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Using ORSIM Technology to Educate Anesthesia Providers On Fiberoptic Bronchoscopy: An Objective Structured Clinical Evaluation

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USING ORSIM TECHNOLOGY TO EDUCATE ANESTHESIA PROVIDERS ON FIBEROPTIC BRONCHOSCOPY: AN OBJECTIVE STRUCTURED CLINICAL EVALUATION

by

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A Doctoral Project
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ABSTRACT

Fiberoptic bronchoscopy (FB) is an essential skill that has been used for years by healthcare providers for diagnostic and therapeutic interventions. The basic components of a fiberoptic bronchoscope include a light source, fiber optics (thin, flexible fibers with a glass core that light can pass through), and a camera (Qanash et al., 2020). The light source and camera work together to enhance the ability of the healthcare provider to visualize the anatomic and physiologic structures and mechanisms while the fiber optics provide a passageway through which the light source can shine. To enhance the effective use of a fiberoptic bronchoscope by anesthesia providers, an Objective Structured Clinical Examination (OSCE) was developed. This doctoral project analyzes the effectiveness of learning through traditional simulation to enhance knowledge of indications and skill of using the fiberoptic bronchoscope by Student Registered Nurse Anesthetists (SRNAs). Additionally, the simulation was performed with a portable fiberoptic bronchoscope simulator called ORSIM. ORSIM technology is a computerized simulation that guides anesthesia providers with the use of a bronchoscope and was designed to enhance the learning and simplicity of the involved airway management procedures.

This doctoral project comprised of five simulation sessions lasting one hour to 90 minutes. Each simulation was performed with two SRNAs with a sample size of 10. A structured outline was provided to participants with information and videos regarding FB use, indications, materials, and simulation setup. Each participant was provided with a post-simulation questionnaire that allowed for data collection to measure knowledge obtained with the simulation. The results of the simulation s highly beneficial based on

the final mean results of the participants which showed a 100% increase in confidence in FB aid during airway management.

ACKNOWLEDGMENTS

We would like to thank our committee chair, Dr. Nina McLain, for her patience and dedication in guiding us in this doctoral project. We also would like to thank our assistant committee chair, Dr. Stephanie Parks, for her energy and efforts in supporting our growth during the completion of the doctoral project. The continued support and encouragement provided by our professors have made a large impact on the completion of this doctoral project.

DEDICATION

Reed Thames

I would primarily like to thank God for the amazing gifts that He gives us as human beings, although we are undeserving. He continually shows His perfect grace and mercy through our lives by giving us knowledge and skills that we are to use for His glory. Next, I would like to thank my amazing wife, Kaitlyn Thames, for her patience and perseverance through the many hours that we have had to sacrifice time together for my friend and classmate Luke LeBlanc and me to work on this doctoral project. I love you, Kaitlyn Thames, and am so blessed to have you in my life. To my parents, David and Susan Thames, I would like to say thank you for assisting me in achieving my aspirations throughout many years of schooling and instilling the qualities of ambition and dedication into me from my youth. I would also like to thank my brother and his wife, Rob and Valerie Thames, for offering their continual support of Kaitlyn and me throughout this journey. Lastly, I would like to thank my great friend and classmate, Luke LeBlanc, for making this challenging journey one that we can enjoy.

Luke LeBlanc

I would like to dedicate this doctoral project to each of my family members and friends for their support and encouragement throughout the completion of this doctoral project. Specifically, I would like to thank my wife, Baylie LeBlanc, for her example and unconditional love for Christ and myself that makes me want to be a better man each day. I would like to thank my brother and his wife, Logan and Brooke LeBlanc for their continued dedication to supporting me throughout the completion of this doctoral project. I would also like to thank my sister and her husband, Paige Rooney and Brandon Rooney,

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LIST OF ABBREVIATIONS

AANA	American Association of Nurse Anesthetists
APRN	Advanced Practice Registered Nurse
CRNA	Certified Registered Nurse Anesthetist
DNP	Doctor of Nursing Practice
ETT	Endotracheal Tube
FB	Fiberoptic Bronchoscopy
IRB	Institutional Review Board
OSCE	Objective Structured Clinical Evaluation
SRNA	Student Registered Nurse Anesthetist
USM	The University of Southern Mississippi

CHAPTER I - INTRODUCTION

It is the anesthesia provider's responsibility to ensure effectual and skillful airway manipulation when manipulation is indicated. This proficiency in airway management is achieved by the anesthesia provider having exceptional knowledge of the airway itself and the equipment that is available to him or her to assist in successfully manipulating the airway. Fiberoptic Bronchoscopy (FB) is a valuable tool in visualizing and diagnosing airway anatomy and pathophysiologic changes that patients may present. While adverse outcomes can occur related to the use of a fiberoptic bronchoscope, FB is generally considered a safe procedure although it is invasive (Qanash et al., 2020). Arduous or unsuccessful endotracheal intubation attempts are both major precipitators of patient morbidity and lawsuits for anesthesia providers. A closed claims study of 11,034 claims allocated through December 31, 2016, indicated that arduous endotracheal intubation, as defined as multiple attempts or failed endotracheal intubation, was the dominant event that generated injury between the years 2000-2012 (Joffe et al., 2019). Up to one out of ten of elective surgical patients present with a difficult airway. The gold standard for difficult airway management is FB, and in a study of 52 difficult airways, there was only a fail rate of less than 4% when FB was utilized (Ajay et al., 2013). As one can deduct from these staggering statistics, it is a necessity for anesthesia providers to incorporate thorough training with a fiberoptic bronchoscope in all anesthesia programs. To best achieve this training, the development of an OSCE addressing airway management using fiberoptic bronchoscopy would be the most effective training model.

Background

Providing education using a realistic simulation method is an essential part of training for healthcare professionals and healthcare students. By compiling an Objective Structural Clinical Evaluation (OSCE) tool, students and healthcare professionals have a clearly defined methodology they can reference describing the process of performing a certain skill. FB is imperative for the diagnosis and management of a plethora of respiratory complications and is more commonly used by anesthesia providers for airway instrumentation for difficult airways. This doctoral project implemented an educational teaching simulation to enhance the knowledge and use of FB by healthcare professionals and students. The doctoral project focuses on the use of ORSIM technology to teach anesthesia providers: what a fiberoptic bronchoscope is, indications for its use, proper usage, and training methods to enhance skills and knowledge of the healthcare professional when instrumenting a patient's airway with a fiberoptic bronchoscope.

Purpose and Content

Anesthesia providers must provide safe, effective health care to patients among a tremendous number of clinical presentations. The adaptability of the anesthesia provider may save an individual's life based upon proper recognition of emergencies that necessitate prompt, precise intervention. The purpose of this OSCE is to address the gap in knowledge when maneuvering fiberoptic bronchoscopes to further prepare anesthesia professionals for airway management to improve patient safety.

Problem Statement

SRNAs lack knowledge, training, and clinical groundwork in fiberoptic bronchoscopy. Due to time constraints and lack of clinical exposure, SRNAs need greater

opportunities to simulate flexible bronchoscopy intubation to improve patient safety. A major issue is the USM Nurse Anesthesia Program (NAP) lacks a consistent, structured, objective format for bronchoscopy training. An OSCE can improve a student's ability to effectively maneuver through FB intubations and even provide further education for practicing Certified Registered Nurse Anesthetists (CRNAs). ORSIM provides comprehensive training in maneuvering a flexible bronchoscope to improve skills regarding airway anatomy, pathology, and instrumentation.

Available Knowledge

Based on an experiment conducted by Latif et al. in 2015, FB performance between an experienced group (eight anesthesiologists) and novice group (15 4th year medical students) was synonymous after training on a virtual reality simulator in a simulation environment. The training time for this study lasted roughly 90 minutes, which included equipment orientation, training video viewing, the conductance of practice intubations, and appraisal of performance. Furthermore, Latif et al. (2015) conducted an evaluation of skill decay in the novice group two months after FB training took place, and this evaluation exhibited a significant amount of FB skill retention. Most importantly, this experiment demonstrated not only the ability but also the efficiency and patient safety of conducting FB training in a controlled simulation environment instead of using live patient training.

The research used to construct this doctoral project was gathered via resources in the Cook Library at The University of Southern Mississippi (USM) and the following research platforms: EBSCO Host, National Center for Biotechnology Information (NCBI), and The University of Toronto Perioperative Interactive Education modules.

Inquiries using the keywords fiberoptic, bronchoscopy, difficult airway, airway management, endotracheal intubation, fiberoptic simulation, and OSCE were used to gather data related to this doctoral project. Data limitations included those published before 2010 and those that were not related to fiberoptic bronchoscopy. Furthermore, data was used regardless of the anesthesia provider is an anesthesiologist or Certified Registered Nurse Anesthetists (CRNA).

Simulation

Simulation provides a low-risk environment for skill enhancement while offering a high-quality evaluation to assess competency. Rather than hoping that one acquires enough training in a real-life clinical setting, simulation provides scheduled training that assures enough training hours to achieve competency in a skill. It is also to the trainee's benefit that simulation provides a space where he or she can make a mistake without an advanced clinician having to intervene, so the trainee is then able to learn the outcome of his or her mistake to not repeat it in a real-life situation. It is less than ideal to achieve competency in a skill by practicing on human subjects, rather becoming competent using a skill simulator that poses no risk of harm to a human being is ideal. Simulation is utilized in a vast multitude of training programs such as military and police training programs, healthcare and first responder skills, pilot training, and mass transit operations. Things involved in simulation include pre-simulation reading assignments to familiarize oneself with material, a list of skills that will be performed during the simulation, a pre-simulation meeting to describe the scenario to be enacted, and a post-simulation debriefing to discuss what went well/poorly as well as an evaluation rubric. Major limitations to interactive learning include lack of equipment, facility space, and

instructors that are proficient in using the simulation equipment (Fielding et al., 2014). However, studies reviewed by Fielding et al. (2014) show that using a skill simulator and active learning mitigates problems such as procedural complications and prolonged procedure times. Both American and European procedural societies encourage a vast amount of practice as a major way to obtain competency in a skill, therefore the use of a skill simulator is an ideal tool to achieve competency before conducting FB on a live patient. In one study, it was required that healthcare providers perform 20 simulated FBs, and it was demonstrated that these providers were much more competent than those that did not have simulation-based training. One example of interactive learning is the "flipped classroom model" in which information is delivered online for the learner to review before a simulation experience. This flipped classroom model allows more time for hands-on learning, and in one study, student satisfaction scores were also much higher in this flipped classroom model rather than traditional teaching models. Lastly, in a systematic review of 17 studies on bronchoscopy training, groups that utilized a simulator had higher competency in various areas of FB skill sets (Fielding et al., 2014). As one can see, simulators allow trainees to conduct high-quality training for infrequently occurring life-threatening situations in a safe and controlled environment. Furthermore, there is an established training outline that allows for an effective bridge from the didactic setting to the application of skills setting included in the simulation. In conclusion, it is essential that active learning be conducted via a FB simulator to achieve proficiency before conducting FB on a live patient.

Objective Structured Clinical Evaluation

An OSCE is a training technique that promotes objective learning to improve outcomes. “The OSCE was developed to reduce bias in the assessment of clinical competence where various aspects of clinical competence are evaluated in a comprehensive, consistent, and structured manner, paying close attention to the objectivity of the process” (Fouad et al., 2019, p. 27). Parts of an OSCE include aims and objectives of the simulation, simulation scenario, assigned pre-reading and videos, trainees included in the OSCE, education level required for a trainee to participate, time allotted to perform the OSCE, suggested practice time before the final examination, equipment that will be provided, a venue where the OSCE will take place, and a grading rubric. OSCEs provide reliable principles for students to base their clinical practice on. “The two major underlying principles of the OSCE are “objectivity” and “structure.” (Fouad et al., 2019, p. 28). The objectivity and structure that are used to create an OSCE promote a more valid, reliable learning process that has removed bias and personal subjectivity. With the integration of OSCEs into Nurse Anesthesia education, provider confidence and patient outcomes can be improved.

General Endotracheal Anesthesia

General Endotracheal Anesthesia known as GETA is anesthesia achieved through the use of an inhaled anesthetic gas into an endotracheal tube (ETT) into the patient’s lungs and ultimately into the central nervous system. General anesthesia can be described as “an altered physiological state characterized by reversible loss of consciousness, analgesia, amnesia, and some degree of muscle relaxation” (Butterworth et al., 2018, p. 155). It is used in surgical procedures to provide a surgical field for surgeons and provide

analgesia, amnesia, and anesthesia for the patient. Therefore, ETT placement into the trachea is a common procedure performed by anesthesia providers aiming to achieve general anesthesia. Placement of an ETT allows for the anesthesia provider to deliver a set respiratory rate, peak pulmonary pressure, tidal volume, and gas percentage into the airway to maintain the patient's respiration and oxygenation during the delivery of general anesthesia. "An ETT is generally placed to protect the airway and for airway access. Intubation is indicated in patients who are at risk of aspiration and in those undergoing surgical procedures involving body cavities, the head and neck, and those who will be positioned so that the airway will be less accessible" (Butterworth et al., 2018, p. 324).

The process of placement of an ETT in the trachea is commonly done by direct laryngoscopy using a handle attached to a curved or straight blade. However, this procedure is not considered to be risk-free and has several associated complications. Additionally, certain patients cannot tolerate direct laryngoscopy. "Patients with unstable cervical spines, poor range of motion of the temporomandibular joint, or certain congenital or acquired upper airway anomalies- laryngoscopy with direct or indirect laryngoscopes may be undesirable or impossible" (Butterworth et al., 2018, p. 323). The use of FB technology is less invasive and reduces the trauma to the airway during ETT placement and facilitates placement of the ETT in circumstances it may otherwise not be possible. Furthermore, FB is used in difficult airway situations where no other airway access can be obtained. The American Society of Anesthesiologists (ASA) Difficult Airway Algorithm is an evidence-based method used to manage patients with difficult airway presentations in which maintaining oxygenation is the primary goal. When an

anesthesia provider encounters a difficult airway in which direct laryngoscopy and glideslope use is unsuccessful for ETT placement, the algorithm suggests usage of “alternative intubation techniques" (American Society of Anesthesiologists [ASA], 2013). FB is a favorable alternative technique that can increase the likelihood of successful intubation and oxygenation due to the reduction in fail rates that occur with fiberoptic intubation over direct laryngoscopy (Ajay et al., 2013). It is critical for anesthesia providers to be trained and confident in the use of fiberoptic bronchoscope technology because of the obligation to be competent in multiple methods of securing a patient's airway to ensure adequate oxygenation. Through understanding the ASA Difficult Airway algorithm, anesthesia providers see the necessity of successful training in fiberoptic bronchoscopy. This provides an effective, less traumatic technique for placement of an ETT either in emergent situations or those who present with difficult airways. With improved technology and training with FB, the number of failed endotracheal intubations can be reduced. Furthermore, the number of injuries related to failed airway access attempts can be reduced along with possible improved patient outcomes.

Fiberoptic Bronchoscopy

The increasing demand for clinical advancement practices by CRNAs necessitates improved training and simulation. To meet the increasing demand, Student Registered Nurse Anesthetists (SRNAs) are required to improve fiberoptic bronchoscopy skills to ensure effective airway management. Flexible Fiberoptic Bronchoscopy is desired when a difficult airway, described as a patient that is difficult to bag-mask-ventilate or intubate, is expected. FB can be performed with the patient awake by spraying 2% lidocaine into

the nares, oropharynx, and hypopharynx, and spraying phenylephrine into the nares. Furthermore, it is favorable to consider administering midazolam to the awake patient before manipulating the airway (University Health Network, 2012). When the oral range of motion is decreased, it is required to enter the airway through the nares, which is why the nares are prepped with 2% lidocaine and phenylephrine spray (Navarro et al., 2012). To place the endotracheal tube (ETT) into the airway using FB, the ETT must be placed over the bronchoscope before the FB is inserted into the airway. Then, vocal cords are visualized and traversed, the ETT can slide over the FB into the trachea, and finally, the FB can be removed. Lastly, it is extremely important that the ETT be well secured to prevent accidental displacement (Navarro et al., 2012). The creation of the Fiberoptic Bronchoscopy OSCE will develop the SRNA's ability to manage a variety of airway presentations effectively and provide objective training that prepares for emergencies.

DNP Essentials

The Doctor of Nursing Practice (DNP) Essentials are core elements of education that must be present in programs that offer a DNP degree. They outline the core competencies of a graduate-level nursing program and are a vital guide by which many programs train exceptional advanced practice registered nurses (APRNs). These Essentials are required by the Commission on Collegiate Nursing Education for a program to maintain accreditation (American Association of Colleges of Nursing [AACN], 2021). The list of USM's DNP Essentials with explanation of each Essential can be found in Appendix B. The DNP Essentials that were met by this OSCE include:

Essential One: Scientific underpinnings for practice. This doctoral project incorporates the use of evidence-based practice guidelines to create educational guidance in fiberoptic bronchoscopy intubation.

Essential Two: Organization and Systems leadership for quality improvement and systems thinking. This doctoral project includes measures to improve patient safety by effectively improving the management of patients with difficult airways.

Essential Six: Interprofessional collaboration for improving patient and population health outcomes. This doctoral project includes a model for inter-collaboration among multiple healthcare teams to improve education and training on flexible bronchoscopy intubation to promote improved patient outcomes and meet knowledge deficits.

Essential Seven: Clinical prevention and health for improving the nation's health. This project includes education to promote improved technique during airway instrumentation with fiberoptic bronchoscopy to reduce complications related to failed or delayed airway instrumentation.

Summary

Airway management is an essential skill for safe anesthesia practice. The development of an OSCE to address the lack of training for SRNAs in fiberoptic bronchoscopy will provide reliable education for the improvement and understanding of the use of fiberoptic bronchoscopy for airway management. The ORSIM device provides enhanced learning opportunities that specifically meet the clinical preparedness needs of anesthesia providers with concurrent OSCE training with ORSIM technology.

CHAPTER II – METHODOLOGY

Context

To address the gap in knowledge and experience of CRNA's use of FB, the development of an OSCE with proper implementation can potentially enhance clinical competency. With the improved simulation of FB used for airway instrumentation, SRNAs and CRNAs should be able to perform competently in their role when instrumenting and managing the patient's airway in the surgical setting. With the use of an OSCE to improve education on FFB, the risk of bias is reduced, and objectivity is enhanced.

FB can be a frightening skill to learn for anesthesia providers due to its infrequent use and lack of formal training. However, the importance of the anesthesia provider being able to competently perform FB is especially important when difficult airway risk factors are present that put the patient at risk for difficult airway instrumentation. Therefore, it is desirable for anesthesia professionals to improve their FB capability with the use of ORSIM technology. With approximately 20 students entering the field of anesthesia each year upon graduation from The University of Southern Mississippi's Nurse Anesthesia Program, an OSCE improving FB should enhance CRNAs' airway management skills.

Intervention

After establishing a faculty member as a committee chair to act as a collaborative faculty representative and subsequent approval by the Institutional Review Board (IRB), FB knowledge and training were assessed to determine the gap in formal training. An OSCE was developed based upon published data that reveals current evidence-based measures addressing FB performed by anesthesia providers. Ten clinically active

anesthesia providers with minimal former FB training were recruited to participate in the study and actively participated in the OSCE. A pre-simulation evaluation to assess clinical knowledge, experience, and maneuverability of a fiberoptic bronchoscope was used before OSCE conduction. Following the completion of the simulation utilizing ORSIM, a post-experience survey was completed by members to assess improvement in knowledge, experience, and maneuverability of a fiberoptic bronchoscope. Results of the simulation are calculated based upon the comparison in pre and post-simulation surveys.

Measures

The goal of this doctoral project was to facilitate an active learning experience in which anesthesia providers are introduced to FB. The authors of this doctoral project used the evidence-based S.M.A.R.T guideline to implement specific goals (who, what, when, where), measurable (to keep up with progress), attainable (within reach of the one setting the goal), realistic (encompasses every part of a SMART goal to ensure achievability), and timely (able to be achieved within a set amount of time). It has been demonstrated that writing goals in the SMART format improve the successful completion of these goals (Traugott, 2014). Each letter respectively represents specific, measurable, achievable, relevant, timely. Furthermore, goals being written down allowed each step to be reviewed to ensure the goal is becoming closer to being achieved. The measures to implement this introduction included a pre-simulation survey, the performance of an OSCE, and a post-simulation survey. Upon completion of the post-simulation survey, a debriefing session was held in which the quality of the intervention was appraised, and constructive criticism was welcomed.

Two virtual simulations using the ORSIM technology were used in this OSCE to familiarize nurse anesthesia students with FB. One simulation included navigating the FB to chase gophers into gopher holes. There were 20 different holes that the gopher can appear in with each hole requiring different angulated manipulations of the FB. The gopher holes simulated alveoli that would be examined using FB. The second simulation was a virtual navigation through a patient's airway that has normal anatomy. Not only did this experience enhance knowledge of airway anatomy, but also reinforced proper manipulation of the FB through a normal patient airway.

Steps in implementing this OSCE included developing a Qualtrics survey, developing and obtaining online informed consent, developing a recruitment email, and applying to the IRB. After receiving approval from the IRB (Protocol #IRB-21-324), the recruitment email was sent along with a copy of the OSCE and online informed consent to current anesthesia providers whose emails are publicly available or those that volunteered to participate in the OSCE. The OSCE was then performed with a total of 10 anesthesia provider who agreed with online consent and were willing to participate in the study.

Analysis

Data was compiled from the Qualtrics survey after SRNAs performed and evaluated the OSCE, and descriptive statistics were used to evaluate the data and responses from the Qualtrics survey tool. A post-experience survey was used to collect qualitative data regarding each participant's evaluation of the OSCE. All the collected information was compiled and analyzed to reinforce what was done well and what could be done better regarding the implementation of the OSCE. The OSCE was altered

according to feedback received and submitted to the DNP committee chair for approval. Finally, the OSCE was submitted to the USM NAP Administrator for inclusion in the simulation curriculum.

Ethical Considerations

Although airway instrumentation is a common practice performed by anesthesia providers, it is the responsibility of the provider to ensure patients' requests are met. Before performing any fiber optic technique that involves instrumentation of the airway, patients need to be fully informed of the risks, benefits, and concepts involved in the procedure. Additionally, it is likely that fiberoptic bronchoscopy is used during emergency airway situations where anesthesia providers must be aware of the patient's code status and intubation preferences. A "Do Not Intubate" or "DNI" indicates a patient should not receive airway manipulation and fiberoptic bronchoscopy is not an option. All factors must be considered and communicated to the patient or family members involved to reduce miscommunication occurrence and improve patient satisfaction. FFB enhancement using ORSIM can improve patient outcomes but should be performed only on those who are proper candidates that can benefit from the procedure itself. Performing FFB on patients who will not potentially clinically benefit is not following the AANA code of ethics.

Summary

This doctoral project comprised of five simulation sessions lasting 1.5 hours each, and each session contained two SRNAs. Before the simulation sessions, participants were given a pre-simulation evaluation that asked students to list two indications for FB and inquired about their confidence in performing FB. Furthermore, the OSCE and a list of

materials needed to perform FB were provided to participants before the simulation was conducted. After the group's simulation was over, they were taken to the debriefing room where post-simulation evaluations were completed. Constructive evaluation of the OSCE was then welcomed, data was compiled and analyzed, and an analysis of efficacy was developed based on whether participants indicated an increased level of knowledge and confidence in the performance of FB between the pre-simulation and post-simulation evaluation.

CHAPTER III - RESULTS

Being trained using FB ORSIM technology is beneficial for both anesthesia providers and patients. To best educate the SRNA cohorts, implementation of the OSCE will provide training and improve understanding. Those that participated in this study were evaluated based on their pre-stimulation and post-simulation knowledge of FB and their ability to maneuver a FB using the gopher chase simulation and a normal patient airway simulation. Furthermore, the participants evaluated this OSCE for constructive feedback to be given so that the OSCE can be critiqued based on the results of the post-simulation survey. The outcomes from this doctoral project will help develop a consistent way to provide education and training using FB to ultimately improve patient care.

Pre-Simulation Results

This study was conducted using six SRNAs in their 1st year of training and four SRNAs in their 2nd year of training. There was a total of ten participants (n=10), and they were divided into groups of two based on their position in the anesthesia program (1st year students were grouped, and 2nd year students were grouped). Only one student (n=1) out of the 10 participants indicated that they had previous experience with FB, and there was minimal pre-simulation knowledge of indications and benefits of FB.

Post-Simulation Results

Results showed 100% (n=10) of participants indicated that they felt more confident in their understanding and ability to maneuver a FB after the simulation experience. Furthermore, 90% (n=9) of participants said that they would consider using FB for intubation/airway instrumentation, and 10% (n=1) said that he or she would "maybe" use FB for this purpose. In the post-simulation survey, 100% (n=10) stated that

the information in the OSCE was clearly and easily understood. This shows that the OSCE developed presented straightforward and concise information and instruction to enhance knowledge and training using FB. The OSCE also provided information that is evidence-based and relevant to current anesthesia practice as indicated by 100% (n=10) agreeance by participants. Figure 1 represents the satisfaction of participants.

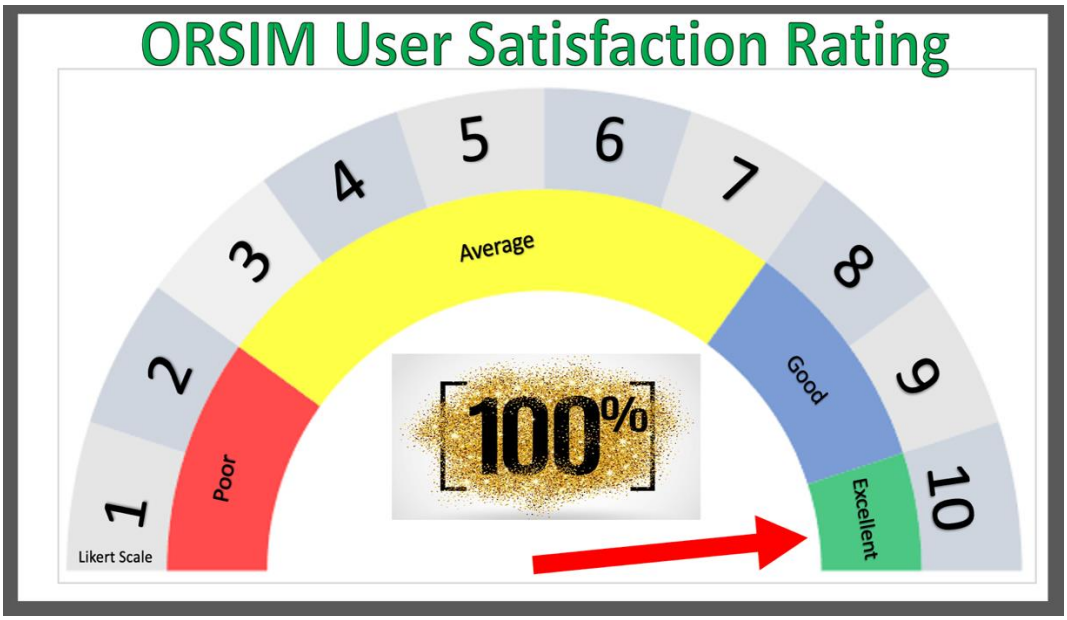


Figure 1. ORSIM User Satisfaction Rating

100% of participants indicated the FB OSCE should be incorporated into NAP curriculum.

The effectiveness of ORSIM technology to train anesthesia providers to perform FB was evaluated as 100% by participants, and 100% (n=10) elected that implementation of this OSCE will improve management of patients with a difficult airway. Figure 2 below includes multiple participant feedback examples:

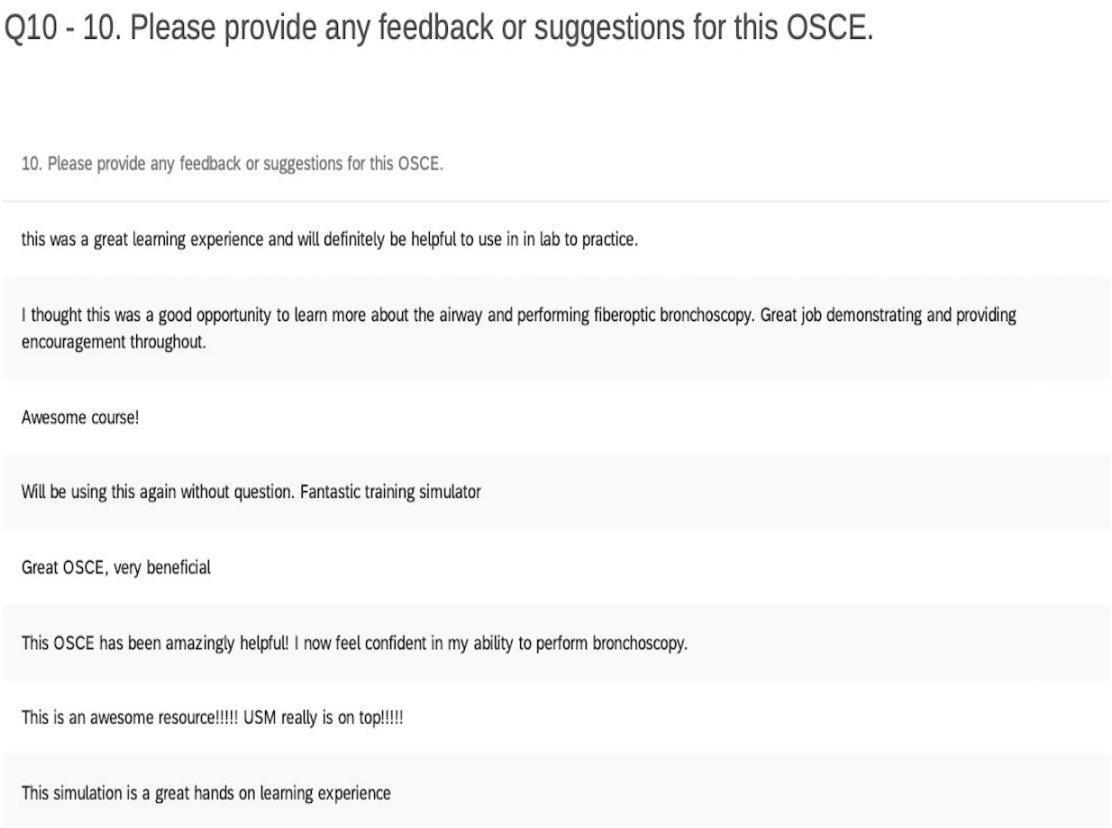


Figure 2. Participant Feedback

Summary

Fiberoptic bronchoscopy can be a valuable tool for the anesthesia provider if properly trained. ORSIM technology provides an exceptional and realistic learning environment for anesthesia providers without the possibility of harm to actual patients. With the gopher chase simulation and various vivid patient scenarios, the anesthesia provider using ORSIM will certainly become more confident in their FB skills. As indicated by the pre-and post-simulation results of this study, subjects were able to review and understand the OSCE before the simulation, and they certainly gained knowledge and enhanced their ability to maneuver a FB. When a situation arises that requires FB to instrument a patient's airway, those who have performed the FB OSCE

using ORSIM technology will potentially provide better patient care than those that did not use this OSCE and will likely result in improved patient care and satisfaction.

CHAPTER IV – DISCUSSION

The goal of the OSCE is to improve patient outcomes by improving the training of anesthesia providers in FB. With the integration of a formal evidence-based OSCE into the USM NAP curriculum, SRNAs will be more prepared to perform airway instrumentation with a fiberoptic bronchoscope. Using ORSIM technology to educate SRNAs on the maneuvering and functions used in FB, SRNAs will be far more prepared to handle patients with difficult airway presentations. As a result, the occurrence of failed intubation, hypoxia, and patient harm can be reduced. With SRNAs formally trained in FB, anesthesia delivery can be safer for surgical procedures requiring general anesthesia and endotracheal intubation. Improved training, confidence, and capability of SRNAs moving into anesthesia practice will over time produce a more effective team of anesthesia providers capable of airway management in a variety of airway scenarios, including those requiring fiberoptic airway placement.

The success of the OSCE can be measured by evaluating post-simulation responses by participants to determine if the goals of the doctoral project were met. Based upon the results gathered through survey collection of participants in the OSCE, SRNAs with no previous exposure to FB did improve their knowledge and confidence in airway instrumentation with a fiberoptic bronchoscope. Additionally, 100% of participants indicated the OSCE was clearly and easily understood. Furthermore, 100 participants indicated they would consider using FB for intubation/airway instrumentation after completion of the OSCE. The results gathered demonstrate improved knowledge and confidence in airway instrumentation using FB. Therefore, SRNAs who complete the OSCE training using ORSIM technology are more likely to

enter anesthesia practice with enhanced skills in airway management. Better understanding and confidence in FB through the implementation of the OSCE into the NAP curriculum will result in fewer failed intubation attempts and improved patient care in settings where general endotracheal anesthesia is required.

The DNP Essentials best met by the OSCE include Essential One: Scientific underpinnings for practice. This doctoral project facilitates the formation of evidence-based practice guidelines to create educational guidance for anesthesia providers in intubation using FB. Intubation is a vital technique used frequently throughout an anesthesia provider's career. Formal training in FB allows anesthesia providers to complete an evidence-based training model that guides the practice model when performing airway instrumentation. Also, the OSCE successfully meets DNP Essential Seven: Clinical prevention and health for improving the nation's health. The training provided by the ORSIM technology OSCE includes education to improve FB technique during airway instrumentation to reduce complications related to failed or delayed airway instrumentation. Reduction in failed or delayed airways will result in decreased patient harm and can improve the nation's health.

Limitations

The OSCE performed included a sample size of 10 SRNAs. The time constraints and sample size of the study must be considered. The strength of the study should be improved with further study over time with more anesthesia providers performing the OSCE with ORSIM technology. Additionally, it will be difficult to measure outcomes unless it is observed over time. Due to the doctoral project being limited to the time spent during the doctoral program, the results of long-term data are limited. Therefore, further

studies assessing outcomes and anesthesia provider confidence and capability in FB should be completed to further assess the effectiveness of ORSIM technology training simulations.

Conclusions

The importance of training in FB is becoming emphasized daily in anesthesia practice. The number of surgical procedures performed is increasing exponentially throughout the nation. General anesthesia requiring endotracheal intubation is frequently used as the primary anesthetic for these procedures to provide analgesia and amnesia for the patient. Adequate training of SRNAs in airway instrumentation through the use of FB allows for improved airway management resulting in a reduction in failed intubations, reduction in induction times, and improved oxygenation of patients undergoing surgery. All ten participants desired the FB OSCE to be adopted into the curriculum for training purposes. The OSCE using ORSIM technology provides a formal training method for anesthesia providers that is versatile and easily memorized for the integration into anesthesia practice and has been submitted to NAP administration for adoption into the program.

APPENDIX A – Fiberoptic Bronchoscopy OSCE

ANESTHESIA OBJECTIVE STRUCTURED CLINICAL EVALUATION

ORSIM Fiberoptic Bronchoscopy Training

LEARNER OUTCOMES:

1. Be able to identify patients who present challenges with endotracheal intubation.
2. Understand indications, risks, and benefits of fiberoptic bronchoscopy.
3. Perform simulated navigation of FFB utilizing ORSIM gopher hole scenario.
4. Perform simulated endotracheal intubation utilizing the ORSIM with proper airway anatomy landmark identification.

DOMAINS:

Clinical skill, Performance Assessment.

PURPOSE:

Demonstrate the ability of the USM NAP student to utilize ORSIM technology for airway management and airway instrumentation.

LEARNER OBJECTIVES:

1. Describe which patients present challenges with endotracheal intubation.
2. Demonstrate ability to utilize ORSIM to manage patient airway scenarios.
3. Analyze technique for fiberoptic bronchoscopy guidance.

INDIVIDUAL OR GROUP OSCE: Group

REQUIRED READING and ASSOCIATED LECTURES:

Butterworth, J. F., Mackey, D. C., & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). McGraw Hill Education.
Chapter: 19

REQUIRED VIDEO:

https://www.youtube.com/watch?v=Iiv54EvU_Hs (ORSIM introduction)

https://www.youtube.com/watch?v=xGtY1Ui0rmY (Normal airway anatomy)

https://www.youtube.com/watch?v=lTfhad77gvc (Airway Trauma)

REQUIRED PARTICIPANTS: USM NAP student, NAP faculty examiner, clinical skills lab staff.

VENUE: USM NAP clinical skills lab.

STUDENT LEVEL OF OSCE: Semester 3-9

TIME ALLOTTED: 90 minutes

RECOMMENDED PRACTICE PRIOR TO EXAMINATION: 45 minutes for gopher simulation and 45 minutes for human airway instrumentation for a total attempt time = 90 minutes.

CONTEXT: (Background/story)
The anesthesia provider is to perform a pre-anesthesia assessment in the preoperative area. Next, the anesthesia provider notes a patient with a potentially difficult airway. The patient is rolled into the operating room and prepared for induction of anesthesia. The anesthesia provider requests a "scope" to gain a better view of the patient's airway.

Gather the correct supplies to perform fiberoptic bronchoscopy-guided endotracheal intubation.

EQUIPMENT& SUPPLIES:
Portable fiberoptic bronchoscope
Lidocaine
Endotracheal Tube
10 cc syringe
Etco2 monitor
O2 saturation monitor
Proper sedation pharmaceutical agents

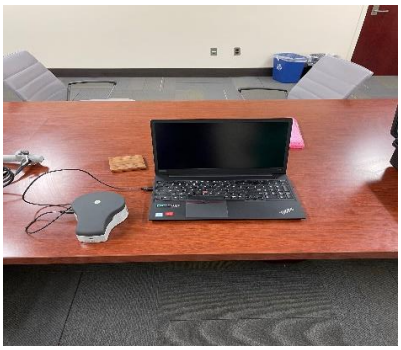
ENDOTRACHEAL TUBE SELECTION:
ET selection shall be based upon visualization of the patient's airway anatomy.

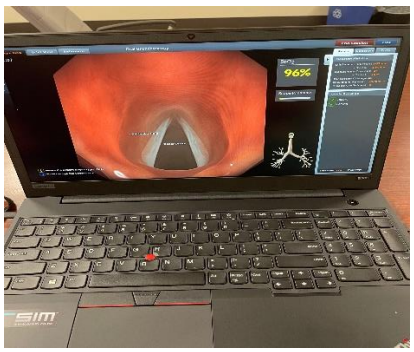
TASK STATEMENT:
Your task is to discuss several patient populations that can present with a difficult airway and proper risk reduction per patient presentation. The provider shall gather proper equipment for the fiberoptic bronchoscopy procedure. Next, the provider must simulate the placement of the bronchoscope with appropriate manipulation of the bronchoscope to ensure the safe maneuvering of the device. Practice maneuvering the bronchoscope will be done by utilizing gopher hole scenarios on the ORSIM device. Next, the provider must verbalize important airway landmarks as the bronchoscope is used for airway instrumentation using the normal anatomy scenarios provided by the ORSIM device. The provider must verbalize and perform proper placement of the Endotracheal Tube into the trachea bypassing the bronchoscope through the vocal cords. Following successful movement through the vocal cords into the trachea, students will remove the bronchoscope and assess learning.

PROCESS

1. Prepare appropriate equipment (Airway equipment and fiberoptic bronchoscope)
2. Discuss patients that commonly have difficult airway instrumentation (Epiglottitis, obese, hyoid mandibular distance, mouth opening, airway obstruction, etc.)
3. Verbalize the aseptic technique required for the bronchoscope procedure.
4. Demonstrate proper usage of ORSIM bronchoscope by verbalizing directional manipulation of bronchoscope tip.
5. Place bronchoscope tip into ORSIM simulated gopher hole scenario.
6. Correctly perform gopher hole scenario before moving on to the patient airway scenario to ensure safe and effective maneuverability of the bronchoscope.
7. Perform airway instrumentation using the normal anatomy airway scenario and confirm the location of common airway landmarks followed by placement of scope through the vocal cords into the trachea.
8. Repeat the procedure as needed using ORSIM guided learning techniques for students needing further teaching.

IMAGES:





DEBRIEFING FORM:

Student Debriefing Form

1. What semester are you currently enrolled/training as an SRNA?
2. Before the simulation, had you ever used a fiberoptic bronchoscope?
3. After using the ORSIM fiberoptic bronchoscope simulator, do you feel more confident in your understanding and use of a fiberoptic bronchoscope?
4. Would you consider using fiberoptic bronchoscopy as a technique for intubation/airway instrumentation?
5. Is the information presented in the OSCE stated clearly and easily understood?
6. Does the OSCE provide information that is evidence-based and relevant to anesthesia practice today?
7. Do you think the ORSIM simulator is an effective tool for training anesthesia providers to perform fiberoptic bronchoscopy?
8. Will the implementation of the OSCE improve the management of patients with difficult airway presentations?
9. Please provide any feedback or suggestions for this OSCE.

ASSESSMENT

QUESTION AND DEMONSTRATION STATION:

	TASKS	PASS	FAIL	COMMENTS
*	1. Prepare and select appropriate equipment			
	2. Discuss patients that commonly have difficult airway instrumentation (Epiglottitis, obese, hyoid mandibular distance, mouth opening, airway obstruction, etc.)			
*	3. Verbalize the aseptic technique required for the bronchoscope procedure.			
*	4. Demonstrate proper usage of ORSIM bronchoscope by verbalizing directional manipulation of bronchoscope tip and completing gopher hole scenario.			
	5. Place bronchoscope tip into ORSIM simulated airway.			
*	6. Correctly identify airway landmarks and verbalize location as the procedure ensues.			
*	7. Place bronchoscope tip through the vocal cords into the trachea.			
*	8. Safely remove bronchoscope without compromising scope integrity or increasing pressure on the scope.			
	9. Repeat the procedure using ORSIM scenarios based upon the need for struggling students.			

Steps with * Must be properly completed. All steps must be completed/passed to receive a passing grade.

The OSCE by the student demonstrates foundational knowledge and correct use of the ORSIM simulator for fiberoptic bronchoscopy: (Circle one) **PASS FAIL**

Does the student need to repeat this OSCE at a later date to satisfy learning requirements? (Circle one) **YES NO Date to return for evaluation:** **_____**

EXAMINER: _____ DATE: _____

APPENDIX B – DNP Essentials

	DNP Essential	Achievement
I	Scientific Underpinnings for Practice	The PATHE project was completed after an extensive evidence-based literature review on the implementation of a patient completed pre-anesthetic take-home evaluation. The evidence obtained within the literature review as well as the recommendation provided by the authors was applied from the literature of scientific works.
II	Organizational and Systems Leadership for Quality Improvement and Systems Thinking	The PATHE sets out to improve quality through current practice recommendations utilizing pre-anesthetic processes and patient involvement to a panel of experts to analyze, interpret, and offer insight for application in clinical practice.
III	Clinical Scholarship and Analytical Methods for Evidence-Based Practice	This doctoral project utilized a systematic review of the available knowledge to evaluate the current best practices and make targeted recommendations on quality improvement of the pre-anesthetic process to current anesthetic providers.
IV	Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	This doctoral project meets this essential through the creation of a feedback-guided provider survey to assist optimization and implementation of the PATHE documentation.
V	Healthcare Policy for Advocacy in Health Care	The doctoral project meets this essential through the identification of inconsistencies in the pre-anesthetic process. The adoption of PATHE in anesthesia care areas could lead to more consistent health history collection and improved quality of care.
VI	Interprofessional Collaboration for Improving Patient and Population Health Outcomes	This Essential is met through the collaboration of anesthesia providers' feedback to optimize best practice recommendations for PATHE.
VII	Clinical Prevention and Population Health for Improving the Nation's Health	The essential is met through the recommendation of the implementation of PATHE in all anesthesia care settings to improve patient involvement and compliance with the pre-anesthetic process and improved peri/post-anesthetic outcomes.
VIII	Advanced Nursing Practice	This essential is accomplished by the evaluation of the most current literature, the presentation of the PATHE process and documents, and the team-centered approach with the goal of best practice recommendation.

APPENDIX C –IRB Approval Letter

Office *of*
Research Integrity

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

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NOTICE OF INSTITUTIONAL REVIEW BOARD ACTION

The project below 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 regulations (45 CFR Part 46), and University Policy to ensure:

- The risks to subjects are minimized and 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 involving risks to subjects must be reported immediately. Problems should be reported to ORI via the Incident template on Cayuse IRB.
- The period of approval is twelve months. An application for renewal must be submitted for projects exceeding twelve months.

PROTOCOL NUMBER: IRB-21-324
PROJECT TITLE: Using ORSIM Technology to Educate Anesthesia Providers on Fiberoptic Bronchoscopy: An Objective Structured Clinical Evaluation
SCHOOL/PROGRAM: Leadership & Advanced Nursing
RESEARCHER(S): Luke LeBlanc, Nina Mclain, Selby Thames

IRB COMMITTEE ACTION: Approved
CATEGORY: Expedited
7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

PERIOD OF APPROVAL: September 1, 2021

Donald Sacco Jr.

Donald Sacco, Ph.D.
Institutional Review Board Chairperson

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