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Difficult Airway Algorithm Objective Structured Clinical Evaluation

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DIFFICULT AIRWAY ALGORITHM OBJECTIVE STRUCTURED CLINICAL EVALUATION

by

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ABSTRACT

Airway management is an essential component of providing safe anesthesia. Management of the difficult airway is a valuable skill. Student registered nurse anesthetists (SRNAs) may be unprepared to manage a difficult airway in the clinical setting due to limited exposure. Lack of preparation in the management of the difficult airway can result in poor patient outcomes, including brain injury and death, and poor student outcomes, including increased anxiety and decreased intubation success (Wands & Minzola, 2015). The University of Southern Mississippi's (USM) nurse anesthesia faculty recognized the need for an Objective Structured Clinical Examination (OSCE) in difficult airway management. The OSCE was developed and may be utilized by first-year SRNAs prior to entering the clinical setting, with the aim of increasing student competence and preventing adverse patient outcomes.

The Difficult Airway Algorithm OSCE and an anonymous evaluation survey were presented to four USM nurse anesthesia faculty, 25 practicing Certified Registered Nurse Anesthetists (CRNAs), 19 third-year SRNAs, and 19 second-year SRNAs. Fifty-four participants completed the survey, and 100% of participants agreed that the OSCE contained evidence-based information that is relevant to current anesthesia practice. Open-ended feedback resulted in common themes of the OSCE being very well thought out and incredibly useful, as well as a suggestion to include the ASA Difficult Airway Algorithm as a visual aid along with the OSCE packet and to clarify the objectives in the given scenario. Based on the reviewed literature and survey results, it is concluded that the Difficult Airway Algorithm OSCE could potentially positively impact SRNAs, and ultimately impact the outcomes of patients.

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LIST OF ABBREVIATIONS

AACN	American Association of Colleges of Nursing
AANA	American Association of Nurse Anesthetists
APL	Adjustable Pressure-Limiting
ASA	American Society of Anesthesiologists
BMV	Bag-Mask Ventilation
CCAT	Common Clinical Assessment Tool
CE	Continuing Education
COA	Council on Accreditation of Nurse Anesthesia Educational Programs
CRNA	Certified Registered Nurse Anesthetist
DNP	Doctor of Nursing Practice
EBP	Evidence-Based Practice
IRB	Institutional Review Board
NAP	Nurse Anesthesia Program
OSCE	Objective Structured Clinical Examination
OR	Operating Room
SRNA	Student Registered Nurse Anesthetist
USM	The University of Southern Mississippi

CHAPTER I - INTRODUCTION

Background

In 1975, Harden, Stevenson, Downie, and Wilson were the first to describe evaluating a medical students' ability to use effective judgment skills using the objective structured clinical examination. The structured clinical examination was introduced to avoid the disadvantages of the traditional clinical examination (Harden et al., 1975, p. 448). OSCE is now recognized as one of the most valid, reliable, and effective tests to measure cognitive, interpersonal communication, and psychomotor skills (Siddaram & Anil, 2018, p. 102). More of the student's knowledge can be tested using the structured clinical examination, and the variables and complexity of the examination are more easily controlled, defined more clearly, and (Harden et al., 1975, p. 448).

The goal of the Difficult Airway Algorithm OSCE is to provide an assessment of performance that is precise, objective, and reproducible, which allows for uniform testing of students' clinical skills (Zayyan, 2011, p. 220). Administering an OSCE for the evaluation of clinical skills helps eliminate bias and standardizes simulation-styled examinations (Zayyan, 2011, p. 221). The advantages of utilizing an OSCE include improving students' clinical performance, increasing students' decision-making abilities, and preparing highly qualified and clinically competent graduates (Nazeer et al., 2020).

The AANA indorses the use of formal assessment of clinical competence through an OSCE to ensure the competence of student nurse anesthetists as they begin and continue their clinical training (Wunder et al., 2014, p. 421). "The main advantage of OSCE is that it allows sampling of multiple areas of clinical competence compared to the traditional oral clinical examination, overcoming the problem of case specificity and

resulting in improved reliability" (Hijazi & Downing, 2008, p. 193). OSCEs identify specific clinical steps that students are missing or areas that need improvement, which allows students to seek additional resources to improve their clinical practice (AbdAlla & Mohammed, 2016, p. 400).

Statement of the Problem

Failure to secure a patient's airway during the induction stage of a general anesthetic can lead to significant morbidity and mortality (Lucisano & Talbot, 2012, p. 26). To improve outcomes, the American Society of Anesthesiologists (ASA) has implemented an algorithm that can be followed when an anesthesia provider is unable to establish an airway using traditional approaches (American Society of Anesthesiologists [ASA], 2013). An objective structured clinical evaluation (OSCE) may be used to prepare anesthesia providers for difficult airway management (Lucisano & Talbot, 2012, p. 27). Simulating clinical scenarios using methods such as an OSCE improves critical thinking and decision-making skills, increases confidence, and improves clinical preparation (Henrichs et al., 2002, p. 222). The University of Southern Mississippi's (USM) Nurse Anesthesia Program (NAP) lacks a uniform clinical evaluation of difficult airway management "The principal adverse outcomes associated with the difficult airway include (but are not limited to) death, brain injury, cardiopulmonary arrest, airway trauma, and damage to the teeth"(Apfelbaum et al., 2022, p. 32). An evidence-based OSCE for difficult airway management will be developed and presented to USM's Nurse Anesthesia Program for consideration. The purpose of a difficult airway OSCE is to facilitate the management and assessment of the difficult airway and to reduce the likelihood of patient adverse outcomes by student nurse anesthetists (SRNAs).

Significance of the Project

Providing learning evaluations that accurately assess the competency of Student Registered Nurse Anesthetists (SRNA) is an essential element in creating a proactive patient safety-centered environment (Battles et al., 2004, p. 48). An OSCE allows for a method that focuses "on actual performance rather than on knowledge assessment only in the form of written examinations" (Battles et al., 2004, p. 48). The USM Nurse Anesthesia Program has a need for a standardized assessment of students' ability to demonstrate difficult airway management. An OSCE can be utilized by the USM NAP to prepare students for dealing with difficult airways in a controlled environment before they are presented with a difficult airway in the actual clinical setting. This project will provide an evidence-based, objective structured clinical examination to The University of Southern Mississippi Nurse Anesthesia Program using the American Society of Anesthesiologists Difficult Airway Algorithm (ASA, 2013).

Available Knowledge

Nursing and medical programs have used objective structured clinical examinations (OSCEs) for decades to determine participants' level of clinical performance and understanding, provide feedback on areas for improvement, and assist with preparation for clinical practice (Kelly et al., 2016). The literature matrix shown in Appendix A demonstrates the evidence from literature regarding the effectiveness of OSCEs. Appendix B demonstrates a graphic depiction of the ASA difficult airway algorithm

Definition of an OSCE

The Objective Structured Clinical Examination assesses the proficiency of skills based on objective testing through direct observation. The OSCE is an evaluative tool that students and professors can utilize to determine what clinical actions healthcare providers would take. The OSCE allows for the assessment of precise steps taken during the demonstration of clinical skills. Because the OSCE is objective, accurate, and reproducible, it allows for uniform testing of students (Zayyan, 2011, p. 221). Contrasting the traditional examination, OSCE is the closest to providing realistic clinical scenarios outside of the actual clinical setting.

The definition of the OSCE assessment technique has been termed throughout the years to reflect some of the alterations that have been made. Harden defined the OSCE as;

> An approach to the assessment of clinical competence in which the components are assessed in a planned or structured way with attention being paid to the objectivity of the examination. The student is assessed at a series of stations, with one or two aspects of competence being tested at each station. The examination can be described as a "focused" examination with each station focusing on one or two aspects of competence. (Harden, 1988, p. 20)

According to Newble,

> The OSCE is not a test method in the same way as an essay or multiple-choice question. It is… an organization framework consisting of multiple stations around which students rotate and at which students perform and are assessed on specific tasks. (Newble, 2004, p. 201)

Academic scholars agree that the OSCE assessment technique provides an effective method to evaluate a students' clinical competence in a focused examination process that relies more on critical thinking versus standard paper or computerized testing. Understanding what defines an OSCE is fundamental to the design of a uniform clinical evaluation tool that may be utilized by SRNAs.

The Purpose of an OSCE

The OSCE is used to evaluate areas most critical to the performance of healthcare professionals, which would otherwise be difficult to evaluate using the traditional clinical examination. Traditional clinical examination primarily assesses theory rather than simulating practical performance (Zayyan, 2011, p. 220). "Feedback suggests the OSCE is an objective tool for evaluating clinical skills. Students perceived OSCE scores as a true measure of the essential clinical skills being evaluated and are not affected by the student's personality or social relations" (AbdAlla & Mohammed, 2016, p. 400).

> Moreover, it is possible to control its complexity and to define more clearly what skills, attitudes, problem-solving abilities, and factual knowledge are to be assessed. Because the examination is more objective, it is more easily repeatable than the traditional clinical exam, and standards from year to year may be more easily compared. The structured clinical examination can provide feedback to staff and students to a much greater extent than conventional clinical examinations (Harden et al., 1975, p. 448).

OSCE Measurement of Skill and Competence

The OSCE is a clinical or performance-based examination that has been established as a gold standard assessment for determining the clinical competence of

healthcare professionals since the mid-1970s (Nieto et al., 2020, p. 67). Epstein and Hundert define professional competence as: "the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values and reflection in daily practice for the benefit of the individual and community being served" (Epstein & Hundert, 2002, p. 226). The OSCE tests not only what examinees know but also their clinical skills and how they put their knowledge into practice. Over the last 40 years, the OSCE has been widely adopted as the recommended approach to the assessment of clinical competence and continues to be recognized as the gold standard for performance-based assessment, and its impact on education has been immense (Sloan et al., 1995, p. 738).

Formative Evaluation

As an assessment tool, the OSCE serves a number of different functions and can be used in a wide range of contexts (Harden et al., 2018, p. 21). It can be used to certify a student's clinical competence or as a learning tool that provides feedback to the learner. USM's NAP prepares students for the clinical setting through a simulation lab. The Difficult Airway Algorithm OSCE can be used as an evaluation method for managing the difficult airway during the first year and as a reference for the duration of the three-year program. OSCEs are useful for trainees in the graduate process and continual postgraduate education. In postgraduate training, the OSCE is used to formally certify that the trainee has completed, to the specified standard, a period of general or specialist training (Harden et al., 2018, p. 21). An appealing feature of the OSCE is that a formative evaluation can be completed and provided to the learner detailing areas where they have achieved the standard necessary and areas where further study is required. Poorly

performing students can be identified, and appropriate remediation can be offered (Harden et al., 2018, p. 21).

Reliability and Validity

A test is termed valid when it measures what it is intended to measure. The use of an OSCE minimizes both evaluator and patient variations while standardizing the knowledge and skills being evaluated. The OSCE has been deemed valid through many years of evidence over a range of medical professions and is a standard for evaluating a medical students' clinical readiness. (Harden et al., 2018, p. 20). The extent to which the results of an assessment are considered dependable, consistent, and free from error constitutes the reliability of that assessment. According to Harden, the OSCE format demonstrates increased reliability over other formats of clinical testing due to the extent to which the scores in the OSCE are consistent, dependable, and reproducible.

OSCE Structure

"An OSCE is a station-based examination designed to assess multiple students' clinical performances over the same materials at the same time" (Boursicot & Roberts, 2005, p. 17). Determining what should be assessed is the first step in setting up an OSCE. The skill assessed in an OSCE will vary depending on the stage of the learner and the purpose of the examination (Harden et al., 2018, p. 21). The clinical tasks chosen for the OSCE should enhance the learning objectives of the course and assess what the learners have been taught (Boursicot & Roberts, 2005, p. 17). OSCE preparation for the student includes student expectations, a grading rubric, and a debriefing form. The student expectations should be clear and void of interpretation by the evaluator or student.

The anesthesia-based OSCE utilizes realistic clinical scenarios, medical manikins, standardized testing measures, anesthesia machines, and equipment used during anesthesia care. Proctors evaluate the student's clinical performance at the stations using standardized rubrics and checklists (Nieto et al., 2020, p. 67). A team of many examiners judges the student's performance rather than simply two or three examiners at each of the various stations throughout the examination (Zayyan, 2011, p. 220). The grading rubric is the means by which the students' performance is measured during the OSCE. The grading rubric includes specific tasks to be completed, the pass or fail of the specific task, and narrative comments from the examiner (Harden et al., 2018, p. 20). Feedback provided during debriefing is also an important element of an OSCE. Debriefing feedback should relate to the student's performance in the simulated scenarios as well as to their overall performance in relation to outcome categories, such as communication skills, critical thinking, and practical clinical skills (Harden et al., 2018, p. 20).

Difficult Airway

The difficult airway is not traditionally defined in academic literature. "According to the ASA, a difficult airway is defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both" (ASA, 2013). The difficult airway represents the relationship between patient risk factors, the limitations of the facility, and the skill level of the anesthesia provider (ASA, 2013). Airway management is paramount to safe perioperative care. Airway management always begins with a comprehensive airway-relevant history and physical exam (Barash et al., 2018, p. 1932).

The manageability of a difficult airway depends on several factors such as the patient's physical characteristics, airway features, current medical condition, and past medical history. Knowing a patient's history and risk factors assist the anesthesia provider in predicting the difficulty of managing a patient's airway and is paramount to the anesthesia provider's ability to provide the appropriate level of care (Kollmeier et al., 2021). Practitioners who do not regularly perform intubations should not attempt intubating a patient with a difficult airway. Failed intubation attempts lead to gastric insufflation and possible aspiration, trauma to the airway, and blood and secretions in the airway; these alterations to the airway only further complicate the intubation process and can lead to complete airway obstruction (Kollmeier et al., 2021). Once a difficult airway has been identified, anesthesia providers should limit direct laryngoscopy intubation attempts, have difficult airway equipment readily available, be prepared to change techniques, and the most experienced provider should handle subsequent intubation attempts (Kollmeier et al., 2021). The ASA Difficult Airway Taskforce publishes guideline updates to guide the care of a patient with a difficult airway and reduce adverse outcomes. The ASA difficult airway algorithm has led to increased patient comfort and faster successful management of the difficult airway when it is both unanticipated or anticipated (Koenig, 2010).

Difficult Airway Algorithm

> Practice guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints, and are not intended to replace local institutional policies.

> In addition, practice guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements… Practice guidelines are subject to revision as needed by the evolution of medical knowledge, practice, and technology. They provide standard recommendations which are supported by analysis and synthesis of the current literature, practitioner and expert opinion, clinical feasibility data, and open-forum commentary (Apfelbaum et al., 2013, p. 251).

The most critical task performed by anesthesia providers is maintaining oxygenation. Management of the difficult airway requires a prompt response to deter patient harm. It may be challenging for the student to respond promptly due to cognitive overload in a highly stressful environment. Cognitive aids such as difficult airway management algorithms have been shown to both provide a framework for appropriate decision-making and reduce cognitive overload (Koenig, 2010). Before the development of published airway algorithms, difficult airway management depended solely on the skills of an experienced practitioner. However, airway management recommendations that have been systematically developed provide standardized and streamlined patient care, which results in improved patient outcomes (Koenig, 2010).

The Difficult Airway Algorithm OSCE that will be developed follows the difficult airway algorithm that was created by the ASA. The ASA difficult airway algorithm was chosen because this algorithm is the guideline endorsed by the AANA. The ASA difficult airway algorithm was not created to be an absolute requirement (Koh et al., 2016, p. 244). The ASA's difficult airway algorithm does not ensure any specific clinical outcome and is subject to modification as medical knowledge and technology

evolve (Apfelbaum et al., 2013, p. 63). The ASA's difficult airway algorithm provides basic recommendations that are validated by a combination of up-to-date literature, expert knowledge, practitioner feedback, and clinical data (Apfelbaum et al., 2013, p. 52).

The updated 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway (Apfelbaum et al., 2013, p.251) differs from the 2013 ASA difficult airway algorithm (Apfelbaum et al., 2021, 31-51) in the following ways:

- It was developed by an international task force of anesthesiologists.
- It includes considerations for patients whose airways are being managed while awake.
- It reviews updated information regarding equipment for both standard and advanced difficult airway management.
- It includes recommendations for utilizing supplemental oxygen prior to and during the difficult airway management process.
- It includes evidence for the extubation process for the difficult airway.
- It offers non-invasive and invasive alternatives for managing the difficult airway.
- It highlights awareness of the passage of time and limiting the number of attempts of different devices and techniques during difficult airway management.
- It provides new algorithms concerning both adult and pediatric difficult airway management.

The scenarios that were demonstrated by the Difficult Airway Algorithm OSCE included the following scenarios and were created by utilizing the 2013 ASA difficult airway algorithm (Apfelbaum et al., 2013, 251-262):

- Difficult facemask or laryngeal mask airway (LMA), intubating LMA, or fast track LMA: It is not possible for the anesthesia provider to provide adequate ventilation because of one or more of the following complications: inadequate mask or SGA seal, excessive gas leakage, or excessive resistance to the entrance or exit of gas. Signs of inadequate ventilation include, but are not limited to, absent or inadequate chest rise and fall, absent or inadequate breath sounds, auscultatory signs of severe obstruction, cyanosis, gastric air entry or dilatation, decreasing or inadequate oxygen saturation (SpO2), absent or inadequate exhaled carbon dioxide, absent or inadequate spirometric measures of exhaled gas flow, and hemodynamic changes associated with hypoxemia or hypercarbia such as hypertension, tachycardia, and arrhythmia.
- Difficult supraglottic airway (SGA) placement: SGA placement requires multiple attempts in the presence or absence of tracheal pathology.
- Difficult laryngoscopy: it is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy.
- Difficult tracheal intubation: tracheal intubation requires multiple attempts in the presence or absence of tracheal pathology.
- Failed intubation: placement of the endotracheal tube fails after multiple attempts.

ASA Difficult Airway Algorithm Steps (Apfelbaum et al., 2013, 251-262):

1. Assess the likelihood and clinical impact of six basic management problems:
    - difficulty with patient cooperation or consent
    - difficult mask ventilation
    - difficult supraglottic airway placement
    - difficult laryngoscopy
    - difficult intubation
    - difficult surgical airway access
2. Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.
3. Consider the relative advantages and practicality of basic management choices such as:
    - awake intubation versus intubation after induction of general anesthesia
    - non-invasive technique versus invasive techniques for the initial approach to intubation
    - video-assisted laryngoscopy as an initial approach to intubation
    - preservation vs. ablation of spontaneous ventilation
4. Develop primary and alternative strategies.

Awake Intubation

Consider an airway approach by non-invasive intubation; if successful, no further action is required. If not successful, consider the following: cancel the case, consider the feasibility of alternative approaches, or proceed to invasive airway access. Initially, proceeding to invasive airway access is also an option. Alternative approaches include but are not limited to using a face mask or supraglottic airway anesthesia, blockade of

regional nerves, or infiltration of local anesthesia. The pursuit of alternative approaches usually implies that mask ventilation will likely be successful. If the alternative approaches are inadequate during any particular step in the algorithm, proceed to the Emergency Pathway. "Invasive airway access includes surgical or percutaneous airway, jet ventilation, and retrograde intubation" (Apfelbaum et al., 2013).

Intubation After Induction of General Anesthesia

If the initial intubation attempt is successful, no further action is required. If the initial intubation attempt is unsuccessful, call for help and consider returning the patient to spontaneous ventilation and awakening the patient (Apfelbaum et al., 2013).

Face Mask Ventilation

The non-emergency pathway is considered when ventilation is adequate, yet the intubation is unsuccessful. If ventilation is adequate and intubation is unsuccessful, advance to alternative approaches to intubation. Alternative approaches to "difficult intubation include but are not limited to video-assisted laryngoscopy, alternative laryngoscope blades, supraglottic airway, fiberoptic intubation, intubating stylet or tube changer, light wand, and blind oral or nasal intubation" (Apfelbaum et al., 2013 p. 256). If alternative approaches to intubation result in successful intubation, no further action is required. If intubation remains unsuccessful after the application of alternative approaches, consider the following: invasive airway access, alternative approaches that have not been previously attempted, and awakening the patient. If the patient is awakened, the option remains to consider re-preparation of the patient for awake intubation or canceling the surgery.

If face mask ventilation is not adequate, consider attempting the SGA. If SGA ventilation is adequate, advance to the adequate Face mask ventilation non-emergency pathway. If SGA is not adequate or feasible, advance to the Emergency Pathway. The Emergency Pathway is when both ventilation is not adequate, and intubation is not successful. Emergency Pathway: call for help, advance to emergency non-invasive airway ventilation. Emergency non-invasive airway ventilation consists of the SGA. If the non-invasive emergency airway is successful in ventilating the patient, advance to the following options: invasive airway access, alternative approaches, or awaken the patient. If emergency non-invasive airway ventilation is unsuccessful, advance to the invasive airway access approaches (Apfelbaum et al., 2013).

Adverse Outcomes

"Difficult or failed airway management in anesthesia is a major contributor to patient morbidity and mortality, including potentially preventable adverse outcomes such as airway trauma, damage to teeth, brain injury, cardiopulmonary arrest, or death" (Barash et al., 2018, p. 1977). Some studies suggest that more than 90% of difficult airways are unanticipated (Kollmeier et al., 2021). Difficult and failed airway management account for 2.3% to 16.6% of anesthetic deaths (Barash et al., 2018, p. 1913).

Additional complications experienced by patients with a difficult airway include pulmonary aspiration, esophageal intubation, and failed airway management. Considerations to reduce these complications include anesthesia clinician and anesthesia student preparedness, thorough patient assessment and planning, proper communication between healthcare providers, and a standardized airway management protocol or

algorithm (Cook & MacDougall-Davis, 2012, p. 73). SRNAs are expected to be able to manage a patient's airway in a variety of situations. Inability to manage a difficult airway in the clinical setting can lead to increased student anxiety, decreased intubation success, and poor patient outcomes (Wands & Minzola, 2015, p. 406). The "purpose of the ASA difficult airway algorithm is to facilitate the management of the difficult airway and to reduce the likelihood of adverse outcomes" (ASA, 2013, p. 252).

Rationale

"In 1990, George Miller outlined a model for the assessment of clinical competency. Miller's pyramid model divides the development of clinical competence into four hierarchical processes" (Witheridge et al., 2019, p. 191). The "pyramid consists of four stages: knows, knows how, shows how, and does. Miller's pyramid model divides the development of clinical competence into four hierarchical processes" (Ramani & Leinster, 2008, p. 352). At the lowest level of the pyramid is knowledge; knowledge is tested by traditional written exams. The next level knows how represents the application of knowledge which is assessed by clinical problem-solving. The third tier shows how to demonstrate the use of clinical skills, which are assessed by OSCE, standardized patients, or clinical competency exams (Ramani & Leinster, 2008, p. 354). Finally, on top of the pyramid, it does, which is assessed by observation of daily direct clinical performance.

The lower tier levels represent the cognitive components of aptitude and include classroom-based assessments (Witheridge et al., 2019, p. 191). The two higher tiers of the pyramid represent the interactive components of clinical competence, which involves assessment in both simulated and real clinical settings (Witheridge et al., 2019, p. 191). The observable behavior is at the apex of the hierarchy because Miller's pyramid implies

a preference for the actual observable actions as opposed to cognitive assessments (Witheridge et al., 2019, p. 192). Miller's model suggests that performance-based assessments, such as those experienced in OSCEs, could provide an approximation to how students will behave in the actual clinical setting and, therefore, are the preference for cognitive assessments (Witheridge et al., 2019, p. 192).

The performance-based assessment as a competence concept has led to increased use of OSCEs in the assessment of medical training (Witheridge et al., 2019, p. 192). The Difficult Airway Algorithm OSCE embodies the "shows how" tier and requires the learner to demonstrate the integration of cognitive and performance-based skills into successful clinical performance (Ramani & Leinster, 2008, p. 354). In addition to assessing the "shows how" tier, the Difficult Airway Algorithm OSCE also has the ability to assess knows and knows how tiers; it is postulated that a student must know and know-how prior to showing how (Khan et al., 2013, p. 1441). The OSCE is an assessment technique that presents many benefits to nurse anesthesia students and additionally provides the most theoretically beneficial structure for the proposed Difficult Airway Algorithm OSCE project.

DNP Essentials

Using the Doctor of Nursing Practice (DNP) Essentials is fundamental to the development of the Difficult Airway Algorithm OSCE (American Association of Colleges of Nursing [AACN], 2006). This project was established utilizing the DNP essentials listed in Appendix C as well as the following DNP Essentials:

1. Essential One: Scientific Underpinning for Practice

    The Difficult Airway Algorithm OSCE provided USM's NAP with an evidence-based protocol demonstrating the approach to managing the difficult airway. The difficult airway algorithm that was demonstrated was developed by the ASA.

2. Essential Two: Organizational and Systems Leadership for Quality and Improvement and Systems Thinking

    Essential two requires using a team-styled approach to meet the goals of the project. The Difficult Airway Algorithm OSCE development involves two doctoral candidates as well as an expert panel. The members of the expert panel appraised the Difficult Airway Algorithm OSCE before it was presented to USM's NAP for acceptance.

3. Essential Three: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

    Essential three requires the application of up-to-date, evidence-based research to meet the objectives of this project. Peer-reviewed journals, articles based on expert findings, and best-practice guidelines were used to create the Difficult Airway Algorithm OSCE.

4. Essential Six: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

    The team of experts who assessed the Difficult Airway Algorithm OSCE before it was presented to USM's NAP was comprised of members from a variety of areas, such as USM nurse anesthesia instructors and current

practicing nurse anesthetists. The panel of experts evaluated and provided feedback for modifications and amendments to the Difficult Airway Algorithm OSCE.

Specific Objectives

The primary goal of this doctoral nursing project is to create an OSCE that will improve student understanding and competence in managing the difficult airway using the ASA difficult airway algorithm. Through the Difficult Airway Algorithm, OSCE student knowledge and application of knowledge will be assessed using the ASA difficult airway algorithm. The Difficult Airway Algorithm OSCE allows for well-structured and organized assessment in the evaluation of students' competence in the management of the difficult airway. The goal of the Difficult Airway Algorithm OSCE is to increase USM's NAP participation in using OSCEs to assess the competency of nurse anesthesia students. The Difficult Airway Algorithm OSCE will also accomplish the goal of increasing student knowledge on difficult airway management. The Difficult Airway Algorithm OSCE will result in increased nurse anesthesia student skill efficiency and increased clinical competence. The overall goal of demonstrating the ASA difficult airway algorithm through an OSCE is to increase patient safety and student objective skill in the clinical setting.

Summary

USM's NAP students will benefit from utilizing the Difficult Airway Algorithm OSCE. The Difficult Airway Algorithm OSCE not only functions as an assessment tool but as a reference for learning as well. The Difficult Airway Algorithm OSCE allows students a hands-on approach in addition to didactic learning. The Difficult Airway

Algorithm OSCE allows students to simulate clinical scenarios that demonstrate the identification and management of the difficult airway without altering actual patient safety. Simulating clinical scenarios outside of the actual clinical setting decreases student stress levels, increases student confidence, and increases the likeliness of successful student performance when subjected to actual situations in the clinical setting. The Difficult Airway Algorithm OSCE ultimately provides the optimal learning experience while avoiding risks to actual patient safety.

CHAPTER II - METHODOLOGY

Introduction

Airway management is an essential component of providing safe anesthesia. Management of the difficult airway is a valuable skill. Students may be unprepared to manage a difficult airway in the clinical setting due to limited exposure. Lack of preparation in the management of the difficult airway can result in poor patient outcomes, including brain injury and death, and poor student outcomes, including increased anxiety and decreased intubation success (Wands & Minzola, 2015). Therefore, to assist in preventing adverse patient and student outcomes, an OSCE for the management of the difficult airway was developed based on evidence-based, peer-reviewed literature. A video demonstration of the Difficult Airway Algorithm OSCE was also recorded. The Difficult Airway Algorithm OSCE and demonstration video were disseminated at The School of Leadership and Advanced Nursing Practice, DNP Scholarship day on March 4, 2022, and presented to USM's NAP administration for consideration of implementation in the nurse anesthesia curriculum.

Context

The University of Southern Mississippi (USM) is a state-supported university located in Hattiesburg, Mississippi. The USM NAP is a three-year doctoral program. The first 12 months of the program are didactic, and the remaining 24 months are comprised of didactic and clinical experience. The USM NAP admits 25 students into each cohort annually, and there are three cohorts. The USM NAP is seeking evidenced-based OSCEs to uniformly evaluate students on their clinical performance. USM NAP students learn airway management skills during the third semester of the first year, prior to clinical

rotation. USM The Difficult Airway Algorithm OSCE has the potential to improve the clinical competency of the nurse anesthesia student in the management of the difficult airway. The specific aim will be to assess a student's understanding of airway management and the application of clinical skills in relation to managing a difficult airway. The Difficult Airway Algorithm OSCE will also offer a platform for instructors to fairly evaluate the student with limited bias. The short-term goal of this project is to increase the USM NAP students' foundational knowledge of the management of the difficult airway. Implementation of this Difficult Airway Algorithm OSCE has the potential to decrease stress levels related to difficult airway management during clinical scenarios (Wands & Minzola, 2015). Additionally, the Difficult Airway Algorithm OSCE will evaluate the students' clinical skills in a standardized manner and provide students with feedback in areas that need improvement. The use of the Difficult Airway Algorithm OSCE in the nurse anesthesia program has the potential to improve patient outcomes by producing safe and competent anesthesia providers.

A targeted review of the literature was performed to obtain current best practice guidelines for managing the difficult airway. Difficult airway algorithms are well documented in the literature as a valuable tool in managing the difficult airway. This Difficult Airway Algorithm OSCE was created utilizing the American Society of Anesthesiologists (ASA) difficult airway algorithm. The ASA Difficult Airway Algorithm is endorsed by the American Association of Nurse Anesthetists (AANA). This doctoral project will serve to bridge the gap in knowledge by developing an OSCE that serves as a training tool for NAP students preparing to enter the clinical setting. The goal of this Difficult Airway Algorithm OSCE is to serve as an effective evaluation tool for

the clinical instructor in determining the student's readiness to manage the difficult airway of an actual patient.

Intervention

1. The proposed project was submitted to the USM IRB for oversight of human research liability and was approved under protocol number 21-433 (Appendix D).
2. Informed consent (Appendix E), an email invitation (Appendix F), the Difficult Airway Algorithm OSCE (Appendix G), and a link to a survey (Appendix H) were composed.
3. A panel of experts consisting of USM NAP faculty, USM clinical affiliates, and 2nd and 3rd-year SRNAs was formed. Email addresses were requested of selected USM clinical affiliates by SRNAs for voluntary participation in the Difficult Airway Algorithm OSCE assessment process. All surveys were submitted confidentially through the Qualtrics software system.
4. Responses from the research participants were compiled into a table, and quantitative and qualitative data analysis was performed.
5. Responses from the panel of experts were evaluated, and any necessary changes were implemented.
6. The Difficult Airway Algorithm OSCE was approved by the DNP project committee.
7. A demonstration video was recorded based on information obtained from the literature review and feedback from the panel of experts.

8. The Difficult Airway Algorithm OSCE and demonstration video were disseminated at SLANP DNP Scholarship Day.
9. The Difficult Airway Algorithm OSCE and demonstration video were presented to the administration of USM's NAP for consideration for implementation in the nurse anesthesia curriculum.
10. After dissemination, physical data was destroyed by a paper shredding device, and electronic data was deleted from a password-protected computer. In addition to the deleting of these materials, the trash was properly disposed of to ensure complete destruction and disposal of all related physical data.
11. Neither compensation nor repercussion for participation or non-participation was rendered. All participation was non-compensated and on a voluntary basis.

Measures and Instruments Used to Study Intervention

A survey (Appendix H) was conducted to measure the quality and educational outcome of the Difficult Airway Algorithm OSCE. The survey questioning covered the following five topics directed at quantitative and qualitative data:

1. Consent to the survey was confirmed by asking, "Do you consent to participation?" Participation in assessing the OSCE is voluntary, and the participants did not receive any financial reimbursement or benefit for participating.
2. It was assessed if the participant was an SRNA or a CRNA by asking, "Are you an SRNA or CRNA?" The participants were divided into a group of

CRNAs and a group of SRNAs, and responses were reviewed for each group of participants.

3. Participants were asked if they believed the objectives of the Difficult Airway Algorithm OSCE were clearly presented by asking, “Were the OSCE’s objectives clearly presented?” The aim is to have the OSCE’s objectives be as clear as possible.
4. Participants were asked if they believed the information provided in the OSCE was evidence-based and up-to-date with current practice by asking, “Was the information provided in the OSCE evidence-based and up-to-date with current practice?” Because the panel of participants surveyed are experts in the field of airway management, their judgment, and clinical expertise are greatly valued.
5. It was assessed if the Difficult Airway Algorithm OSCE provides didactic references needed to complete the procedure by asking, “Does the OSCE provide didactic references needed to complete the procedure?” Because the aim is to provide an OSCE that can be adopted into the USM NAP curriculum, the references needed to complete the procedure should be included in the OSCE.
6. The purpose of the survey was to identify areas for improvement before the publication of the Difficult Airway Algorithm OSCE. Participants were asked to give any suggestions or comments for improvement of the OSCE by asking, “Do you have any suggestions or comments regarding the OSCE?” Because the panel of participants included those with knowledge in the area of anesthesia, the personal experience of these participants is highly valued. Participants were asked to provide guidance on any missing items or suggested additional items.

Analysis

The suggestions of each respondent were taken into consideration. It is important that the responses allowed for the authors of Difficult Airway Algorithm OSCE to make necessary suggested changes. For ease of assessment of responses, the choices of responses consisted of the following: Yes, No, SRNA, CRNA, and an option to write suggestions for improvement. Once the survey results were gathered, each response was evaluated, and the received responses were transferred to a data table and analyzed by the chair leaders and NAP authors of the Difficult Airway Algorithm OSCE.

Design

OSCE Development

Using research and the ASA Difficult Airway Algorithm, an OSCE (Appendix G) was developed. The OSCE contained background information about the OSCE, simulation patient information, steps to complete the OSCE, and a uniform grading rubric that outlined the critical steps which must be met to pass. A video demonstrating the proper steps to take to complete the OSCE was also filmed for review. After development, the OSCE was evaluated for accuracy and for the use of evidence-based practice by a panel of experts consisting of faculty members from clinical preceptors from USM's clinical affiliates, and the USM NAP. Clinical preceptors from USM's clinical affiliates were selected for their expertise in the management of the difficult airway, and faculty members from the USM NAP were selected for their expertise in the evaluation of nurse anesthesia students. Second-year and third-year student registered nurse anesthetists (SRNA) in the USM NAP were also utilized to evaluate the OSCE. In order to ensure the highest quality of educational material, a standardized grading rubric,

as referenced in Appendix G, that outlined fundamental objectives which were expected to be followed according to the supplemental material and OSCE simulation video was reviewed by both USM clinical affiliates and USM NAP faculty.

Participant Recruitment

The panel of experts, as well as the second and third-year USM NAP students, were recruited via email. For USM students and faculty, an email was disseminated via USM's emailing system. For USM clinical affiliates, email addresses were obtained from participating CRNAs. Participation from CRNAs was considered voluntary and had no associated monetary gain. Separate emails (Appendix F) were sent out to the USM NAP faculty members, clinical preceptors, and SRNAs. The emails stated that volunteers were being sought to provide feedback on an OSCE related to the management of a difficult airway. Additionally, the emails had a disclaimer that assured the participants that their participation would remain anonymous and the collected data would remain confidential. Participants were assured that participation in the survey was completely voluntary, and that non-participation would not result in any type of repercussion. Additionally, informed consent (Appendix E) was included in the email and obtained before participation in the study.

Evaluation

The Difficult Airway Algorithm OSCE was evaluated by the authors, the panel of experts, and USM NAP students. The evaluators reviewed the OSCE and supporting material which was provided via e-mail. The evaluator was tasked with determining the validity, objectiveness, and effectiveness of the proposed OSCE. Evaluators were requested to complete a survey that was developed and uploaded to Qualtrics™. The

survey link was received by evaluators via email and was requested to be completed after evaluating the OSCE and supporting material. The survey included a section for evaluators to add comments or suggestions. The survey and access to the OSCE were open for a period of two weeks. After the allotted time, the results of the survey were analyzed. Based on the feedback from the survey, necessary changes were made to the OSCE template and submitted to the evaluation committee for review.

Implementation

After the completed Difficult Airway Algorithm OSCE was approved by the committee, it was presented to the USM NAP administration for adoption into their OSCE curriculum. The finished doctoral project was also presented to the public at the Spring 2022 USM School of Leadership and Advanced Nursing Practice DNP Scholarship Day. Afterward, the OSCE was presented to the USM NAP for implementation at the USM NAP student simulation laboratory. The population required for completion of the Difficult Airway Algorithm OSCE is one faculty member for each group of two to three SRNAs. The USM NAP simulation lab simulates a real-life operating room scenario which potentially increases the effectiveness of the difficult airway algorithm simulation.

Ethical Consideration

A potential ethical consideration of Difficult Airway Algorithm OSCE is having two standards of education. If there were multiple professors teaching the same information and one decided to utilize the Difficult Airway Algorithm OSCE while the others did not, the result could be two different standards of education. There are no

anticipated conflicts of interest. In an effort to avoid ethical conflicts, the project was submitted to the USM IRB for oversight of human research liability.

Summary

In summary, airway management is a crucial element of delivering safe anesthesia care. Difficult airway management is a valuable skill that students may not be prepared to apply in the clinical setting due to limited exposure. Hence, to assist in preventing adverse student and patient outcomes, the Difficult Airway Algorithm was developed based on evidence-based, peer-reviewed literature, and a video demonstration of the Difficult Airway Algorithm OSCE was recorded. The Difficult Airway Algorithm OSCE and demonstration video were disseminated at The School of Leadership and Advanced Nursing Practice, DNP Scholarship Day on March 4, 2022, and presented to USM's NAP administration for consideration of implementation in the nurse anesthesia curriculum.

CHAPTER III – RESULTS

Introduction

The University of Southern Mississippi Nurse Anesthesia Program lacks a uniform method to assess clinical competency in nurse anesthesia students for the management of difficult airways. The Difficult Airway Algorithm OSCE can be used to objectively assess airway management skills while limiting bias. The purpose of this doctoral project was to provide an evidence-based objective, structured clinical examination, clinical scenario, and video demonstration to The University of Sothern Mississippi Nurse Anesthesia Program for the identification and management of the difficult airway using the ASA Difficult Airway Algorithm (Apfelbaum et al., 2013).

Steps of the Intervention

The Difficult Airway Algorithm OSCE was approved by the DNP chair and committee. After approval, the Difficult Airway Algorithm OSCE was edited and finalized based on evidence-based practice methods. The OSCE included the expected learner outcomes and objectives, required supplemental reading and lecture material, needed equipment and supplies, process instructions, and an assessment rubric. The Difficult Airway Algorithm OSCE demonstration video also accompanied the OSCE packet. The OSCE video demonstrates the proper expected steps in managing a patient with a difficult airway and includes the critical portions of the assessment and management process. The OSCE, survey questions and informed consent were approved by the USM IRB. After this approval process, the final recruitment for the board of experts was completed. The panel of experts included practicing CRNA preceptors and USM NAP faculty, who each regularly interact with patients who have difficult airways

and have frequent experience educating student nurse anesthesia providers. The panel of experts was consulted throughout the process research and development process. After the conclusion of constructing the OSCE, a set of questions was developed to assess the effectiveness and quality of the OSCE. The questionnaire was dispersed to a wide range of anesthesia providers, including nurse anesthesia students and practicing CRNAs.

The survey packet included the Difficult Airway Algorithm OSCE (Appendix G), the informed consent (Appendix E), and the survey (Appendix H). The survey was sent to the panel of experts, nurse anesthesia students, and selected practicing CRNAs. The survey was anonymously sent utilizing Qualtics©, and the received data did not contain any identifying information. The following questions were included in the survey questionnaire: (1) if the participant consented to participation, (2) if the participant was a CRNA or SRNA, (3) if the OSCEs objectives were presented clearly, (4) if the presented information was evidenced-based and up to date, (5) if the OSCE provided didactic references, (6) and the last question was free text requesting any additional suggestions and feedback. The questions that agree or disagree with options for selection are included in Figure 1.

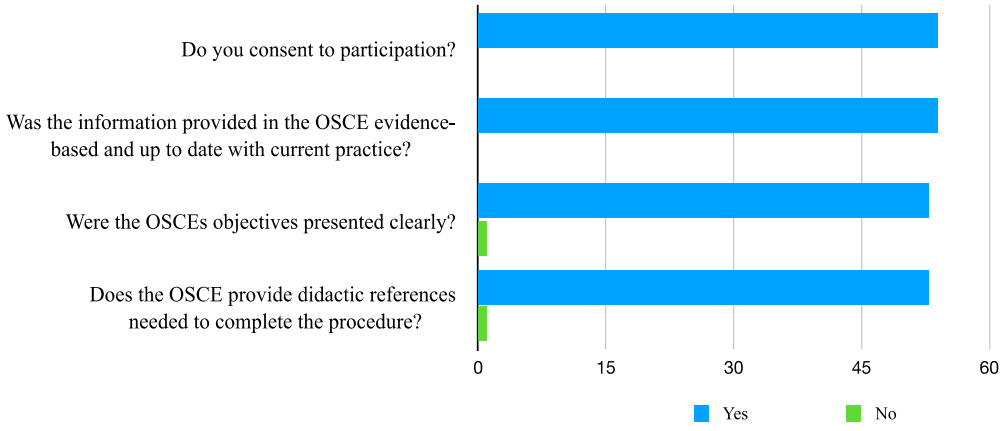


Figure 1. Responses to Yes or No Survey Questions

There was a total of 54 participants. One hundred percent of the participants agreed that the information provided in the OSCE was evidence-based and up to date with current practice. Ninety-eight percent of the participants agreed that proper didactic references were provided, and the OSCEs objectives were presented clearly. There were two survey questions that did not include agreed or disagreed options. One question asked if the participants were SRNAs or CRNAs. Seventy-four percent of the participants were SRNAs, while twenty-six percent were CRNAs. The final question was a free text question requesting suggestions and comments. Four of the eleven free-text comments were included in Table 1. The comments that are not included simply stated, “Great job!” or “no,” that the responder did not have any comments or suggestions.

Table 1

Selected Free-Text Responses to Question 6

Responder	**Comments**
51	The first objective asks us to identify 3 difficult airway scenarios. Only one is presented in the case study, I am wondering if you meant to identify three methods that could be used in the ONE scenario? That was unclear. 1. Identify the three difficult airway management scenarios In the Second objective: I’d suggest changing “how to manage the difficult airway” to difficult airway management.
52	Great OSCE, incredibly useful.
18	An outstanding OSCE that demonstrates what an OSCE should be.
13	Provide algorithm as an additional visual aid with the OSCE packet.

The survey was sent to 36 SRNAs and 29 CRNAs. The survey remained open for two weeks, and a reminder survey was sent after one week prior to the survey closing. The response rate was 83% and included 40 SRNAs and 14 CRNA. The majority of qualitative responses stated that the OSCE was incredibly useful and well thought out.

Limitations

The limitations were taken into consideration. There was a small sample size addressed; however, the selected panel members are either expert airway management providers or students who are actively learning up-to-date, evidence-based practice concerning airway management. Although the sample size was small, the selected participants specialize in airway management and were able to provide beneficial and practical feedback. Another noted limitation was the number of questions in the survey. The survey was made as brief and concise as possible to decrease interaction time and possibly increase willingness to participate. The survey size limitation was taken into consideration prior to sending the survey, and to assuage this limitation, a question requesting additional feedback and suggestions provided an open door for respondents to add any additional information not covered in the agree or disagree questions. The last noted limitation was that not all of the consulted medical providers were invited to participate in the survey. There were several medical residents and nurse practitioners consulted throughout the research process concerning the ease of understanding the OSCE instructions from the viewpoint of an advanced medical provider who does not specifically specialize in airway management. The decision to exclude these medical

providers was made on the basis of wanting to receive the most beneficial feedback from providers who specifically specialize in airway management.

Outcomes

The Difficult Airway Algorithm OSCE provides an evidence-based process for managing a patient with a difficult airway. The OSCE and video demonstration will serve as an up-to-date, evidence-based valuable resource for all medical providers; however, the information is especially beneficial to medical providers who specialize in airway management. The problem statement presented to USM's NAP concerning the lack of a uniform evaluative measure for student nurse anesthesia providers has been fulfilled by The Difficult Airway Algorithm OSCE. The survey process allowed the surveyors the opportunity to assess the effectiveness of the provided information and gain valuable feedback. The feedback received confirmed that the Difficult Airway Algorithm OSCE has the potential to provide an effective, evidence-based, standardized evaluative tool to assess and train student nurse anesthesia providers.

CHAPTER IV – DISCUSSION

In summary, the high response rate received from the Difficult Airway Algorithm OSCE survey was in support of the OSCE. Participants agreed that the OSCE was up-to-date with current practice and that it was incredibly useful and well thought out. A major strength of the project is that even though a small population was surveyed, that population practically applies airway management routinely. The population specifically excluded first-year SRNAs who had not yet had experience in airway management in the clinical setting. The population included second and third-year SRNAs who are in the clinical setting an average of forty hours per week, practicing airway management on a routine basis. The population also included full-time CRNAs who manage airways frequently, as well as CRNA faculty members familiar with airway education and the use of OSCEs. This population responded to the survey stating that the Difficult Airway Algorithm OSCE was incredibly useful, well thought and up-to-date with current practice. Qualitative feedback concerning the clarity of the OSCE instructions was taken into consideration. All adjustments made to the OSCE maintained evidence-based practice standards and were approved by the DNP chair.

Interpretation

The Difficult Airway Algorithm OSCE has the potential to positively impact both SRNAs and patients as well as generate new knowledge in the field of airway management education and skills evaluation. After a literature review, no other published OSCEs on the utilization of the difficult airway algorithm to compare the Difficult Airway Algorithm OSCE to were identified. Therefore, disseminating this OSCE will generate new knowledge in the field of airway management education and skills

evaluation. The Difficult Airway Algorithm OSCE has the potential to increase student satisfaction and preparation when faced with a difficult airway in the clinical setting. Furthermore, the Difficult Airway Algorithm OSCE has the potential to reduce adverse outcomes associated with a difficult airway, such as patient death, brain injury, cardiopulmonary arrest, unnecessary surgical airway, airway trauma, and damage to the teeth by student nurse anesthetists. The only potential costs associated with the implementation of the Difficult Airway Algorithm OSCE are the time it would take to orient faculty and staff to using the OSCE, and the time it would take to administer the OSCE.

It is also to be noted that Dr. William H. Rosenblatt, a professor of anesthesiology at the Yale School of Medicine, presented a Sneak Preview of The New ASA Difficult Airway Guidelines at the American Association of Nurse Anesthetists Annual Congress in August of 2021. According to the new guidelines he presented, the only major updates to the Difficult Airway Algorithm are a focus on limiting the number of intubation attempts, calling for additional help early, and optimizing oxygenation throughout attempts to secure the patient's airway. All of these updates have been included in the Difficult Airway Algorithm OSCE.

Conclusions

In conclusion, the Difficult Airway Algorithm OSCE has the potential to be a useful training and educational tool across the healthcare spectrum. The Difficult Airway Algorithm OSCE can be used as a training evaluation for SRNAs in their first, second, and third years of training throughout nurse anesthesia programs as their knowledge and skill level improves throughout their training. In addition to being utilized by SRNAs

from the University of Southern Mississippi, the OSCE could also be utilized by SRNAs from other nurse anesthesia programs as well.

Furthermore, the Difficult Airway Algorithm OSCE could be used as a training tool for medical students, anesthesia assistants, physician assistants, respiratory therapists, paramedics, and emergency medical technicians. The OSCE could also be used for airway practice and continuing education for CRNAs and medical doctors. The utilization of the Difficult Airway Algorithm OSCE as a training tool is especially significant in the Face of COVID-19 with the added rigor and frequency of airway management that the aforementioned healthcare professionals have experienced as a result of the virus.

A point of further research would be to demonstrate the use of the airway equipment included in the Difficult Airway Algorithm OSCE. A future researcher could focus on explaining how to use the various tools included in the Difficult Airway Algorithm OSCE, such as a laryngeal mask airway, a bougie, a flexible endoscope for fiberoptic intubation, and a video-assisted laryngoscope. Further researchers could also focus on demonstrating how to perform emergency airway procedures such as a cricothyrotomy.

In summary, the Difficult Airway Algorithm OSCE has the potential to be a useful tool for USM NAP students. The implementation of this OSCE could facilitate learning and reduce bias in evaluating clinical airway skills while doing so. The NAP faculty have expressed their support of this project and have the means to support its use. The Difficult Airway Algorithm OSCE could be utilized as an asset to uniformly evaluate

the management of the difficult airway among nurse anesthesia students in the nurse anesthesia program.

APPENDIX A - Literature Matrix

Date of Publication	Author	Type of Evidence	Summary
18 October 2012	American Society of Anesthesiologists	Research article	There is no standard definition of a difficult airway. The practice guidelines outlined by the ASA term the difficult airway as any airway that is resistant to proper ventilation, intubation, or both. The ASA difficult airway algorithm was designed by a collection of both written data and clinician expertise.
2017	Barash, Paul G.; Cullen, Bruce F.; Stoelting, Robert K.; Cahalan, Michael K.; Stock, M. Christine; Ortega, Rafael; Sharar, Sam R.; Holt, Natalie F.	Book chapter	To understand the management of the difficult airway, the assessment of the airway and patient history that may complex the airway must be understood. Concepts such as airway equipment and delivery sources are important concepts discussed in this chapter which help lay the foundation for understanding management of the difficult airway.
16 May 2005	Katharine Boursicot, Trudie Roberts	Medical Journal Article	To disseminate and test information in a formal education setting, the information must be factual and the testing process must be organized in a manner that can be repeated reasonably for all students. The OSCE is new testing and student assessment strategy. The OSCE itself has a specific process that makes it a

			valuable assessment strategy.
5 Jun 2008	Mohammed Hijazi and Steven M. Downing	Medical Journal Article	Written exams have long been utilized as a means to assess medical students' preparedness for the clinical setting. However, written exams assess how a practitioner thinks. OSCEs are proving to be a more reliable resource for the assessment of what interventions a practitioner will implement.
February 2012	Karen Lucisano, Laura Talbot	Medical Journal Article	At one time, anesthesia students commonly practiced their airway skills on actual patients in the clinical setting. This article advocates for the simulation of airway management procedures versus students' first encounter with airway management being in the clinical setting.
25 October 2019	Annamaria Witheridge, Gordon Ferns, and Wesley Scott-Smith	Medical Journal Article	In 1990, George Miller identified the gap between traditional written assessments and real-life assessments. This article revisits what is known as Miller's pyramid, which advocates for the use of OSCEs. As stated through Miller's pyramid, the OSCE is not intended to assess cognitive skills, and it is utilized to assess observable behavior in the clinical setting.
December 2014	Linda L Wunder, Derrick C Glymph, Johanna Newman,	Medical Journal Article	This article outlines the importance of a structured assessment before the nurse anesthesia

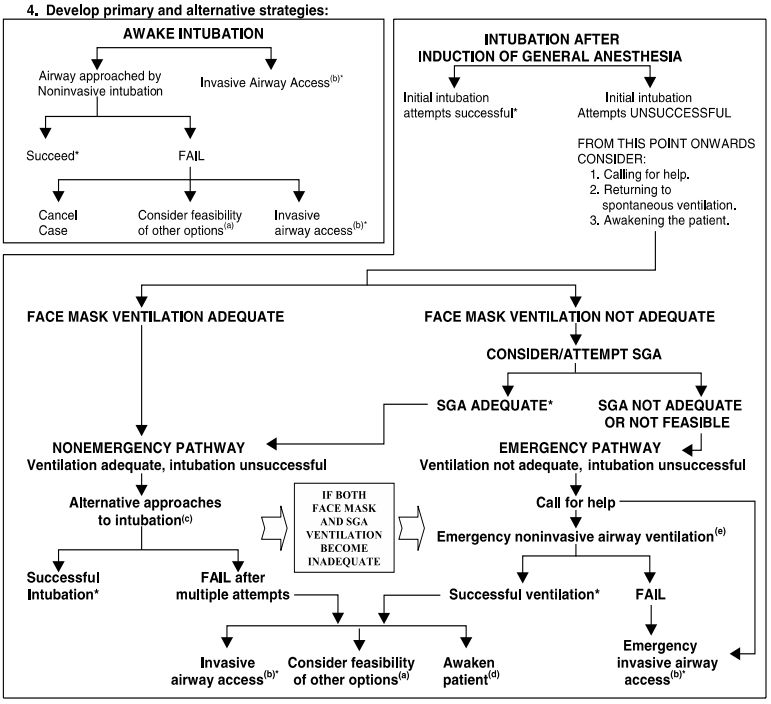
	Vicente Gonzalez, Juan E Gonzalez, Jeffrey A Groom		experiences the actual clinical setting. The OSCE has demonstrated consistent potential to be a valuable assessment tool for first-year nurse anesthesia students.

APPENDIX B – ASA Difficult Airway Algorithm

American Society of Anesthesiologists®

DIFFICULT AIRWAY ALGORITHM

1. **Assess the likelihood and clinical impact of basic management problems:**
   - **Difficulty with patient cooperation or consent**
   - **Difficult mask ventilation**
   - **Difficult supraglottic airway placement**
   - **Difficult laryngoscopy**
   - **Difficult intubation**
   - **Difficult surgical airway access**
2. **Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.**
3. **Consider the relative merits and feasibility of basic management choices:**
   - **Awake intubation *vs.* intubation after induction of general anesthesia**
   - **Non-invasive technique *vs.* invasive techniques for the initial approach to intubation**
   - **Video-assisted laryngoscopy as an initial approach to intubation**
   - **Preservation *vs.* ablation of spontaneous ventilation**
4. **Develop primary and alternative strategies:**



***Confirm ventilation, tracheal intubation, or SGA placement with exhaled CO_2.**

a. Other options include (but are not limited to): surgery utilizing face mask or supraglottic airway (SGA) anesthesia (e.g., LMA, ILMA, laryngeal tube), local anesthesia infiltration or regional nerve blockade. Pursuit of these options usually implies that mask ventilation will not be problematic. Therefore, these options may be of limited value if this step in the algorithm has been reached via the Emergency Pathway.

b. Invasive airway access includes surgical or percutaneous airway, jet ventilation, and retrograde intubation.

c. Alternative difficult intubation approaches include (but are not limited to): video-assisted laryngoscopy, alternative laryngoscope blades, SGA (e.g., LMA or ILMA) as an intubation conduit (with or without fiberoptic guidance), fiberoptic intubation, intubating stylet or tube changer, light wand, and blind oral or nasal intubation.

d. Consider re-preparation of the patient for awake intubation or canceling surgery.

e. Emergency non-invasive airway ventilation consists of a SGA.

Fig. 1. Difficult Airway Algorithm.

APPENDIX C – DNP Essentials

DNP Essentials	Clinical Implications
Essential One: Scientific Underpinnings	Research and collection of data on the evidence-based best practice related to the management of the difficult airway and presented through an OSCE to increase patient safety and improve student competence.
Essential Two: Organizational and Systems Leadership for Quality Improvement and Systems Thinking	Communication with a panel of experts regarding the proposed OSCE containing best-practice guidelines for use by SRNAs at the University of Southern Mississippi.
Essential Three: Clinical Scholarship and Analytical Methods for Evidence-Based Practice	Use of literature research and review of current evidence-based practice to create and implement an OSCE containing best-practice guidelines.
Essential Four: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	The goal of this project is to promote the standardized, evidence-based practice to improve Nurse Anesthesia Program students' clinical preparedness and increase correlating positive patient outcomes. This project was devised from evidence gathered using technology as a means to research this topic and the use of OSCEs.
Essential Five: Healthcare Policy for Advocacy in Health Care	This project advocate for an improvement in learning methods by the utilization of an OSCE by nurse anesthesia students with the goal of increased positive health outcomes.
Essential Six: Interprofessional Collaboration for Improving Patient and Population Health Outcomes	Collaboration with a selected panel of experts based on their advanced knowledge and experience in airway management and clinical instruction.

Essential Seven: Clinical Prevention and Population Health for Improving the Nation's Health	Implementation of a standardized educational tool to improve the clinical preparedness of students and decrease the number of adverse patient outcomes related to a lack of preparation in managing a difficult airway.
Essential Eight: Advanced Nursing Practice	Educating SRNAs on the management of the difficult airway to increase their clinical preparedness and the quality of patient care that they provide in the clinical area.

(American Association of Colleges of Nursing [AACN], 2006)

APPENDIX D – USM IRB Approval Letter

Office *of*
Research Integrity

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

118 COLLEGE DRIVE #5116 • HATTIESBURG, MS | 601.266.6756 | WWW.USM.EDU/ORI

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 submission on InfoEd IRB.
- The period of approval is twelve months. An application for renewal must be submitted for projects exceeding twelve months.

PROTOCOL NUMBER:	21-433
PROJECT TITLE:	Difficult Airway Algorithm Objective Structured Clinical Evaluation
SCHOOL/PROGRAM	Leadership & Advanced Nursing
RESEARCHERS:	PI: Brooke Degheb Investigators: Degheb, Brooke~Phipps, Cassandra~Collins, Mary Jane~
IRB COMMITTEE ACTION:	Approved
CATEGORY:	Expedited Category
PERIOD OF APPROVAL:	31-Jan-2022 to 30-Jan-2023

Donald Sacco, Ph.D.
Institutional Review Board Chairperson

APPENDIX E – Informed Consent

ORI | Office of Research Integrity

INSTITUTIONAL REVIEW BOARD

STANDARD (ONLINE) INFORMED CONSENT

STANDARD (ONLINE) INFORMED CONSENT PROCEDURES

The Project Information and Research Description sections of this form should be completed by the Principal Investigator before submitting this form for IRB approval. Use what is given in the research description and consent sections below when constructing research instrument online.

Last Edited May 13th, 2019

Today's date: December 13, 2021		
PROJECT INFORMATION		
Project Title: Difficult Airway Algorithm		
Principal Investigator: Brooke Degheb	Phone: 601-408-3214	Email: Brooke.degheb@usm.edu
College: Nursing and Health Professions	School and Program: School of Leadership and Advanced Nursing Practice	

RESEARCH DESCRIPTION

1. **Purpose**:

The purpose of the survey is to provide an evidenced based objective structured clinical examination for anesthesia providers concerning diffficult airway management.

2. **Description of Study:**

An anonymous electronic survey will be utilized to evaluate an objective structured clinical examination for diffficult airway management. The survey can be completed in 30 minutes with minimal inconvenience to particpants. The data will be collected and analyzed for common themes. This data will be used to create an evidenced based objective structured clinical examination for anesthesia providers concerning diffficult airway management. Results will be disseminated at USM SLANP Scholarship Day in March 2022.

3. **Benefits:**

No benefits have been identified to the participant or to others as a result of participation in the study.

4. **Risks:**

The time required to complete this survey is the only expected inconvenience. The survey is brief and consists of six questions to minimize the inconvience to the participant.

5. **Confidentiality:**

The electronic survey is anonymous with no participant identifiers. Deidentified survey results will be kept confidential by storing on a password protected computer, and in a locked drawer. Following the dissemination of research results, electronic data will be destroyed by deleting from the password protected computer and trash bin will be deleted. Physical data will be destroyed by shredding.

6. **Alternative Procedures:**

The survey is voluntary with no repercussions for non-participation. Alternatives to participation will be the choice to not participate.

7. **Participant's Assurance:**

This project and this consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5125, Hattiesburg, MS 39406-0001, 601-266-5997.

Any questions about this research project should be directed to the Principal Investigator using the contact information provided above.

CONSENT TO PARTICIPATE IN RESEARCH

I understand that participation in this project is completely voluntary, and I may withdraw at any time without penalty, prejudice, or loss of benefits. Unless described above, all personal information will be kept strictly confidential, including my name and other identifying information. All procedures to be followed and their purposes were explained to me. Information was given about all benefits, risks, inconveniences, or discomforts that might be expected. Any new information that develops during the project will be provided to me if that information may affect my willingness to continue participation in the project.

Include the following information only if applicable. Otherwise delete this entire paragraph before submitting for IRB approval: The University of Southern Mississippi has no mechanism to provide compensation for participants who may incur injuries as a result of participation in research projects. However, efforts will be made to make available the facilities and professional skills at the University. Participants may incur charges as a result of treatment related to research injuries. Information regarding treatment or the absence of treatment has been given above.

CONSENT TO PARTICIPATE IN RESEARCH

By clicking the box below, I give my consent to participate in this research project.

☐ Check this box if you consent to this study, and then click "Continue." (Clicking "Continue" will not allow you to advance to the study, unless you have checked the box indicating your consent.)

If you do not wish to consent to this study, please close your browser window at this time.

APPENDIX F - Email Invitation

Dear Participant,

You are being invited to participate in a survey as part of a DNP project being conducted by Cassandra Phipps and Brooke Degheb at The University of Southern Mississippi. If you have any questions, please reach out to Cassandra.Phipps@usm.edu or Brooke.Degheb@usm.edu. The purpose of this project is to create an objective structured clinical examination (OSCE) that will improve student understanding and competence in managing the difficult airway using the ASA difficult airway algorithm.

The project presents minimal or no risk of harm to you. Questions will be asked using the online survey tool Qualtrics, which consists of six questions. The survey should take 30 minutes to complete. All information you share is anonymous and will be kept confidential. Your data will be unidentified and anonymous.

Your participation is completely voluntary. If you choose not to participate, you can stop taking the survey and exit your browser at any time. There will be no repercussions for non-participation. An informed consent is required and is included in the survey. This project and the informed consent form have been reviewed by The University of Southern Mississippi Institutional Review Board (IRB), which ensures that research projects involving human subjects follow federal regulations. This project falls under IRB protocol number 21-433. Refer to the informed consent for participant assurance information.

If you have any questions, please contact us using the information provided below.

Thanks in advance for your time and cooperation!

Brooke Degheb
[redacted]

Cassandra Phipps
[redacted]

Before beginning the survey, review the attached files:
Informed Consent
OSCE for Difficult Airway Management

Follow this link to the Survey:
https://usmuw.co1.qualtrics.com/jfe/form/SV_42W4z07b3RvxmWW

ANESTHESIA OBJECTIVE STRUCTURED CLINICAL EXAM
Difficult Airway Algorithm

LEARNER OUTCOMES: Students will be able to:

1. Properly use airway equipment to manage the difficult airway.
2. Be able to identify phases of the difficult airway algorithm.
3. Identify patients at risk for difficult intubation and select the appropriate airway algorithm
4. Understand roles in the difficult airway algorithm
5. Properly manage the difficult airway using the ASA difficult airway algorithm

DOMAINS:

Clinical Skill
Critical Thinking
Formative Evaluation-Feedback

PURPOSE:

The purpose of this OSCE is to assess the identification and management of the difficult airway using the ASA Difficult Airway Algorithm

LEARNER OBJECTIVES:

1. Identify the three difficult airway management scenarios
2. Demonstrate understanding of how to manage the difficult airway using the difficult airway algorithm
3. Appropriately select the proper airway algorithm path based on the patient's presentation

INDIVIDUAL OR GROUP OSCE: Group

REQUIRED READING and ASSOCIATED LECTURES:

1. Barash, P. G., Cullen, B. F., Stoelting, R. K., Cahalan, M. K., Stock, M. C., Ortega, R., Sharar, S. R., & Holt, N. F. (2017). Chapter 28 Airway Management. In Clinical anesthesia (8th ed., pp. 1901–1990). Wolters Kluwer.

2. Apfelbaum, J. L., Hagberg, C. A., Caplan, R. A., Blitt, C. D., Connis, R. T., Nickinovich, D. G., Hagberg, C. A., Caplan, R. A., Benumof, J. L., Berry, F. A., Blitt, C. D., Bode, R. H., Cheney, F. W., Connis, R. T., Guidry, O. F.,

Nickinovich, D. G., & Ovassapian, A. (2013). Practice guidelines for the management of the difficult airway. *Anesthesiology*, *118*(2), 251–270. https://doi.org/10.1097/aln.0b013e31827773b2

REQUIRED VIDEO: Difficult Airway Algorithm video

REQUIRED PARTICIPANTS: Student examinees (No more than a group of 3), Examiner

VENUE: USM Simulation Lab

STUDENT LEVEL OF OSCE: Semester 3-4

TIME ALLOTTED: 15-30 minutes

SEQUENTIAL PRACTICE & TESTING: Assessment graded on demonstration of knowledge. No further testing is required.

RECOMMENDED PRACTICE PRIOR TO EXAMINATION: Two attempts to become proficient at this OSCE. Three attempts to master this OSCE. 15-30 minutes for one attempt of the Difficult Airway Algorithm. Three attempts are recommended, 15-30 minutes each.

CONTENT OUTLINE

CONTEXT:

You are assigned to Mr. Williams, a 65-year-old male who is scheduled for an Appendectomy. He is 105 kg with no known allergies. Mr. Williams has never had a surgical procedure. Preoperatively his vital signs are a blood pressure of 142/76 mmHg, Heart Rate of 79 bpm, Respiration Rate of 14, and oxygen saturation of 98% on room air. Mallampati II, no removable items in mouth, teeth are intact. The only pertinent medical history is high blood pressure, and the patient does not take any medication. How will you manage this scenario?

EQUIPMENT& SUPPLIES:

- Anesthesia machine (full set-up following the anesthesia check-off rubric)
- Properly fitting mask
- Direct Laryngoscopes (Mac, Miller, Phillips)
- Endotracheal tubes (patient size, one size up, one size down)
- Stylet
- Supraglottic airway devices (laryngeal mask airway (LMA), intubating laryngeal mask airway (ILMA), fast track LMA)

- Available invasive airway equipment
- Video-assisted laryngoscope (Glide-Scope, C-MAC)
- Alternative intubation devices (bougie)
- Securing device (tape)

SITE SELECTION:
University of Southern Mississippi's School of Nursing Simulation Lab

TASK STATEMENT:

The purpose of this OSCE is to identify signs of a patient with a difficult airway and demonstrate proper management of the difficult airway algorithm.

PROCESS:

1. Properly assess the patients' airway

2. Gather proper equipment based on patient needs

3. Select proper airway management task based upon patient airway

4. Either successfully intubate or successfully ventilate the patient

5. Either properly confirm tube placement or awaken the patient.

DEBRIEFING FORM:

1. What are the primary concerns in this scenario?
2. What could have been done differently to ensure better outcomes for the patients?
3. How did the group work as a team?
4. What interventions were done, and were they appropriate?

RUBRIC FOR DIFFICULT AIRWAY ALGORITHM

ASSESSMENT

QUESTION & DEMONSTRATION STATION:

	TASKS	PASS	FAIL	COMMENTS
	1. Prepares and selects appropriate equipment			
	2. Properly assesses the airway:			

	Look externally to assess the patient for difficult ventilation/extubation: beard, short thyro-mental status, short neck status, small mouth opening. Look inside the mouth, assess teeth and airway (Mallampati) Assess neck range of motion			
	3. Select the correct airway management algorithm based on patient assessment (mannequin presentation)			
	4. **Awake intubation selected:** Successfully intubates patient by a non-invasive approach Not successful: considers other anesthesia options, including fiberoptic intubation, video-assisted laryngoscopy, supraglottic airway (LMA or ILMA), regional anesthesia, or Select the appropriate invasive technique			
	5. **Selects intubation after induction of general anesthesia** Successfully intubates on the initial attempt Not Successful: Call for help Return patient to spontaneous ventilation Awaken the patient			
	6. **Intubation after induction of general anesthesia unsuccessful** Advances in face mask ventilation			

	Ventilation adequate, intubation unsuccessful advances to alternative approach (video-assisted laryngoscopy, alternative laryngoscope blade, SGA, bougie) Successful intubation Or Failed intubation after multiple attempts, advances to invasive airway access (surgical approach, jet ventilation, retrograde intubation) Or Failed intubation after multiple advances to options (SGA) Or Awakens patient Or If both face mask and SGA ventilation are inadequate, advances to Emergency Pathway (surgical approach, jet ventilation, or retrograde intubation)			
	7. **Intubation after induction of general anesthesia was unsuccessful & face mask ventilation was not adequate** SGA Ventilation Successful Or SGA not adequate or feasible, advances to Emergency Pathway:			

	Calls for help Reattempt SGA placement with an additional provider, successful ventilation advance to following options: Invasive airway access Or Alternative approaches (video-assisted laryngoscopy, alternative laryngoscope blades, fiberoptic intubation, nasal intubation) Or Complete case with SGA Or Awaken patient			
	8. Reattempt SGA placement with an additional provider, unsuccessful ventilation advance to following options**:** Advances to emergency invasive airway access (surgical approach, jet ventilation, retrograde intubation)			
	9. Confirms ventilation, tracheal intubation, or SGA placement with exhaled CO2			
	10. Properly documents difficult airway and educates the patient on difficult airway status			

The OSCE by the student demonstrates foundational knowledge and correct demonstration of the difficult airway algorithm: (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 H – Survey Questions

1. Do you consent to participation?

   Yes or No

2. Are you an SRNA or CRNA?

   SRNA or CRNA

3. Were the OSCE's objectives clearly presented?

   Yes or No

4. Was the information provided in the OSCE evidence-based and up-to-date with current practice?

   Yes or No

5. Does the OSCE provide didactic references needed to complete the procedure?

   Yes or No

6. Do you have any suggestions or comments regarding the OSCE?

   _____

   _____

   _____

APPENDIX I – Survey Responses

Participant Number	Do you consent to participation?	Are you an SRNA or CRNA?	Were the OSCE's objectives clearly presented?	Was the information provided in the OSCE evidence-based and up-to-date with current practice?	Does the OSCE provide didactic references needed to complete the procedure?	Do you have any suggestions or comments regarding the OSCE?
1	Yes	SRNA	Yes	Yes	Yes	None
2	Yes	SRNA	Yes	Yes	Yes	
3	Yes	CRNA	Yes	Yes	Yes	
4	Yes	SRNA	Yes	Yes	No	
5	Yes	CRNA	Yes	Yes	Yes	
6	Yes	CRNA	Yes	Yes	Yes	No
7	Yes	CRNA	Yes	Yes	Yes	
8	Yes	SRNA	Yes	Yes	Yes	
9	Yes	SRNA	Yes	Yes	Yes	
10	Yes	SRNA	Yes	Yes	Yes	
11	Yes	SRNA	Yes	Yes	Yes	
12	Yes	SRNA	Yes	Yes	Yes	
13	Yes	CRNA	Yes	Yes	Yes	Provide algorithm as an additional visual aid with the

						OSCE packet.
14	Yes	SRNA	Yes	Yes	Yes	
15	Yes	SRNA	Yes	Yes	Yes	
16	Yes	SRNA	Yes	Yes	Yes	
17	Yes	SRNA	Yes	Yes	Yes	Great Job!!
18	Yes	SRNA	Yes	Yes	Yes	An outstanding OSCE that demonstrates what an OSCE should be.
19	Yes	SRNA	Yes	Yes	Yes	
20	Yes	SRNA	Yes	Yes	Yes	
21	Yes	CRNA	Yes	Yes	Yes	
22	Yes	CRNA	Yes	Yes	Yes	
23	Yes	CRNA	Yes	Yes	Yes	
24	Yes	SRNA	Yes	Yes	Yes	Great job, ladies!
25	Yes	SRNA	Yes	Yes	Yes	
26	Yes	SRNA	Yes	Yes	Yes	No
27	Yes	CRNA	Yes	Yes	Yes	None at the moment, very well thought out.
28	Yes	SRNA	Yes	Yes	Yes	
29	Yes	CRNA	Yes	Yes	Yes	

30	Yes	SRNA	Yes	Yes	Yes	
31	Yes	CRNA	Yes	Yes	Yes	
32	Yes	SRNA	Yes	Yes	Yes	
33	Yes	SRNA	Yes	Yes	Yes	
34	Yes	CRNA	Yes	Yes	Yes	
35	Yes	SRNA	Yes	Yes	Yes	
36	Yes	SRNA	Yes	Yes	Yes	
37	Yes	SRNA	Yes	Yes	Yes	
38	Yes	SRNA	Yes	Yes	Yes	
39	Yes	SRNA	Yes	Yes	Yes	No
40	Yes	SRNA	Yes	Yes	Yes	
41	Yes	SRNA	Yes	Yes	Yes	
42	Yes	SRNA	Yes	Yes	Yes	
43	Yes	SRNA	Yes	Yes	Yes	
44	Yes	SRNA	Yes	Yes	Yes	
45	Yes	SRNA	Yes	Yes	Yes	
46	Yes	SRNA	Yes	Yes	Yes	
47	Yes	SRNA	Yes	Yes	Yes	
48	Yes	SRNA	Yes	Yes	Yes	
49	Yes	SRNA	Yes	Yes	Yes	
50	Yes	SRNA	Yes	Yes	Yes	
51	Yes	CRNA	No	Yes	Yes	The first objective asks to

						identify 3 difficult airway scenarios. Only one is presented in the case study, I am wondering if you meant to identify three methods that could be used in the ONE scenario? That was unclear. 1. Identify the three difficult airway management scenarios In the Second objective: I'd suggest changing "how to manage the difficult airway" to difficult airway management

52	Yes	SRNA	Yes	Yes	Yes	Great OSCE, incredibly useful.
53	Yes	CRNA	Yes	Yes	Yes	
54	Yes	SRNA	Yes	Yes	Yes	

REFERENCES

AbdAlla, A., & Mohammed, K. (2016). The objective structured clinical exam (OSCE): a qualitative study evaluating nursing students' experience. *International Journal of Science and Research, 5*(3), 399–402.

American Association of Colleges of Nursing (AACN). (2006). *The essentials of doctoral education for advanced nursing practice* [PDF]. aacnnursing.org. https://www.aacnnursing.org/Portals/42/Publications/DNPEssentials.pdf

American Society of Anesthesiologists (ASA). (2013). Practice guidelines for management of the difficult airway. *Anesthesiology*, *118*(2), 1–20.

Apfelbaum, J. L., Hagberg, C. A., Caplan, R. A., Blitt, C. D., Connis, R. T., Nickinovich, D. G., Hagberg, C. A., Caplan, R. A., Benumof, J. L., Berry, F. A., Blitt, C. D., Bode, R. H., Cheney, F. W., Connis, R. T., Guidry, O. F., Nickinovich, D. G., & Ovassapian, A. (2013). Practice guidelines for management of the difficult airway. *Anesthesiology, 118*(2), 251–270. https://doi.org/10.1097/aln.0b013e31827773b2

Apfelbaum, J. L., Hagberg, C. A., Connis, R. T., Abdelmalak, B. B., Agarkar, M., Dutton, R. P., Fiadjoe, J. E., Greif, R., Klock, P., Mercier, D., Myatra, S. N., O'Sullivan, E. P., Rosenblatt, W. H., Sorbello, M., & Tung, A. (2021). 2022 American society of anesthesiologists practice guidelines for management of the difficult airway. *Anesthesiology, 136*(1), 31–81.https://doi.org/10.1097/aln.0000000000004002

Barash, P. G., Cullen, B. F., Stoelting, R. K., Cahalan, M. K., Stock, M. C., Ortega, R., Sharar, S. R., & Holt, N. F. (2018). Chapter 28 Airway Management. In *Clinical anesthesia* (8th ed., pp. 1901–1990). Wolters Kluwer.

Battles, J. B., Wilkinson, S. L., & Lee, S. J. (2004). Using standardized patients in an objective structured clinical examination as a patient safety tool. *Quality and Safety in Health Care*, *13*(1), 46–50. https://doi.org/10.1136/qshc.2004.009803

Boursicot, K., & Roberts, T. (2005). How to set up an osce. *The Clinical Teacher*, *2*(1), 16–20. https://doi.org/10.1111/j.1743-498x.2005.00053.x

Cook, T., & MacDougall-Davis, S. (2012). Complications and failure of airway management. *British Journal of Anaesthesia*, *109*(1), 68–85. https://doi.org/10.1093/bja/aes393

Epstein, R. M., & Hundert, E. M. (2002). Defining and assessing professional competence. *JAMA*, *287*(2), 226. https://doi.org/10.1001/jama.287.2.226

Harden, R. (1988). What is an osce? *Medical Teacher*, *10*(1), 19–21.

Harden, R., Stevenson, M., Wilson Downie, W., & Wilson, G. (1975). Assessment of Clinical Competence using Objective Structured Examination. *British Medical Journal*, *1975*,(1), 447–451.

Henrichs, B., Rule, A., Grady, M., & Ellis, W. (2002). Nurse anesthesia students' perceptions of the anesthesia patient simulator: a qualitative study. *American Association of Nurse Anesthetists*, *70*(3), 219–225.

Hijazi, M., & Downing, S. M. (2008). Objective structured clinical examinations as an assessment method in residency training: Practical considerations. *Annals of Saudi Medicine*, *28*(3), 192–199. https://doi.org/10.5144/0256-4947.2008.192

Kelly, M. A., Mitchell, M. L., Henderson, A., Jeffrey, C. A., Groves, M., Nulty, D. D., Glover, P., & Knight, S. (2016). Osce best practice guidelines—applicability for nursing simulations. *Advances in Simulation*, *1*(1). https://doi.org/10.1186/s41077-016-0014-1

Khan, K. Z., Ramachandran, S., Gaunt, K., & Pushkar, P. (2013). The objective structured clinical examination (osce): Amee guide no. 81. part i: An historical and theoretical perspective. *Medical Teacher*, *35*(9), 1437–1446. https://doi.org/10.3109/0142159x.2013.818634

Koenig, H. M. (2010). No More Difficult Airway, Again! Time for Consistent Standardized Written Patient Notification of a Difficult Airway. *The Official Journal of the Anesthesia Patient Safety Foundation*, *25*(2). https://doi.org/https://www.apsf.org/article/no-more-difficult-airway-again-time-for-consistent-standardized-written-patient-notification-of-a-difficult-airway/

Koh, W., Kim, H., Kim, K., Ro, Y.-J., & Yang, H.-S. (2016). Encountering unexpected difficult airway: Relationship with the intubation difficulty scale. *Korean Journal of Anesthesiology*, *69*(3), 244. https://doi.org/10.4097/kjae.2016.69.3.244

Kollmeier, B. R., Boyette, L. C., Beecham, G. B., Desai, N. M., & Khetarpal, S. (2021, January 31). *Difficult Airway*. U.S. National Library of Medicine, National Center for Biotechnology Information. https://www.ncbi.nlm.nih.gov/books/NBK470224/

Lucisano, K. E., & Talbot, L. A. (2012). Simulation Training for Advanced Airway Management for Anesthesia and Other Healthcare Providers: A Systematic Review. *American Association of Nurse Anesthetists*, *80*(1), 25–31.

Nazeer, M., Ahmed, M., Hattiwale, H., & Adam, I. (2020). Using OSCE as an assessment tool for clinical skills: medical students' feedback. *ResearchGate*, *3*(1). https://www.researchgate.net/publication/339443225

Newble, D. (2004). Techniques for measuring clinical competence: Objective structured clinical examinations. *Medical Education*, *38*(2), 199–203. https://doi.org/10.1111/j.1365-2923.2004.01755.x

Nieto, V. K., Eagle, I., Mishler, S., & Rulli, D. (2020). Utilization of Objective Structured Clinical Examinations (OSCE) as an Assessment for Clinical Competency and Licensure: A survey of dental hygiene directors' knowledge and attitudes. *Journal of Dental Hygiene*, *94*(6), 65–71.

Ramani, S., & Leinster, S. (2008). Amee guide no. 34: Teaching in the clinical environment. *Medical Teacher*, *30*(4), 347–364. https://doi.org/10.1080/01421590802061613

Siddaram, S., & Anil, S. (2018). A comparative analysis between objective structured clinical examination (osce) and conventional examination (ce) as formative evaluation tool. *International Journal of Nursing Education*, *10*(3), 102–105. from https://doi.org/10.5958/0974-9357.2018.00076.4

Sloan, D. A., Donnelly, M. H., Schwartz, R. W., & Strodel, W. E. (1995). The Objective Structured Clinical Examination: the new gold standard for evaluating postgraduate clinical performance. *Annals of Surgery*, *222*, 735–742.

Wands, B., & Minzola, D. (2015). Comparison of successful intubation between video laryngoscopy view before attempted intubation and direct laryngoscopic

intubation by student registered nurse anesthetists: a pilot study. *American Association of Nurse Anesthetists*, *83*(6), 403–409.

Witheridge, A., Ferns, G., & Scott-Smith, W. (2019). Revisiting Miller's pyramid in medical education: The gap between traditional assessment and diagnostic reasoning. *International Journal of Medical Education*, *10*, 191–192. https://doi.org/10.5116/ijme.5d9b.0c37

Wunder, L. L., Glymph, D. C., Newman, J., Gonzalez, V., Gonzalez, J. E., & Groom, J. A. (2014). Objective Structured Clinical Examination as an educational initiative for summative simulation competency evaluation of first-year student registered nurse anesthetists' clinical skills. *American Association of Nurse Anesthetists*, *82*(6), 419–425.

Zayyan, M. (2011). Objective structured clinical examination: The assessment of choice. *Oman Medical Journal*, *26*(4),219–222. https://doi.org/10.5001/omj.2011.55