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Elevating the Head of Bed During Preoxygenation for Obese Patients Undergoing General Anesthesia: A Clinical Policy Proposal

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ELEVATING THE HEAD OF BED DURING PREOXYGENATION FOR OBESE PATIENTS UNDERGOING GENERAL ANESTHESIA: A CLINICAL POLICY PROPOSAL

by

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A Doctoral Project
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ABSTRACT

Preoxygenation plays a vital role in ensuring patient safety for all patient populations, especially those considered clinically obese. The negative pathophysiological effects obesity has related to body habitus and respiratory mechanics increases the risk of unexpected adverse events. Obese patients encounter a 50% decrease in functional residual capacity (FRC) when undergoing general anesthesia. Dixon et al., (2005) addressed the link between efficient oxygenation and improving oxygen storage by lessening atelectasis and intrapulmonary shunting via preoxygenation in a more upright position. Can standardizing preoxygenation techniques among anesthesia providers improve patient safety and decrease hospital system's risk by implementing an evidence-based clinical policy?

An evidence review and evaluation was conducted with six articles being used as primary references in addition to supplementary articles and scholarly textbooks. A policy was developed using strong evidence, facility procedures, and AGREE II methods. A panel of experts was formed to assist with policy review, critiques, and expert opinions. An evaluation questionnaire assessed the available knowledge on the topic, clinical relevance, and adoptability of policy in clinical practice. The data indicated members of the expert panel were willing to adopt the evidence-based clinical policy within the Anesthesiology department and deemed the policy suitable for submission to the hospital clinical policy committee.

Current evidence supports the need for elevating the head of bed during preoxygenation of obese patients undergoing general anesthesia. Anesthesia providers and operating room staff members would benefit from further education on this topic.

Educational opportunities can further increase patient safety and decrease hospital system's risk.

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I would like to thank my committee chair, Dr. Bonnie Harbaugh, and committee member, Dr. Michong Rayborn, for the selfless dedication shown to me throughout the completion of this doctoral project. Without their expertise and guidance, achieving this goal would not have been possible.

DEDICATION

This doctoral project is dedicated to my loving family. For without them, I would have been lost. The unconditional love and support received from my wife, Wesley, and two sons, Brian and Colton, was the driving force throughout the pursuit of my Doctor of Nursing Practice degree. Without them, I would not be where I am today. Also, I would like to thank my parents, Brian and Andrea Seymour, for their unwavering support and encouragement when I needed it most.

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LIST OF ABBREVIATIONS

AACN	American Association of Colleges of Nursing
AGREE	Appraisal of Guidelines Research and Evaluation
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CPG	Clinical Practice Guideline
CRNA	Certified Registered Nurse Anesthetists
DNP	Doctor of Nursing Practice
EBP	Evidenced Based Practice
ERV	Expiratory Reserve Volume
FRC	Functional Residual Capacity
GA	General Anesthesia
HOB	Head of Bed
OR	Operating Room
SWOT	Strengths, Weakness, Opportunities, Threats
WHO	World Health Organization

CHAPTER I - INTRODUCTION

One of the most stressful and time-sensitive events encountered in the operating room (OR) is the anesthetic induction. During this time, anesthetists can encounter a "can't ventilate can't intubate" scenario which turns a standard procedure into a medical emergency in a matter of seconds. Anesthesia providers, anesthesiologists and certified registered nurse anesthetists (CRNA), are responsible for the safety and well-being of each patient while under general anesthesia (GA). To ensure patient safety and improve patient outcomes during induction, anesthetists' use of adequate preoxygenation techniques can be the difference between a routine procedure and a medical emergency.

As defined by the *World Health Organization* (WHO), obesity is an abnormal or disproportionate accumulation of fat that can negatively affect health and well-being ("Obesity & Overweight", 2017). The *Centers for Disease Control and Prevention* (CDC) classifies obesity as a body weight higher than what is considered a healthy weight based on a given height, usually a body weight index (BMI) greater than 30. Obesity prevalence rates have increased almost three-fold since 1975, accounting for nearly 650 million obese individuals as of 2016 ("Obesity & Overweight", 2017). As of August 2017, Mississippi is the second most obese state in the nation; with an obesity rate of 37.3% (Segal, Rayburn, & Beck, 2017). Anesthesia providers need be aware of the increased risks associated with obese patients undergoing GA: (a) hypoxemia; (b) difficult mask ventilation; and (c) difficult intubation (Boyce, Ness, Castroman, & Gleysteen, 2003). With this in mind, obese patients would benefit greatly from having head of the bed (HOB) elevated during preoxygenation based on current evidence. An evidence-based policy outlining the details of HOB elevation for a specific at-risk

population would decrease unexpected complications during induction of GA and mitigate risks associated with obesity and surgery.

Statement of the Problem

Obese patients undergoing GA are at increased risk for unexpected adverse events compared to the non-obese population, which makes adequate preoxygenation for this population critical. Preoxygenating obese patients in a more upright position can improve oxygen storage and lessen the occurrence of atelectasis and intrapulmonary shunting, all of which provide more efficient oxygenation (Dixon et al., 2005). Evidence indicates postural changes may "influence the effectiveness of preoxygenation in severely obese patients, particularly that a head-up posture would provide better preoxygenation when compared to the supine position" (Dixon et al., 2005, p. 1111). An evidence-based hospital policy addressing positioning changes of obese patients during preoxygenation, prior to induction of GA, can be of great importance to anesthesia providers, specifically by improving patient safety and decreasing hospital system's risk.

Background and Significance

Preoxygenation prior to induction of general anesthesia has become a standard of practice in the OR setting. Nagelhout and Plaus (2014) believe "adequate preoxygenation is essential prior to the induction of anesthesia because it helps to delay arterial desaturation during subsequent apneic situations" (p. 436). Adequate preoxygenation means everything when a difficult airway scenario is encountered. Seconds seem like minutes when the patient's life hangs in the balance. Therefore, the ability to adequately preoxygenate patients can literally be a lifesaver. The preoxygenation process increases oxygen reserves and provides a "longer duration of non-hypoxic apnea should one be

faced with an unanticipated difficult airway" (Ramkumar, Umesh, & Philip, 2011, p. 189). Extending the time to desaturation is of great importance when airway difficulties are anticipated in securing an advanced airway or patients are respiratory compromised with limited oxygen reserves (Nerurkar, Nayak, & Tendolkar, 2016). Studies show the ability to maintain hemoglobin arterial oxygen saturation during long periods of apnea proves to be a very important piece to an anesthetic induction (Ramkumar et al., 2011). If done correctly and with the HOB elevated, preoxygenation can prolong oxygen desaturation times an average of 100 seconds (Lane et al., 2005). The results of Nerurkar et al's., (2016) randomized controlled comparative clinical trial consisting of 60 patients found preoxygenating patients in a 20° HOB position was superior compared to the supine position with apneic oxygen desaturation times prolonged an additional 96 seconds. The research evidence shows the importance and benefit of having a standardized preoxygenation technique in place prior to the induction of general anesthesia for obese patients.

Purpose of the Project

The purpose of this project was to create an evidence-based policy that standardizes preoxygenation techniques in obese patients undergoing GA. According to Altermatt, Munoz, Delfino, and Cortinez (2005), "compared with the supine position, the adoption of the sitting position for pre-oxygenation increases the period of apnea without desaturation by an average of 50-60 seconds in obese patients" (p.708). This outcome shows that a simple maneuver such as elevating the HOB can play a major role in improving safety during induction. Altermatt et al. (2005), recommend position changes during preoxygenation be considered as part of the induction routine for obese patients.

The goal of this project was to provide a local hospital with a summation of current literature, detailing the advantages elevating the HOB has on counteracting the negative pathophysiological effects obesity has on respiratory function. Working in conjunction with my clinical mentor, a hospital policy was drafted and presented to a panel of experts: (a) director of anesthesiology, (b) chief CRNA, (c) three staff CRNAs, and (d) DNP committee members. The outcome of the project was to create a hospital-wide policy aimed at standardizing the preoxygenation techniques of anesthesia providers, elevating the HOB, to be adopted and considered the standard of care.

Needs Assessment

A needs assessment was completed at a level II trauma hospital in South Mississippi over a two-week period. Upon witnessing almost all patients, both obese and non-obese, preoxygenated in the supine position within the OR setting during clinical rotations. A need for an evidence-based policy was suggested to my clinical mentor, who asked me to look further into the problem. An obvious lack of consistency in preoxygenation techniques among anesthesia providers was readily apparent. The policies and procedures manual for OR and anesthesia services were reviewed and a policy regarding preoxygenation for patients undergoing GA was not on file. A meeting was scheduled with the director of anesthesiology to discuss the details of this project and ways in which this project might benefit his staff and patients alike. The project was completed under his direct clinical mentorship.

Best practice guidelines and protocols were examined to determine the path of this project moving forward. The simple, easy technique of elevating the HOB 20° during preoxygenation can increase the time available if a difficult airway is encountered,

proving to be the difference between a hypoxic event and a safe anesthetic induction (Nerurkar et al., 2016). An evidence-based practice (EBP) hospital policy aimed at standardizing patient care delivery to improve patient safety and outcomes for high-risk patients was highly needed based on current evidence and needs assessment.

DNP Essentials

The Doctor of Nursing Practice (DNP) degree curriculum consists of eight essential elements known as the DNP Essentials. These essentials serve as outcome-based foundational competencies for all DNP graduates (AACN, 2006). Prior to completion of a DNP project, all DNP essentials must be met in accordance to AACN guidelines. All eight essentials were addressed within this nursing capstone project. However, Essentials II, III, and V strongly relate to this project and will be discussed in this section.

The American Association of Colleges of Nursing [AACN] (2006) describes Essential II as organizational and systems leadership for quality improvement and systems thinking. This essential was addressed by formulating an evidence-based policy aimed at improving patient quality of care in the OR setting. Hospital approval would provide a standardized preoxygenation technique for obese patients undergoing GA. Essential III covers clinical scholarship and analytical methods for evidence-based practice (American Association of Colleges of Nursing [AACN], 2006). This essential was met upon completion of an evidence review and analysis. Current evidence-based practice literature was used to support the benefit and usefulness of positioning changes during preoxygenation of obese patients prior to induction of GA. Essential V includes health care policy for advocacy in health care (AACN, 2006). This project consists of the

development and evaluation of a hospital policy. An evidence-based hospital policy regarding positioning changes during preoxygenation of obese patients prior to induction of GA to improve quality of care, patient safety, and decrease unexpected adverse events. A detailed chart describing all DNP essentials that were met within this DNP project can be found in Appendix A.

Synthesis of Evidence

An extensive evidence review was performed to investigate current evidence pertaining to preoxygenating obese patients with the HOB elevated. The search was performed using several online databases including PubMed, Medline, CINHAL, Cochrane Library, EBSCOhost, and Google Scholar. The following keywords were searched: *preoxygenation, apnea, positioning, obesity*, and *oxygen saturation*. Inclusion criteria consisted of articles published within the last fifteen years, written in the English language, and identified a relationship between elevating HOB during preoxygenation and extending oxygen desaturation times while apneic. Exclusion criteria were defined as articles published outside of the last 15 years, written in languages other than English, and those that did not directly relate to a connection between preoxygenation with HOB positioning and improving apneic desaturation times. The initial search was limited to full text only articles with publication dates between 2003-2018. Keywords were searched in different orders and combinations as an advanced search method to populate most relevant articles. Eighty-two articles were found after eligibility and exclusion criteria were met. Upon further review, seven articles were accepted as primary references based on a strong relationship between elevating the HOB during preoxygenation and potential for improved patient safety and outcomes. Supplementary

articles and scholarly textbooks were used as additional resources. A literature matrix summarizing the primary references is provided in Appendix B.

In addition to an online database search, a detailed review of current clinical practice guidelines (CPG) pertaining to preoxygenation was conducted. The American College of Physicians, Guidelines International Network and National Guideline Clearinghouse were all searched using the keywords: *preoxygenation, obesity*, and *positioning*. Different orders and combinations were used to identify the most relevant articles. The searched resulted in zero articles or CPGs related to preoxygenation and anesthesia. The only CPG found regarding preoxygenation was pertaining to the use of adequate preoxygenation prior to tracheal suctioning via tracheostomy.

The importance of practice guidelines in the clinical setting is best defined by their ability to summarize best practices and positively impact direct patient care. Guidelines often "serve as useful tools to direct clinical practice. They typically include all relevant process and outcome measures that would be indicated for the average patient with a specific diagnosis or treatment problem" (Schmidt & Brown, 2012, p. 376). Guidelines can also provide algorithms or step-by-step instructions to aid in solving a clinical problem (Schmidt & Brown, 2012). The previous statements outline the benefit of CPGs, yet an extensive search resulted in zero practice guidelines for preoxygenation techniques pertaining to obese patients undergoing GA. The lack of current CPG's and clinical policies on preoxygenation is where this project's purpose lies, in translating evidence into CPGs and clinical practice policy.

Obesity

Obesity rates continue to rise despite a concentrated effort by health care providers and government officials to address the problem. The most recent data suggests the number of obese individuals surpasses underweight individuals and one-third (33.8%) of Americans are considered clinically obese (Barash et al., 2013). The WHO estimates, that by 2025, the number of severely overweight adults will double (Nagelhout & Plaus, 2014). Obese individuals have an increased risk of morbidity and mortality linked to a wide array of medical conditions such as (a) coronary artery disease, (b) pulmonary hypertension, (c) congestive heart failure, (d) restrictive lung disease, (e) obesity hypoventilation syndrome, and (f) obstructive sleep apnea (Hines & Marschall, 2012).

Obesity is best quantified using a formula known as body mass index (BMI). BMI is calculated by dividing the square of a patient's height in meters (m^2) by weight in kilograms (kg). The degree of obesity is best categorized based on BMI, with ≥ 30 kg/m^2 considered obese. A BMI of 30 to 34.9 kg/m^2 is classified as obesity (class I). A BMI of 35 to 39.9 is obesity (class II). Morbidly obese (class III) individuals have a BMI ≥ 40 kg/m^2, followed by super obesity and super-super obesity with a BMI of ≥ 50 kg/m^2 and ≥ 60 kg/m^2 respectively (Barash et al., 2013).

Patients with an increased BMI are at greater risk for developing adverse complications while undergoing GA, compared to non-obese patient population. Obesity directly affects gas exchange and lung volumes secondary to redundant tissue of upper airway, thorax, and abdomen (Hines & Marschall, 2012). Lung capacities, mainly Functional Residual Capacity (FRC) are severely reduced when patients are placed in the

supine position compared to sitting or prone (Nagelhout & Plaus, 2014). The reduction in lung volume capacities speaks to the importance of positioning changes during preoxygenation. By placing obese patients in the sitting position, the "abdominal contents shift caudally and anteriorly, causing less interference with diaphragmatic movement and allowing greater expansion of dependent lung regions" (Nagelhout & Plaus, 2014, p. 405).

Preoxygenation

Preoxygenation is essential to providing a safe effective anesthetic for all patient populations, especially the obese. The goal of preoxygenation is the replacement of nitrogen for oxygen in the FRC. This process greatly impacts oxygen storage and substantially increases the tolerance to apnoea (Sirian & Wills, 2009). Barash et al., (2013) describes the importance of adequate preoxygenation as being "vital in obese patients because rapid oxygen desaturation can occur after loss of consciousness, due to increased oxygen consumption and decreased functional residual capacity [FRC]" (p. 1284). This statement is critical to the induction process of GA. Nagelhout and Plaus (2014) believe adequate preoxygenation is a vital component of minimizing arterial oxygen desaturations during episodes of apnea post induction. The reciprocal relationship between preoxygenation and the increase of oxygen stores in the FRC is paramount to avoiding prolonged arterial oxygen desaturation.

Efficient preoxygenation plays a major role in increasing the FRC of obese patients prior to undergoing GA. The preoxygenation process does not only increase oxygen stores within FRC but helps abate hypoxia and hemodynamic disturbances accompanying tracheal intubation (Nagelhout & Plaus, 2014). There are two commonly

used techniques for preoxygenation: (a) 4 vital capacity breaths of 100% FiO2 30 seconds prior to induction, and (b) normal inspiration of 100% FiO2 for 3-5 minutes prior to induction. (Nagelhout & Plaus, 2014). In conjunction with preoxygenation, patient outcomes and safety can be greatly improved with a simple maneuver, HOB elevation.

To mitigate the negative pathophysiological changes obesity has on respiratory function, elevating the HOB at least 25° during preoxygenation provides the longest safe apnea period, in absence of hypoxia, during GA induction (Altermatt et al., 2005; Boyce et al., 2003). This intervention can provide valuable time in avoiding arterial oxygen desaturation if a difficult airway scenario is encountered. According to Altermatt et al. (2005), the induction process has expected periods of apnea, which makes preoxygenation a "fundamental component of safe general anesthesia, especially in the management of patients with potentially difficult airway or impaired pulmonary reserve" (p. 708).

Respiratory Impairment

A major challenge for anesthesia providers is the identification and management of multifactorial pathophysiological changes attributed to obesity, specifically those affecting pulmonary and respiratory function. Body habitus changes such as (a) centrally located fat accumulation around chest and abdomen; (b) increased elastic resistance; and (c) decreased chest wall compliance all decrease FRC, vital capacity, expiratory reserve volume (ERV) and total lung capacity. (Barash et al., 2013). Already predisposed to a decrease in FRC, supine positioning and cephalad displacement of the diaphragm further potentiate this problem (Nagelhout & Plaus, 2014).

In conjunction with body habitus changes, supine positioning can compound the negative relationship between obesity, FRC and ERV (Sirian & Wills, 2009). Elevating the HOB relieves the upward pressure and cephalad displacement, the weight of the abdomen, places on the diaphragm. Boyce et al. (2003) and Sirian and Wills (2009) affirms that supine positioning negatively compounds the pulmonary changes facing obese patients. As stated by Barash et al., (2013) regarding hypoxemia in obese patients, "anesthesia and supine positioning worsen the situation such that up to a 50% reduction in FRC occurs in obese anesthetized patient compared with 20% in the non-obese individual" (p. 1276). Elevating the HOB during preoxygenation seems trivial at first glance, but Ramkumar et al's., (2011) study of positioning changes during preoxygenation in the 20° head-up vs. supine position to be clinically and statistically more efficient. Obese patients undergoing GA greatly benefit from positioning changes during preoxygenation from both a comfort and safety standpoint.

Functional Residual Capacity (FRC)

Inpatient populations undergoing GA, both obese and non-obese, FRC is vital to maintaining adequate oxygenation. As defined by Barash et al., (2013), FRC is "the volume of gas remaining in the lungs at passive end expiration" (p. 279). This residual gas, oxygen, at the end of expiration is the basis behind preoxygenation, increasing oxygen stores in the alveoli. FRC is the principal determinant of oxygen reserve during periods of apnea (Barash et al., 2013) and is considered "the most important store of oxygen in the body. The greater the FRC, the longer apnoea can be tolerated before critical hypoxia develops" (Sirian & Wills, 2009, p. 105). The relationship between FRC and oxygen reserves is vital to avoiding episodes of arterial oxygen desaturation and

hypoxemia, specifically during direct laryngoscopy. Oxygen requirements during periods of apnea are supplied by FRC oxygen stores (Nerukar et al., 2016). The preservation of FRC should be at the forefront of every anesthetist's mind when providing care for the obese patient, not just upon induction of anesthesia but maintenance, emergence, and postoperative setting.

Summary

Obese patients are at greater risk of experiencing unexpected adverse events while undergoing GA, compared to the non-obese population. To mitigate the negative pathophysiological effects obesity has on respiratory function; anesthesia providers should elevate the head of bed prior to induction of GA Adequate preoxygenation is critical to the field of anesthesia and considered to be a standard of care for every general anesthetic.

CHAPTER II – METHODOLOGY

The purpose of this doctoral project was to synthesize current literature, evidence, and practice guidelines to create an evidence-based policy outlining positioning changes during preoxygenation of obese patients prior to the induction of GA for a Level II trauma center in South Mississippi. To gain the most from this project and to anticipate potential barriers, a SWOT analysis was performed. See Appendix C.

SWOT Analysis

The use of SWOT analysis has been used widely outside of the healthcare arena since its inception into the business sector. Harrison (2010) defines SWOT analysis as "an examination of an organization's internal strengths and weaknesses, its opportunities for growth and improvement, and the threats the external environment presents to its survival" (p. 92). This type of analysis is best used as a decision-making tool that assists organizations in evaluating programs or services (Harrison, 2010).

SWOT stands for *strengths, weaknesses, opportunities, and threats*. Strengths are the factors that improve organization performance or improve patient care. The strengths of this doctoral project centered around the ability to improve patient safety and decrease hospital system's risk through the standardization of preoxygenation techniques among anesthesia providers. This intervention is a simple, cost-effective maneuver that can easily be adopted by both hospital administration and anesthesia providers.

The weaknesses of projects or business plans usually result in negative outcomes, sacrifice in quality of care, or increased implementation costs. The weaknesses of this doctoral project stem from the lack of use or acceptance from hospital affiliates and anesthesia providers. There is a real possibility the clinical mentor and hospital

administrators will not finalize policy for hospital approval. The lack of interest is an anticipated barrier to the effectiveness and sustainability of the project and policy.

Opportunities are viewed as initiatives or new ideas made available to organizations. Healthcare facilities can benefit by "collaboration among healthcare organizations through the development of healthcare delivery networks, increased funding for healthcare informatics, community partnering to develop new healthcare programs, and the introduction of clinical protocols to improve quality and efficiency" (Harrison, 2010, p. 94). This doctoral project has a wide range of opportunities. Professional rapport established between hospital administration and graduate students can open the door for future partnership. The project can also serve as a framework for future policy development or as a reference for fellow DNP students to formulate needed policies and clinical practice guidelines.

Threats are categorized as anything that can negatively affect performance. The most obvious threat is the lack of participation or acceptance among hospital administrators and anesthesia providers. Another threat might consist of the hospital being hesitant to implement a policy formulated by a non-employee. Anesthesia providers are not always open or receptive to advice pertaining to improving their craft. The most obvious threat could manifest as a lack of interest or willingness to consider a recommendation for position changes during preoxygenation.

The project was created with direct assistance from a panel of experts consisting of: (a) director of Anesthesiology, (b) chief CRNA, (c) three staff CRNA's, and (d) DNP committee members. The contents of the policy include detailed step-by-step instructions outlining the preoxygenation process from time patient enters room until the airway is

secured with a laryngeal mask airway or endotracheal tube. An information session was presented to the panel of experts on current practice guidelines, evidence, and literature outlining the relationship between positioning changes during preoxygenation and improved patient safety and outcomes.

Once an initial draft had been completed, the expert panel and clinical mentor were called upon to review the policy in its entirety. Reviews and edits were completed based on written and verbal recommendations. The policy evaluation process was completed with each subsequent draft until the panel of experts and clinical mentor approved of all changes and content. The completed policy was evaluated for quality and guideline development by using the assessment tool known as the Appraisal of Guidelines Research and Evaluation (AGREE) II (Schmidt & Brown, 2012). As a policy ready for presentation to the hospital practice and policy council, this doctoral project policy standardizes preoxygenation techniques among anesthesia providers, improves patient safety, and decreases hospital system's risks.

AGREE II

The AGREE II instrument was originally created to address concerns of bias associated with the development of clinical practice guidelines and policies (Schmidt & Brown, 2012). It offers a way for researchers, stakeholders, and policymakers to assess the quality of a policy, specifically the development and implementation phases. The web article Introduction to AGREE II (2013) states:

> The AGREE II is both valid and reliable and comprises 23 items organized into the original 6 quality domains: i) scope and purpose; ii) stakeholder involvement; iii) rigor of development; iv) clarity of presentation; v) applicability; and vi)

> editorial independence. Each of the 23 items targets various aspects of practice guideline quality. The AGREE II also includes 2 final overall assessment items that requires the appraiser to make overall judgments of the practice guideline and considering how they rated the 23 items. (para. 4).

The evaluation tool offers a "framework to assess the quality of guidelines, provide a methodological strategy for the development of guidelines, and inform what information and how information ought to be reported in guidelines" ("AGREE II," 2013, p. 1). A 7-point scale is used to rate the 23 items and 2 overall assessment items. The scale ranges from 1-strongly disagree to 7-strongly agree; with scores falling between 2 to 6 not meeting the full criteria ("AGREE II," 2013). Once the quality domain scores have been calculated and interpreted, the individual users must make a judgment based on the quality of the guideline or policy. The criteria used in the evaluation process must be kept in mind ("AGREE II," 2013). A copy of the six domains of AGREE II and the AGREE II scoring sheet is attached in Appendix D and Appendix E respectively.

Design

This doctoral project detailed a rigorous process and created a policy with the potential to standardize preoxygenation techniques among anesthesia providers in hopes of improving patient safety and decreasing hospital system's risk. Collaboration and open communication between the student, clinical mentor, and expert panel was critical for achieving success and viability. The policy, that is now ready for hospital system review, will provide anesthesia providers with step-by-step instructions of the preoxygenation process incorporating positioning changes for obese patients and anyone identified as possibly having a difficult airway. A five-step process was implemented to

guide policy development and content appraisal. The process consisted of (a) committee review, (b) feedback and recommendations, (c) analysis of critiques, (d) application of changes, and (e) dissemination of policy and clinical tool.

The utilization of the review committee was an integral part of the success of this doctoral project. Once an initial draft had been completed, the clinical mentor was consulted to review the draft and assist in making the necessary changes. Next, the chief CRNA, three staff CRNA's, and DNP committee chair were given the opportunity to review the policy and ask the necessary questions. Verbal or written edits were encouraged after each policy appraisal. Feedback, critiques, and recommended changes were incorporated based on the data collected via questionnaire. All edits and formatting followed the hospital policy framework. Once finalized, the completed policy was compared to the six domains of the AGREE II instrument to evaluate overall quality and systematic framework. The completed evidence-based hospital policy was then deemed suitable for submission to the hospital clinical policy committee by the chief CRNA and head of the anesthesia department.

To meet the requirements for completion of this doctoral project, a clinical tool will be used as a policy reminder or guide for anesthesia providers and OR. A laminated card will be attached to the patient charts stating: *Obese? Difficult airway? → Elevate HOB during PreO_2!*

Summary

The standardization of preoxygenation techniques among anesthesia providers can positively impact patient care and decrease hospital system's risk. The development of a clinical based hospital policy can serve as a reminder of the importance of positioning changes during preoxygenation and will hopefully increase the incidence in which the HOB is elevated. Based on feedback from the panel of experts and comparison to the AGREE II score sheet; the evidence-based clinical policy was adopted by the anesthesiology department where the doctoral project was implemented.

CHAPTER III – RESULTS

Overview

The outcome of this doctoral project was to develop an evidence-based policy focused on elevating the HOB during preoxygenation of obese patients undergoing GA. See Appendix F for a copy of the preoxygenation policy. The standardization of preoxygenation techniques among anesthesia providers aids in improving patient safety and decreasing hospital system's risks associated with high-risk patients. A panel of experts was gathered to participate in a detailed presentation discussing current evidence and benefits of postural changes during preoxygenation. All members were given ample time to ask questions and familiarize themselves with the seven core articles used for completion of this project. The committee review process was explained in detail, in which critiques and recommendations for change would be implemented via use of an evaluation questionnaire. The AGREE II rating system was used by the doctoral student to guide the quality and developmental strategy of the policy. Each of the 6 domains was scored on a scale from one to seven, encompassing a total of 23 sections. The overall quality of the AGREE II score sheet ranged from a score of 1, lowest possible quality, to 7, highest possible quality. The finalized policy scored a 6 in overall quality and is considered sufficient to be recommended for use.

The panel of experts was called upon twice to review edits and encourage ideas in which the hospital policy could be improved in any way. Once all edits were completed, the evaluation questionnaire was used to assess the relevance and viability of the

evidence-based policy in the hospital setting. There was no incentive for participation in this doctoral project and participation was on a voluntary basis. All completed evaluation questionnaires were kept in a private location. The final disposition of data will be to destroy all electronic and written data upon completion of this project.

Analysis of Data

The evaluation questionnaire consisted of three questions that provided insight on available knowledge based on topic, clinical relevance, and adoptability of policy in clinical practice. All questions required a yes or no response. The first question asked whether the presentation and summation of evidence provided enough evidence that elevating the HOB during preoxygenation would be able to improve patient safety and hospital system's risk decreased. All (100%) of participants believed the current evidence supports the need and benefit of positioning changed during preoxygenation. The second question assessed the relevance of the evidence-based policy and its translation into a serviceable clinical policy. Again, 100% of participants agreed a comprehensive policy on postural changes during preoxygenation has value in everyday clinical practice. The third question referenced the adoptability of the clinical practice into not only everyday practice but considered the standard of care in the Anesthesiology department. All (100%) of participants approved the adoption of this hospital policy, specifically within the anesthesia department.

Summary

It was determined that an evidence-based hospital policy outlining the benefits of elevating the HOB during preoxygenation of obese patients would be of great value to the hospital and anesthesia department. The current evidence supported the standardization

of preoxygenation techniques among anesthesia providers. The acceptance of this policy will directly impact patient care by improving patient safety among high-risk populations and decreasing hospital system's risk.

CHAPTER IV – DISCUSSION

Future Practice Implications

Upon completion of this project and development of a suitable evidence-based policy addressing positioning changes during preoxygenation of obese patients, all five participants recommended the policy be presented to the hospital clinical policy committee for further review. The data collected from the evaluation questionnaires supported the quality of evidence pertaining to postural changes during preoxygenation and its need for becoming a standard of care prior to the induction of GA. Standardizing preoxygenation techniques among all anesthesia providers via a hospital policy has the potential to greatly enhance the quality of care provided. As a current student and future CRNA, I plan on utilizing the HOB elevation technique for obese patients and those deemed high risk for a difficult airway scenario.

Limitations and Barriers

There were a couple of limitations pertaining to this project. The overall number of members comprising the expert panel was small and the presentation of current evidence and project outlook meeting was time sensitive. Increasing the number of members on the expert panel would provide a broader view on the topic and likely encourage more discussion regarding best clinical practice guidelines. To increase feedback and recommendations, the original presentation and meetings thereafter were limited to fifteen minutes. Expanding the meeting times would ensure more members were able to participate around their busy schedules; further maximizing the potential of this project and the relevance of an evidence-based clinical policy.

Recommendations

There is a need for expansion of this doctoral project in the future. Completion of this project consisted of a finalized evidence-based policy that was deemed suitable for submission to the hospital clinical policy committee. A future graduate student could work directly the policy committee at the local hospital in which this project was implemented. The ultimate goal being hospital approval, uploading the policy into the hospital intranet database, and disseminating the policy widely into the anesthesia department.

Conclusion

After the evidence-based policy was finalized, the five-member expert panel deemed the available evidence discussing positioning changes during preoxygenation of obese patients under GA to be of high quality and of great importance when caring for high-risk patients. Current literature supports the need for positioning changes, elevation of HOB, for all patients undergoing GA but more so the obese population. The goal of this project was to develop a functional clinical policy that could be used in the hospital setting. The proposed policy complies with the hospital's format and aids in standardizing preoxygenation techniques among anesthesia providers while improving patient safety and decreasing hospital system's risk. The expert panel verbalized the significance elevating the HOB during preoxygenation of obese patients has on direct patient care, and fully endorse this project policy.

APPENDIX A – Doctor of Nursing Practice Essentials

Doctor of Nursing Essentials		**How the Essential is Achieved**
I.	Scientific Underpinnings for Practice	Most recent evidence was searched via electronic databases and texts to provide evidence in developing a hospital-based policy.
II.	Organizational and Systems Leadership for Quality Improvement and Systems Thinking	The purpose of this DNP project is to provide evidence for hospital-based protocol to improve patient safety and outcomes for a specific population via the development and implementation of an evidence-based policy. A quality improvement initiative improves patient care and change practice within a system.
III.	Clinical Scholarship and Analytical Methods for Evidence-Based Practice	Literature and evidence were analyzed, practice outcomes evaluated, and relevant information used to support the benefits of positioning changes during preoxygenation in the obese population.
IV.	Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	This DNP essential was met using electronic search databases to compile EBP articles and clinical guidelines pertaining to healthcare policies and positioning changes during preoxygenation.
V.	Health Care Policy for Advocacy in Health Care	The purpose of this DNP project is to develop and implement a healthcare policy to improve quality of care, patient safety, and decrease unexpected adverse outcomes related to anesthetic induction and insertion of endotracheal tube.
VI.	Interprofessional Collaboration for Improving Patient and Population Health Outcomes	The DNP project requires collaboration from many disciplines: CRNAs, Anesthesiologists, DNP committee members, hospital administrators, and nurse practice council. Development and implementation of a new health care policy require buy-in from all disciplines.
VII.	Clinical Prevention and Population Health for Improving the Nation's Health	The goal of this DNP project is to provide an evidence-based policy for anesthesia providers; regarding positioning changes during preoxygenation of obese patients

	undergoing GA. Utilization of positioning techniques can improve patient safety and minimize the risk of unexpected outcomes.
VIII. Advanced Nursing Practice	Abstract and systematic skills used in evaluating the relationship between obese patients, supine positioning, and oxygen desaturation. Anesthesia providers updated on significance of problem and need for policy formulation.

APPENDIX B Literature Matrix

Author/Year/Title	Level/Grade	Design	Findings	Recommendations
Lane, S., Saunders, D., Schofield, A., Padmanabhan, R., Hildreth, A., & Laws, D. (2005). A prospective, randomized controlled trial comparing the efficacy of pre-oxygenation in the 20° head-up vs supine position.	Level: 1B Grade: A	Prospective; Randomized Controlled	Thirty-five participants were randomly assigned to two groups. Group 1 was preoxygenated in 20° head up position and Group 2 preoxygenated in Supine position. A mean duration of apnea time of 100 seconds was found for those preoxygenated with HOB elevated 20° compared to supine position.	Patients, obese and non-obese, undergoing general anesthesia should be preoxygenated with the head of bed elevated 20°. Preoxygenation was found to be clinically and statistically more efficient when positioning changes were adopted, specifically 20° head up position.
Altermatt, F. R., Munoz, H. R., Delfino, A. E., & Cortinez, L. I. (2005). Pre-oxygenation in the obese patient: Effects of position on tolerance to apnoea	Level: 1B Grade: A	Randomized Controlled	Forty obese patients undergoing general anesthesia were divided into two groups. Twenty were preoxygenated with HOB elevated and twenty with HOB in supine position. Those preoxygenated with HOB elevated had an increased	Practitioners should consider using the sitting or HOB elevated position during preoxygenation. Simple maneuver that can be added to part of everyday routine.

			period of apnea without desaturation ranging from 50-60 sec.	
Ramkumar, V., Umesh, G., & Philip, F. A. (2011). Preoxygenation with 20° head-up tilt provides longer duration of non-hypoxic apnea than conventional preoxygenation in non-obese healthy adults.	Level: 1B Grade: A	Randomized Controlled	Forty-five patients were divided evenly into 3 groups prior to preoxygenation. Group C used conventional preoxygenation technique. Group H used 20° HOB elevated and Group P utilized 5 cmH2O of PEEP. Non-hypoxic apnea was prolonged with group H in comparison to group C. Group P did not show a relevant increase. Average of 452 vs 364 seconds respectively.	Preoxygenation is more efficient in the clinical setting when HOB is elevated than in supine position or with application of 5 cmH2O of PEEP. This technique should be utilized in all non-obese patients undergoing general anesthesia.
Nerurkar, A. A., Nayak, S., & Tendolkar, B. A. (2016). A prospective, controlled, randomized comparison of preoxygenation in 20° head-up position versus	Level: 1B Grade: A	Prospective; Randomized Controlled	Sixty obese patients were divided into two groups. Group H preoxygenated with HOB elevated 20° and Group S preoxygenated in the Supine position.	Preoxygenation technique is simple and effective. Should be used whenever possible to facilitate a safe induction of anesthesia. Preoxygenation in the 20° head up position was

supine preoxygenation.			Patients preoxygenated in 20° HOB position had a mean time to desaturation of 96 seconds.	found to be superior to supine position.
Boyce, J. R., Ness, T., Castroman, P., & Gleysteen, J.J. (2003). A preliminary study of the optimal anesthesia positioning for the morbidly obese patient.	Level: 1B Grade: A	Randomized Controlled	Twenty-six morbidly obese patients were randomly assigned to one of three positions for preoxygenation prior to induction of general anesthesia: (1) 30° reverse Trendelenburg; (2) supine-horizontal; (3) 30° back up fowler. The safe-apnea period was prolonged in the group 1 (178 sec) and group 3 (153 sec) compared to group 3 (123 sec).	The longest safe-apnea period was achieved via the 30° Reverse Trendelenburg position compared to the 30° Back Up Fowler and Horizontal-Supine. The Reverse Trendelenburg position is most optimal during preoxygenation for morbidly obese patients prior to induction.
Dixon, B.J., Dixon, J.B., Carden, J.R., Burn, A.J., Schacter, L.M., Playfair, J.M., … O'Brien, P.E. (2005) Preoxygenation is more effective in the 25° head-up	Level: 1B Grade: A	Randomized Controlled	Forty-two severely obese patients were randomly assigned to two groups: (a) supine position; (b) 25° head-up position. Group B had an average	Positioning changes during preoxygenation can optimize oxygen content in the lungs. Doing so increases the time between induction and oxygen desaturation.

position than in the supine position in severely obese patients.			desaturation safety period (DSP) of 201 seconds compared to Group A average DSP of 155 seconds. A difference is 45 seconds between the two groups.	Study provides a potential for improving patient safety of severely obese patients undergoing anesthesia.

APPENDIX C SWOT Analysis

Strength	Weakness	Opportunities	Threats
The strengths of the DNP project center around the development of an evidence-based hospital policy aimed at improving quality of care, patient safety and outcomes for obese patients undergoing general anesthesia. Positioning changes during preoxygenation mitigate the negative pathophysiological effects associated with obesity and decrease incidence of unexpected outcomes or adverse events.	The weakness of this DNP project stems from the lack of use or acceptance from hospital affiliates and anesthesia providers. There is a possibility hospital will not add this project to list of hospital approved policies. If approved and implemented, anesthesia providers might not be willing to adopt positioning changes during preoxygenation into everyday practice.	The DNP project has several opportunities outside of its initial intention. Project can serve as a guide for future policy/protocol development. Can be used as a guide by fellow DNP students to formulate needed policies related to current best practice guidelines.	The most obvious threat to this DNP project is the lack of participation or acceptance. Hospital will not implement evidence-based policy into everyday practice. Lack of interest and education of anesthesia providers regarding new policy and benefits it offers to improve patient care.

APPENDIX D The Six Domains of AGREE II

Domain 1	Scope and Purpose	Concerned with the overall aim of the guideline, the specific health questions, and the target population
Domain 2	Stakeholder Involvement	Focused on the extent to which the guideline was developed by the appropriate stakeholders and represents the views of its intended users
Domain 3	Rigour of Development	Related to the process used to gather and synthesize the evidence, the methods to formulate the recommendations, and to update them
Domain 4	Clarity of Presentation	Deals with the language, structure, and format of the guideline
Domain 5	Applicability	Pertains to the likely barriers and facilitators to implementation, strategies to improve uptake, and resource implications of applying the guideline
Domain 6	Editorial Independence	Concerned with the formulation of recommendations not being unduly biased with competing interests

Six Domains of AGREE II (Schmidt & Brown, 2012)

APPENDIX E AGREE II Score Sheet

Domain	**Item**	**AGREE II Rating**						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
Scope and purpose	1. The overall objective(s) of the guideline is (are) specifically described.							
	2. The health question(s) covered by the guideline is (are) specifically described.							
	3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.							
Stakeholder involvement	4. The guideline development group includes individuals from all the relevant professional groups.							
	5. The views and preferences of the target population (patients, public, etc.) have been sought.							
	6. The target users of the guideline are clearly defined.							

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
Rigor of development	7. Systematic methods were used to search for evidence.							
	8. The criteria for selecting the evidence are clearly described.							
	9. The strengths and limitations of the body of evidence are clearly described.							
	10. The methods for formulating the recommendations are clearly described.							
	11. The health benefits, side effects, and risks have been considered in formulating the recommendations.							
	12. There is an explicit link between the recommendations and the supporting evidence.							
	13. The guideline has been externally reviewed by experts prior to its publication.							
	14. A procedure for updating the guideline is provided.							

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
Clarity of presentation	15. The recommendations are specific and unambiguous.							
	16. The different options for management of the condition or health issue are clearly presented.							
	17. Key recommendations are easily identifiable.							
Applicability	18. The guideline describes facilitators and barriers to its application.							
	19. The guideline provides advice and/or tools on how the recommendations can be put into practice.							
	20. The potential resource implications of applying the recommendations have been considered.							
	21. The guideline presents monitoring and/ or auditing criteria.							

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
Editorial independence	22. The views of the funding body have not influenced the content of the guideline.							
	23. Competing interests of guideline development group members have been recorded and addressed.							
Overall Guideline Assessment	1. Rate the overall quality of this guideline.	**1** *Lowest possible quality*	**2**	**3**	**4**	**5**	**6**	**7** *Highest possible quality*
Overall Guideline Assessment	2. I would recommend this guideline for use.	*Yes*	*Yes, with modifications*					*No*

AGREE II Score Sheet (www.agreetrust.org/.../08/agreeII_score_sheet.docx)

APPENDIX F Preoxygenation Policy

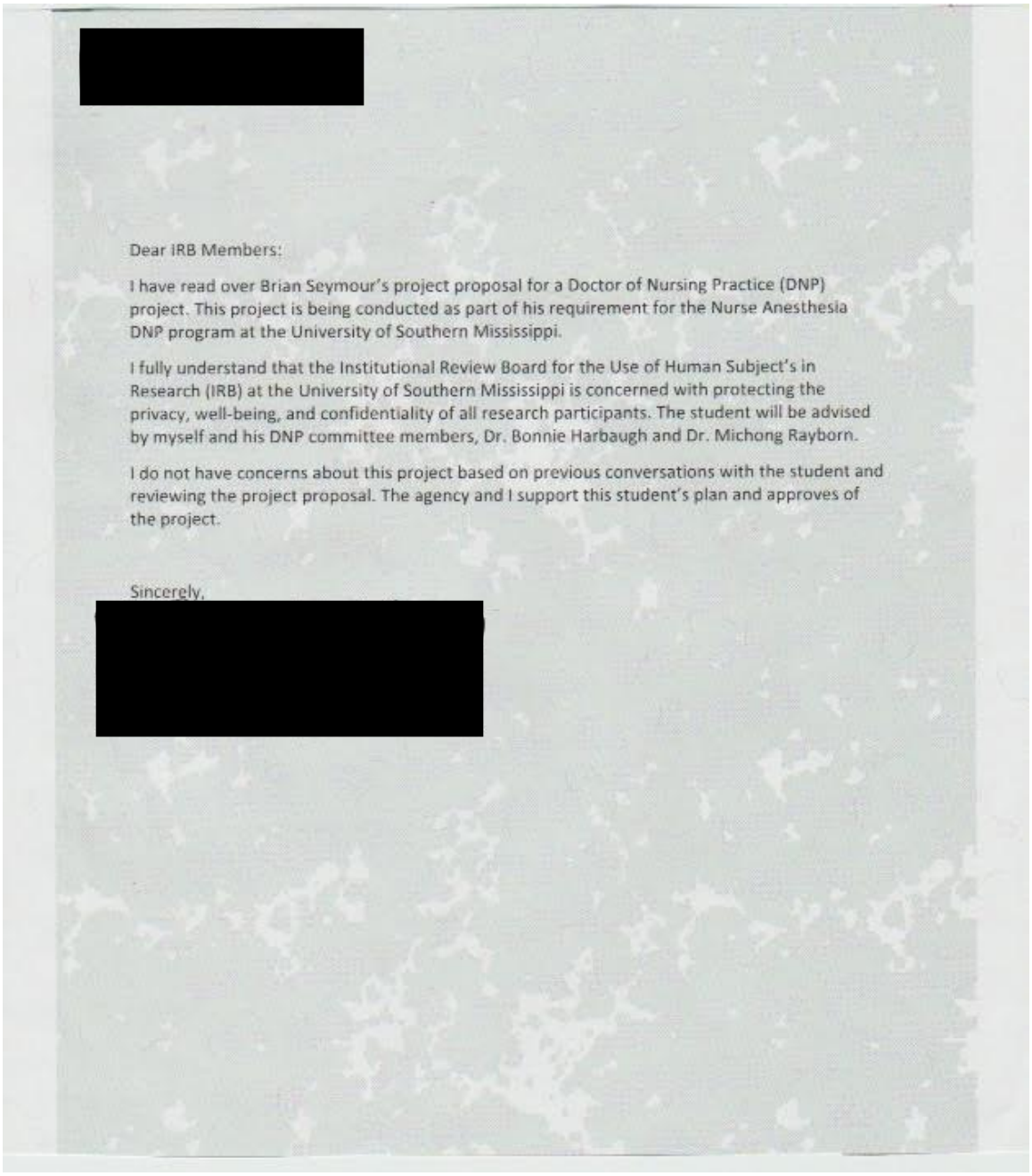
Policy Area: Anesthesia Department	**Subject:** Preoxygenation
Title of Policy: Preoxygenation of Obese Patients Undergoing General Anesthesia	**Number:**
Effective Date:	**Supersedes:**
Approved Date: **Revision Date:**	**Approved by:**

1. **Rationale or background to policy**: To standardize preoxygenation techniques among anesthesia providers to improve safety and outcomes of obese patients undergoing general anesthesia. Obese patients are at greater risk for unexpected adverse events compared to non-obese patients. The pathophysiological changes associated with obesity negatively impact respiratory dynamics by way of decreasing functional residual capacity (FRC). During preoxygenation, the supine position further impairs respiratory function due to the cephalad displacement of the diaphragm; limiting lung expansion and further decreasing FRC. When anesthetized, the obese population experiences a 50% reduction in FRC compared to a 20% reduction in the non-obese. The most current literature supports elevating the head of the bed (HOB) greater than 25° during preoxygenation of obese patients undergoing general anesthesia. Doing so offloads the diaphragm allowing for an increase in FRC; likewise providing adequate preoxygenation and mitigating the potential complications for obese patients.

2. **Policy**: Anesthesia providers will elevate the HOB greater than 25° for patients with a body mass index (BMI) of ≥ 35 or potential for difficult airway. Unless otherwise clinically indicated.

3. **Procedure**:
    1. Anesthesia providers will complete a detailed preoperative assessment. Obesity classification and the possibility of a difficult airway scenario will be evaluated.
    2. If the criteria in procedure 1 are met. Anesthesia providers will prioritize the need for adequate preoxygenation with HOB elevated ≥ 25°.
    3. Patient will be preoxygenated with 100% fraction of inspired oxygen (FiO2) via a tight-fitting mask. There are two techniques available for preoxygenation: (a) 3-5 minutes of normal tidal volume breathing prior to induction (b) 4-8 vital capacity breaths 30 seconds prior to induction.
    4. Once preoxygenation is determined to be adequate based on End-tidal oxygen (ETO2) value of ≥ 90%. Induction of general anesthesia can be completed, and HOB returned to supine position when the securing airway.

APPENDIX G Letter of Support



[redacted]

Dear IRB Members:

I have read over Brian Seymour's project proposal for a Doctor of Nursing Practice (DNP) project. This project is being conducted as part of his requirement for the Nurse Anesthesia DNP program at the University of Southern Mississippi.

I fully understand that the Institutional Review Board for the Use of Human Subject's in Research (IRB) at the University of Southern Mississippi is concerned with protecting the privacy, well-being, and confidentiality of all research participants. The student will be advised by myself and his DNP committee members, Dr. Bonnie Harbaugh and Dr. Michong Rayborn.

I do not have concerns about this project based on previous conversations with the student and reviewing the project proposal. The agency and I support this student's plan and approves of the project.

Sincerely,

[redacted]

APPENDIX H – IRB Approval Letter

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 18080901
PROJECT TITLE: Elevating the Head of Bed During Preoxygenation for Obese Patients Undergoing General Anesthesia: A Clinical Policy Proposal
PROJECT TYPE: Graduate Project
RESEARCHER(S): Brian Seymour
COLLEGE/DIVISION: College of Nursing and Health Professions
DEPARTMENT: School of Leadership and Advanced Nursing Practice
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 09/07/2018 to 09/07/2019

Edward L. Goshorn, Ph.D.
Institutional Review Board

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