA. This presentation describes why OSA is a problem and conveys what RMH is doing to mitigate the effects of OSA in post-surgery patients. As a first step Dr. Cale would like all of the surgeons, anesthesiologist, monitor technicians, and nurses caring for surgery patients. This will ensure all medical professionals caring for surgery patients have the same level of understanding of OSA, the effects it can have on surgery patients, and methods to lessen the effects. Ultimately, Dr. Cale would like everyone in the hospital to go to the OSA presentation and for all patients at RMH to be screened for OSA.

The StopBang is a screening tool used to help doctors figure out which patients are at high risk for having OSA. Patients should be screened for OSA when they come in for a consultation, well before the day of the surgery. The nurse should ask the patients the questions from the StopBang form and use the key on the bottom to notate *High Risk for having OSA* or *Low Risk for having OSA.* If the patient is at high risk for having OSA the nurse should note this in the patients file and send the information to the RMH Sleep Center so the sleep center can get in touch with the patient to set up a sleep study.

The sleep center has six rooms available to conduct the overnight sleep studies, two of those rooms have been set aside to quickly accommodate the patients who were screened as high risk so the patient can be quickly scheduled and not back up the surgery. Conducting the sleep study will show if the patient actually has OSA or not. If the patient does have OSA, they will come back for and additional study to fit them with the CPAP machine and figure out the exact settings for that patient. Settings for CPAP and notes will be added to the patients file so the surgeons and anesthesiologist will have the information on the day of surgery. Then the patient will bring

their CPAP machine with them on the day of surgery along with the settings. Patients with OSA will be hooked up to the CPAP machine during surgery.

When the anesthesiologist and surgeons see the patient has OSA they will take appropriate precautions to help ensure the safety of their patients. “Many of the drugs used during surgery or procedures (anesthetic agents, sedatives, opiates) not only worsen collapse of airways but also blunt hypoxic and hypercarbic responses” ("Obstructive sleep apnea," 2009). Some types of anesthesia are more likely than others to cause this type of respiratory failure. Any type of Opiate significantly increases the risk for respiratory failure in OSA patients and this method of sedation should be avoided in OSA patients (Cale, 2012). An article on sleep apnea in the perioperative period discusses and individual who was “obese and diagnosed with OSA (but not treated) suffered a fatal cardiopulmonary arrest in the postoperative period after receiving opiates” ("Obstructive sleep apnea," 2009). Anesthesiologist should choose a different type of sedative other than opiate when the patient has OSA.

The surgeons and surgical team should make sure the patients CPAP machine is working correctly and that it is on the proper settings. The patient will use the CPAP machine during surgery to keep the air flowing into their lungs which will help to keep the patient from stopping breathing.

After the patient gets out of surgery, Patients who have OSA will be monitored more closely than the patients who do not have OSA. The PACU tool will help the nurses and monitor technicians monitor the patients. The PACU tool lays out a time table for nurses of when to check patients and what to check for, in addition to the monitor technicians constant monitoring of patients breathing, heart rate, and other vitals. Using the PACU tool helps the nurses know how the patient is doing and when they need to monitor patients more closely, move patient to

the Intensive Care Unit (ICU), or prolong their stay in the post-surgical care unit for additional monitoring before sending the patient home. Patients with OSA will be showing normal breathing with no episodes and cleared by a doctor prior to being sent home.

## Performance Gap

The presentation on OSA attempts to give the medical professionals a basic overall understanding of OSA and make sure all the staff has similar level of understanding. While several of the nurses were very knowledgeable about the causes of OSA, the dangers, and ways to care for patients and willing to share stories about experiences they had. Other participants were quiet and did not share much information, and it was difficult to gauge how much these participant knew prior to the presentation. The only surgeon in attendance did speak up and a question which demonstrated his incomplete understanding and improper procedures used by some of the orthopedic surgeons. Even the very knowledgeable participants did not know all of the information that was presented. This demonstrates the knowledge gap in what the participants know and what they need to know.

The point of the screening tool is to find out which patient are at high risk of having OSA, since many patients do not know they have OSA. If patients are not screened then doctors do not know who may be at high risk so no precautions can be taken. Screening tools such as the StopBang are not regularly used at RMH. The department that uses the screening tool the most is the cardio pulmonary rehab. The problem with this is those patients have already had surgery and are then screened for OSA. While screening the patients after surgery is still good, it is more important to screen patients prior to the surgery so appropriate measures can be taken.

Doctors want the screening tool to be used so high risk patients can go to the sleep center and participate in a sleep study prior to their scheduled surgery date. “Only a sleep study can

definitively determine if the patient actually has OSA" ("Sleep apnea," 2011). If the patient does have OSA they will be given a CPAP machine which they will also bring on the day of their surgery. Most surgery patients are currently not being screened, if patients are not screened they cannot be referred to the sleep center for a sleep study. If they do not get a sleep study they will not have a CPAP machine or designated settings. So the patients who do have OSA and do not know it are going into surgery are being placed at a higher risk without a CPAP machine creating a higher chance of respiratory compromise when on anesthesia.

One concern from the surgical team is that the StopBang form is too sensitive and will produce to many false positive and bottle neck the surgery process. In the original StopBang a male over 50 who snored would be considered high risk for OSA. Dr. Cale and his team slightly modified the StopBang screening tool so it would be slightly less sensitive. Dr. Cale's goal was to make it sensitive enough to catch the real high risk patients while not backing up the surgery team. A less sensitive screening tool is more effective if used than a more sensitive screening tool that no one uses.

Sometimes when a patient is scheduled for surgery it is necessary to get them through he sleep study very quickly. In order to cut down the time frame the patient does a split night sleep study, instead of going for an observation then coming back and getting fitted with a mask and figuring out the stings this process is combined into one night. In a split night sleep study the first half of the night is monitoring then the patient is woken up fitted with a mask and goes back to sleep. The sleep technician then work to figure out the correct settings. While this is much better than nothing a two night study is much more accurate than a split night study.

Some of the surgeons and anesthesiologist do not realized that opiates can be dangerous for patients with OSA. The team did not talk to all of the anesthesiologist but one of the orthopedic

surgeons was at the presentation and said their group only uses opiates to sedate patients, and uses opiates for all patients undergoing that particular type of surgery. So it could be assumed that there are more people than just one surgeon who use opiates for patients who have sleep apnea. Additionally this individual did not see the point in using the StopBang screening tool, since they used the Epworth screening tool. But, the Epworth tool is designed to measure the average level of daytime sleepiness (Johns, 1997). Sleepiness can be a side effect of sleep apnea but the level of sleepiness itself is not an indicator of sleep apnea. Just because you ranked how tired you are on a scale it is not conclusive that you have sleep apnea or don't have sleep apnea.

The nurses at RMH do not universally use the PACU tool. Commonly only the monitor technicians monitor the patients in the post-surgery care units. The monitor technicians have a computer which displays several patients' vitals at the same time. The monitor technician is looking to make sure there is nothing drastically going wrong. If a patient stops breathing it may be too late by the time the monitor technician notices there is a problem. The PACU tool helps the nurses be more proactive rather than reactive where the monitor technicians only react to the problem when the patient stops breathing or flat lines a heart rate.

## Learning Theory & Instruction

### *Keller's ARCS model of instruction*

While not necessarily a theory of learning, Keller's ARCS model of instruction does offer a framework that creates the motivation for learning to take place. The team can argue that designing the presentation using Keller's ARCS model, that learners were more motivated, and therefore, likely to transfer more knowledge compared to a presentation design that was not based in any instructional theory. "[Keller] assumes that students' motives (or values), together

with their expectancies (efficacy and outcome expectations), will influence the degree of attention and effort they will supply to a learning task" (Driscoll, 2005, p. 332). Keller's model suggests that presentations begin with attention grabbing information, move to relevant information for the audience members, allow participants the chance to be confident in that they are learning the material, and gain satisfaction from being able to walk away with new knowledge or skills that can be used in a workplace setting. The presentation began with material that was meant to gain the attention of the audience. The team included alarming health facts about OSA, real-life medical costs of OSA, and case studies that demonstrated actual complications resulting from undiagnosed OSA. The team evaluated this aspect of Keller's model by using, "I was fully engaged throughout the entire presentation" which received a mean score of 4.8 (Strongly Agree). There were then several slides entitled, "Why you need to care…" that were meant to offer relevant information to the nurses who were the majority of the audience. This aspect was evaluated by using the question, "I found the examples and information relevant to my position" which received a mean score of 4.7 (Strongly Agree). The team then showed the audience members the STOP-BANG screening tool for potential OSA patients in order for the nurses to feel confident that they are able to use this information about OSA to make positive changes in their workplace. The team measured this aspect using the question, "I believe that I am capable of using the information that was presented" which received a mean score of 4.8 (Strongly Agree). Finally, the team gave the nurses exact instructions and a step-by-step process to follow throughout all stages of perioperative care so that they would be satisfied with their new knowledge and skills. The team measured this last aspect of Keller's model by using the question, "I feel as though I have gained a useful skill that can be used in my workplace setting" which received a mean score of 4.6 (Strongly Agree).

According to Doak (1996), "Designing quality [patient] instruction that is purposeful and cogent requires the integration of strategies that support theoretical concepts based on social-behavioral science and instructional technology theories because they provide a predictable framework for successful interventions, and offer a systematic process to analyze success or failure."

## Data Collection

*Audience characteristics*

The team presented an informational session about OSA and proper screening and treatment to an audience of 20 at Rockingham Memorial Hospital on Thursday, March 22nd. The team originally planned for an audience that would consist of Monitor Technicians, who are responsible for monitoring vital information about patients during their recovery period. This includes such things as heart rate and breathing, among other crucial information. This is an entry-level job at RMH and requires an associate degree and very little experience in the field. The team estimated that the ages of these technicians would range from 18 to 65. Because this position requires very little experience, it is hard to say whether participants would have prior knowledge of OSA at all. However, the team anticipated that the technicians would have little to no prior knowledge of OSA. Therefore, it was surprising to find out that the entire audience consisted of 18 nurses, 1 specialty clinic practice manager, and 1 orthopedic surgeon. 18 were women and 2 were men. Their ages ranged from early 20s up to about 60 years of age.

*Application of instruction*

The instructional module that Dr. Cale's team created was a 51-slide Powerpoint presentation that was presented to the aforementioned audience. Dr. Cale, who was the Subject Matter Expert (SME) for the team, had outlined the material that he felt was the most important

to convey to the members of the clinical team. The presentation started with background about OSA and its dangers. This information was then made relevant to employees in a hospital setting. Dr. Cale then decided to present the STOP-BANG screening tool in order to identify high risk OSA patients and proper protocol for ensuring their safety before, during, and after surgery. He presented step-by-step processes that the surgical and nursing teams could follow and ensured that the information could be used in actual workplace settings. His team was mainly charged with designing the most effective way to get the material to the learners in order to ensure that transfer of learning occurred. This process involved the correct ordering of the information using Keller's ARCS model of instruction, selecting and implementing proper slide layouts for maximum visual acuity and aesthetics, and editing the material in order to make it understandable to a wide range of audiences including those outside of the medical field. This process required the team to conduct a large amount of their own outside research in order to fully understand the vocabulary and key concepts that would need to be conveyed to the audience in a simplified manner. The field of Sleep Medicine has multiple acronyms that are common place for those who have spent some time in a workplace setting that deals with Sleep Medicine to some degree. However, to those who do not possess such experience, it was essential that some terms be explicitly defined and time given to allow audience members to ask questions in order to ensure their full understanding. The presentation itself lasted the entire allotted one hour time frame; however, members of the audience were very proactive in their learning and offered many personal stories and experiences that enhanced the creation of shared meaning among the group. Finally, the team created an 11 question survey in order to analyze several variables including audience knowledge before and after the presentation, how well the

presentation was designed and implemented, and the team's success in following each step of Keller's ARCS model.

## Findings

### *Data Analysis*

These audience members were actually very knowledgeable about OSA prior to the presentation. The team created an evaluation tool that was given to all audience members after the presentation. The tool was based on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) and asked various questions pertaining to knowledge about the material and how it was presented. The audience had a mean score of 4.4 (Agree) to the question of "Before this presentation, I was aware of OSA and some of its dangers." After the presentation, the audience members had a mean score of 4.8 (Strongly Agree) to the question of, "This presentation added to my knowledge of OSA and its dangers." The team used an unpaired t-test to determine that the difference between these means was significantly different ($p = 0.01$); meaning that audience members did learn some information about the material, even though they came into the presentation with a lot of prior knowledge. The team also measured how effectively the instruction was in achieving the team's goal of creating awareness for the correct process to be used in order to identify and offer the best preventative care for OSA patients. The team used the question, "I knew how to properly manage OSA patients before this presentation" and it received a mean score of 3.2 (Neither Agree nor Disagree). This was the lowest scoring question on the entire evaluation and it was apparent that an educational gap was present. The team used the question, "I understand the correct process for the management of OSA patients" in order to determine whether a significant change was made after the presentation was given.

This question received a mean score of 3.9 (Agree) which, using an unpaired t-test, was found to be a significantly significant change ($p = 0.01$). This was a very exciting finding for the team and it proved that their instruction did close some of the educational gap that this particular audience was facing.

*Discussion pertaining to presentation*

Overall, the presentation went extremely well. Dr. Cale was an excellent presenter and was very engaging and humorous throughout the entire presentation. The team received comments on the evaluations that included statements such as, "Dr. Cale presented material well" and, "He clearly wants to work with the nurses to improve patient outcomes." Based on the evaluation scores, it was apparent that the team did an excellent job of following Keller's model and keeping the audience motivated. The team included plenty of graphics on the slides and made sure that there was not an overwhelming amount of information on any one slide. The team cited all of the studies and outside research that Dr. Cale used and made sure that the vocabulary was in terms that could be easily understood to those outside of the medical field. Most importantly, the team was able to celebrate the success of the instruction in closing the awareness gap for that particular audience. It cannot be assumed that these results will be replicated to all audiences, but it was seen as more significant based on how knowledgeable the audience members were about OSA in general before the presentation. It was clear that this audience knew about potentially deadly OSA was, but did not know the available methods for identification of these patients and the necessary precautions that would be needed before, during, and after surgery.

The team did find a few things that needed to be changed. There were a few spelling mistakes that went overlooked throughout the revision process. The team also made the assumption that audience members understood all of the acronyms and specific terminology related to Sleep Medicine. Unfortunately, audience members did have to ask for clarification several times throughout the presentation. The team plans to make a few revisions to the presentation and offer a fully finalized version back to Dr. Cale so that he may use it to spread awareness about OSA throughout the medical community. Dr. Cale would eventually like to educate the entire RMH system and then move to outlying hospital systems in Virginia. The main challenges that the team faced involved the short time frame that was allotted in order to put this presentation together. Also, much of the material that Dr. Cale presented to the team was very complex and hard for everyone to understand without first doing their own outside research. The team wanted to ensure that other audience members would be able to make sense of the information without having to do the same research.

## Performance Improvement Plan

*Education*

The first recommendation that the team would like to make is to continually spread awareness throughout the RMH community about OSA and its dangers. According to Stoddard (1997),

"…four factors determine when "rule-shifting" becomes "culture-shifting" as well. For "culture-shifting" to take place, all four factors must be engaged. The four factors are these: (1) A change that is very broad or profound; **(2) Public awareness of that change;** (3) A general

sense of the legitimacy (or validity) of the change; and (4) Overall, continuous enforcement of the change" (p. 8)

The presentation that the team created proved to be a useful technique for achieving the goal of creating awareness. Even a very knowledgeable clinical team was able to learn some new material after viewing the presentation and engaging in useful discussion. The team would like to begin a culture shift within RMH that includes the ability of all clinical members to not only be aware of OSA and its potential dangers but also be able to successfully identify and treat OSA patients and offer the correct preventative care before, during, and after surgery. There were some small flaws with the presentation but these did not negatively influence the learning that occurred. Fortunately, these errors can easily be fixed. The team would like to take the presentation and run it through several focus groups with other clinical team members and also those outside of the medical field in order to gain some useful feedback and suggestions for improvement. Dr. Cale has expressed his interest in taking this presentation to several other medical and academic institutions throughout Virginia. Therefore, it is important that the presentation be tailored in order to ensure that audiences who are not as familiar with medical terminology can still gain useful knowledge.

The team has several recommendations for how to spread awareness on a local, state-wide, and national level. At the local level, the team would like to partner with the Marketing department at RMH in order to implement new ways to create awareness around the Harrisonburg, Virginia community. According to Virginia Health Information (2012), during the fiscal year of 2010, Rockingham Memorial Hospital had a total of 14,597 admissions for inpatient services. If the team were able to create a simple brochure that would be available for all patients who partake in the admission process, then this could considerably increase the

amount of awareness in and around the local community. Depending on costs, this could simply be done by the same team that designed this presentation or the team could contract the help of a professional media designer. Another way that the team could increase awareness throughout the local community would be to offer this presentation to academic institutions in the area. Throughout the year, high schools often put on educational programs about a variety of social and health topics. OSA could be a great candidate because of its already low awareness rates and the potentially deadly problems that it can cause to people regardless of their age. In particular, James Madison University would also be an excellent venue for a presentation of this kind. The university is able to accommodate a very large audience and it would give Dr. Cale and his team a chance to begin the harder phase of creating awareness for those outside of the medical community.

In order to begin creating awareness at a statewide level, the team would like to partner with other hospitals throughout the state of Virginia. Dr. Cale has already expressed his interest in offering this presentation to other hospitals throughout the state. In order to do this in the most effective manner, the team would like to design an annual conference that includes research proposals, best practices for treatment, and suggestions for future awareness and preventative measures that are being developed at hospitals around the state. Obviously this conference would require a large budget and sponsors from outside companies. Therefore, it may not be a plausible solution for creating awareness around the state. However, a much more cost effective method would be for Dr. Cale and his team to simply travel to other hospitals and give this presentation to team members who would benefit the most. Dr. Cale could lead the charge for implementing the necessary identification tools and standardized procedures for offering the best care to OSA patients.

The team is able to offer a simple recommendation in order to create awareness at the national level. Fortunately, there is already an annual conference, called SLEEP, which would be an excellent venue for the team to offer their presentation to. According to the American Academy of Sleep Medicine,

"SLEEP is the premier gathering in sleep medicine and sleep research. Organized jointly by the American Academy of Sleep Medicine (AASM) and the Sleep Research Society (SRS), SLEEP brings together an international body of researchers, clinicians, technologists, students and other health care professionals. The scientific program includes lecturers, abstract presentations, clinical workshops, symposia and discussion groups. These events focus on topics such as sleep disorders, sleep deprivation, neuroscience, genetics, aging and dreams."

Obviously, most of the participants at this conference can be assumed to know what OSA is and the dangers that go along with it. However, there is no definitive answer as to whether this program offers any education for those who may be new to the medical field or inexperienced to the field of Sleep Medicine. Therefore, this presents an excellent opportunity for the team to offer this presentation for audience members to take back to their respective medical communities and begin to create awareness in areas across the nation.

*Implement the recommended changes*

As discussed above, the ideal situation for RMH would include all surgical patients being screened for OSA prior to surgery and the proper preventative steps being taken before, during, and after surgery for the identified and high-risk patients. The team strongly recommends that the RMH leaders will follow the steps that the team has outlined in the presentation in order for these things to occur hospital-wide. The team has shown that there is an apparent need for a

cultural shift in this direction in order to ensure that RMH lives up to its vision statement of, "[offering] Exceptional quality and compassionate care for every person, every family, every day" (www.rmhonline.com).

In order to achieve the goal of having all surgical patients screened for OSA using the STOP-BANG tool, the hospital needs to follow certain procedures. First, patients who were screened using the STOP-BANG tool and were found to be at high-risk for OSA need to have a referral to the RMH Center for Sleep Medicine and have an evaluation conducted with either Dr. William Cale or Dr. Frank Barch. These Sleep Medicine experts will be able to determine whether a sleep study is necessary in order to positively identify OSA. If, through a sleep study, it is found that a particular patient stops breathing enough during the night to qualify for OSA, then a second study will be set up in order to begin CPAP therapy for the patient. Once the patient is accustomed to using CPAP, then the doctor will identify the correct mask and pressure settings that will successfully negate the respiratory effects caused by the OSA.

There are also several things that the surgical team needs to do in order to ensure the safety of the patients before, during, and after surgery. First, the aforementioned process needs to occur for **all** surgical patients so that OSA can be identified 100% of the time. The RMH Center for Sleep Medicine has taken extra steps to ensure that the surgical system does not become backed up and patients are forced to wait long periods of time in order to go through with the sleep process and have their surgeries. For example, the Sleep Center has reserved 2 extra beds per week for pre-op evaluations, hired a part-time sleep technician who will be available for 2-4 additional studies a week, eliminated the return visit between the initial evaluation and CPAP titration, and opened up the schedule in order to accommodate for an increase in the number of sleep evaluations being requested (W. Cale, personal communication, February 28th, 2012).

During surgery, the anesthesiologists need to begin using forms of anesthesia that do not contain opiates in order to reduce the added respiratory strain on the OSA patients. Also, the surgeons need to have the patients properly hooked up to a CPAP machine during surgery and use the correct mask and pressure settings that the sleep doctor has outlined for them. After surgery, the nurses need to understand the correct use of the PACU tool and have increased monitoring for the OSA patients. The PACU tool outlines specific respiratory events that nurses need to be mindful of and take necessary steps to ensure that respiratory failure or other complications do not occur as a result of these events. If the events do occur, then the nurses need to alert the physicians who are able to determine whether the patient needs to be moved into the ICU or sent to a bed that has a 1:1 nurse monitoring ratio. However, if these events are not present then the physician needs to ensure that the patient is sent home with a follow-up to the Sleep Center to ensure that CPAP therapy is continued as needed.

If all of the aforementioned changes are successfully implemented, then RMH will be much more able to prevent any further complications or deaths resulting from unidentified OSA or lack of proper treatment for identified patients. The process must be embraced by senior leaders within the organization and the educational step must first be put into place for the entire hospital. Clinical staff members must be aware of the importance of this process and be motivated to follow it step-by-step. The team is not able to estimate the costs to RMH for this process, but hopefully this should not be an issue since it is contributing to the assurance of offering complete safety to all of the surgical patients at RMH.

## References

American Academy of Sleep Medicine. (2011). *American sleep apnea association: Sleep apnea*. Retrieved from http://sleepapnea.org/learn/sleep-apnea.html

Cale, W. (2012, February 28). Interview by J. Locke [Personal Interview].

Driscoll, M. P. (2005). *Psychology of Learning for Instruction*(3rd ed.). Boston, MA: Pearson Education, Inc.

Gali, B. et. al, (2007). Management plan to reduce risks in perioperative care of patients with presumed obstructive sleep apnea syndrome. *Journal of Clinical Sleep Medicine, 3*(6), 582-588.

Johns, M. (1997). *The epworth sleepiness scale*. Retrieved from http://epworthsleepinessscale.com/

*Obstructive sleep apnea in the perioperative period*. (2009, August 18). Retrieved from http://patientsafetysolutions.com

Ramachandran et. al, Respiratory Care 2010; 55(4) 414-418

Rockingham Memorial Hospital. (2012). *About rmh.* Retrieved from *http://www.rmhonline.com/Main/AboutRMH.aspx*

*Sleep apnea*. (2011). Retrieved from http://sleepapnea.org/learn/sleep-apnea.html

Stoddard, T. (1997). Bleeding heart: Reflections on using the law to make social change. *New York University Law Review*, Retrieved from http://law.ubalt.edu/downloads/law_downloads/Stoddard.pdf

Virginia Health Information. (2012, 03 23). *Rockingham memorial hospital*. Retrieved from www.vhi.org/Rockingham Memorial Hospital.html?=h7139/

## Appendix A

### RMH Screening for OSA: Is Your Patient at Risk for Sleep Apnea

| | Strongly Agree | Agree | Neither Agree nor | Disagree | Strongly Disagree | Mean Scores |
|---|---|---|---|---|---|---|
| Before this presentation, I was aware of OSA and some of its dangers | **8** | **9** | **1** | | | **4.4** |
| This presentation added to my knowledge of OSA and its dangers | **14** | **4** | | | | **4.8** |
| I knew how to properly manage OSA patients before this presentation | **2** | **4** | **8** | **4** | | **3.2** |
| I understand the correct process for the management of OSA patients | **3** | **10** | **4** | | | **3.9** |
| This presentation was a valuable use of my time | **13** | **5** | | | | **4.7** |
| The information was presented in a clear manner | **15** | **3** | | | | **4.8** |
| The information was presented in a way that enhanced my learning | **15** | **2** | **1** | | | **4.8** |
| I was fully engaged throughout the entire presentation | **14** | **4** | | | | **4.8** |

1 did not answer

| | | | | | | |
|---|---|---|---|---|---|---|
| I found the examples and information relevant to my position | **13** | **4** | **1** | | | **4.7** |
| I believe that I am capable of using the information that was presented | **15** | **2** | **1** | | | **4.8** |
| I feel as though I have gained a useful skill that can be used in my workplace setting | **11** | **7** | | | | **4.6** |

**Comments:**

*Dr. Cale is a good speaker/ teacher.

Presented material well

He clearly wants to work with the nurses to improve patient outcomes.

*Dr. Cale gave an excellent seminar on OSA.

*Very Good. Thank You!