Effect of Airway Management Education on Knowledge, Skill, and Confidence Levels

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Abstract

Airway assessment and management are crucial skills for nurses managing patients during critical situations; nurses are usually the first healthcare providers to identify a deterioration in patients' health status. Proper airway management skills increase the chance of survival for a critical patient. Nursing students, however, may have limited exposure to clinical situations in which it is necessary to identify and manage a deteriorating patient leading to a lack of confidence in airway management. The purpose of this scholarly project was to evaluate the effect of an airway management educational module and low fidelity simulation experience on the knowledge, skill, and confidence level of senior student nurses attending AdventHealth (AHU) University Orlando. The design of this evidence-based practice initiative was quasi-experimental with convenience sampling. All 21 AdventHealth University senior nursing students in the Summer 2022 cohort were allowed access if they chose to view the educational content in Canvas prior to attending a simulation lab. This project used convenience sampling and all students were required to participate in a 20-minute pre- simulation educational module and a 30- minute low fidelity airway management simulation lab. However, assessments, such as a pre-test/ post-test, a skills checklist and a satisfaction and confidence questionnaire used to evaluate knowledge, skills, and confidence levels were voluntary and did not impact student grades.

Effect of Airway Management Education on Knowledge, Skill, and Confidence Levels

Introduction

Airway management is a primary consideration in CPR, anesthesia, and emergency medicine (Kuar et al., 2015; Sakar et al., 2017; Surabenjawong et al., 2015). Failure to manage the airway is a major cause of preventable death in patients with a lack of oxygenation accounting for a mortality rate of up to 80% in those who experience airway respiratory complications (Cook et al., 2012; Kutsogiannis et al., 2011). Permanent brain damage and damage to vital organs may occur as soon as 4-5 minutes without oxygen (Moll, 2020; Sakar et al., 2017). Airway obstruction significant enough to impair gas exchange can quickly progress to hypoxemia, cyanosis, altered mental status, cardiac arrest, and death (Hines et al., 2018; Nagelhaut et al., 2018., Neth et al., 2020). Respiratory and cardiac arrest, although distinct, lead to one another when left untreated, and cardiac arrest alone has an overall survival rate of around 10% (Neth et al., 2020). Therefore, effective airway management skills are essential for providers involved in resuscitation efforts.

As nurses are often first responders in emergencies, knowledge of airway management and the necessary skill set needed to maintain oxygenation is essential. Currently, undergraduate nursing education does not provide sufficient exposure to basic airway management. As basic airway management is addressed during the required CPR course for nursing programs, it is not sufficient to fully address the gap in knowledge between education and clinical practice (Deakin, 2010; Luctkar-flude et al., 2015). Thus, integration of additional education and low fidelity simulation may result in bridging this gap in knowledge, skills, and confidence levels (Luctkar-flude et al., 2015; Musa et al., 2020). An educational module followed by a low fidelity simulation experience was developed and implemented by student registered nurse anesthetists

(SRNA) to address this gap. SRNAs are uniquely qualified to educate on airway management as these students already have extensive experience in both basic and advanced airway management. This education also proved to be beneficial in improving the student nurses' confidence in the skills necessary for dealing with airway management during an emergency.

Significance & Background of Identified Problem

Insufficient ventilation results in a hypercarbic, hypoxemic, and acidotic state, which leads to ineffective cardiac contractility, decreased systemic vascular resistance, and increased pulmonary vascular resistance. Furthermore, it leads to a decrease in the threshold for ventricular dysrhythmias and ineffective cardiac defibrillation (Neth et al., 2020). Complications due to ineffective airway management account for 34% - 85% of legal claims relating to death or brain damage (Barash et al., 2017; Cook et al., 2012; Miller et al., 2015). Given the importance of airway management it is essential to properly define the term. Airway management is the evaluation, planning, and utilization of medical procedures and devices to maintain or restore an effective pathway for oxygenation and ventilation (Airway Management, 2021; Barash et al., 2017;). Thus, proper airway management requires both competency and confidence in knowledge and skills.

Effective airway management involves having sufficient knowledge and being able to translate that knowledge through mastery of relevant skills. Nurses apply the knowledge gained from nursing school to assess patient conditions, take steps to prevent deterioration, and routinely make clinical decisions rapidly, autonomously, and skillfully (Dermitas et al., 2021; Han et al., 2018). However, nursing students are exposed to variable and unpredictable clinical experiences before graduation and may have limited experience in identifying and managing patients' airways (Luctkar-flude et al., 2015). Despite bi-annual certifications in basic life

support, nursing students are not proficient in handling emergency situations, especially when dealing with the management of the airway. This may result from airway management specifically being taught in an abbreviated format to nursing students during their nursing education (Deakin et al. 2010; Samosorn et al., 2020). Therefore, repeated exposure to airway management for an emergent situation is required to improve knowledge necessary for nurses to retain and prevent complications such as death or anoxic brain injury related to ineffective airway management.

It is crucial for nurses to learn the relevant knowledge and perform at an adequate skill level when dealing with patients' airways in an emergency. Nurses are one of the primary team members involved in airway management and are often the first to provide care and serve as an assistant during advanced management (Kuar, 2015). The primary step in effective airway management involves the use of basic airway maneuvers. This consists of proper positioning (head lift-chin tilt maneuver), supplemental oxygen, and bag-mask ventilation with or without adjuncts (Airway Management, 2021). While bag mask ventilation is a primary skill in providing effective ventilations, it is a difficult skill to master without expert guidance and considerable practice for competency (Klienman et al., 2015).

Nursing students report that a lack of preparedness and the related knowledge gaps lead to anxiety about responsibility and being in a constant state of panic when dealing with emergency scenarios and airway management (Luctkar-flude et al., 2015; Musa et al., 2020). Nursing students reported low confidence levels with initiating ventilation with a bag-valve-mask and assessing the airway. When nursing students feel confident in their knowledge and skill, their feeling of preparedness increases when placed in emergency situations once they enter the workplace (Musa et al., 2020; Usher et al., 2015).

Integration of simulation in nursing school may help nursing students feel more prepared to handle stressful situations when they need to apply this knowledge in real life. Simulation is defined as situations where models are used for practice and to gain experience that will enhance students' practical skills (Luctkar-flude et al., 2015; Musa et al., 2020). Simulation provides a low-risk solution to educate nursing students on scenarios that are deemed highly stressful. The utilization of simulation labs has been shown to promote active learning and improve engagement in the learning process among student nurses (Luctkar-flude et al., 2015; Musa et al., 2020). Furthermore, nursing students who learn basic airway management in combination with peer-to-peer instruction, self-instruction videos, and peer-to peer feedback have shown significantly higher performance scores for nasal and oral airway insertion and bag-mask ventilation when compared to standard instructor led methods (Surabenjawong et al., 2015).

Certified Registered Nurse Anesthetists (CRNAs) are experts in both airway and resuscitation skills (Penn & Ruthman, 2005). Although in training, nurse anesthesia students are not complete novices to the clinical setting and have experience as critical care nurses. To become a Student Registered Nurse Anesthetist (SRNA), a four-year bachelor's degree in nursing and a minimum of 1-year experience in the intensive care unit is required. During nurse anesthesia school, SRNAs are required to have a minimum of 2,000 clinical hours, 250 intubations, 35 supraglottic airway insertions, and 650 cases to graduate (Council on Accreditation, 2021). SRNAs are taught to be experts in airway management skills such as bag-mask ventilation, use of airway adjuncts, and proper positioning (head- tilt chin-lift maneuver) to provide effective airway management, thus, SRNAs are equipped with the knowledge and skill to provide support and education to their nursing peers. Therefore, an educational module paired with an SRNA led low fidelity simulation lab on emergency airway management is likely to

improve nursing students' knowledge, confidence levels, and clinical skills (Demirtas et al., 2021; Goket et al., 2014; Kuar 2015; Luctkar-flude et al., 2015; Samosorn et al., 2020).

PICOT Evidence Review Questions

A systematic review of the literature was guided by two questions created in PICOT format. The first question addresses a community-based clinical problem: In staff nurses (P) who work in non-critical care settings, how does simulation-based training (I) affect knowledge, skill, and confidence level when learning emergency airway management (O)?

The second question addresses the clinical innovation: In the Summer 2022 Cohort AdventHealth University Bachelor of Nursing Students (P), what is the effect of a 20-minute online pre-simulation learning module paired with an SRNA-led low fidelity simulation experience regarding emergency airway management (I) on student knowledge, skill, and confidence (O) within the Summer 2022 trimester (T)?

Search Strategy and Results

The search strategies consisted of these databases: PubMed, CINAHL, Google Scholar, and Ovid. Key search terms and MESH combinations included: *airway management* AND *nursing, nurses or nursing* AND *airway management* AND *CPR*. The search limits were English language, research articles, and peer-reviewed. A total of 124 articles were retrieved. After reviewing titles relevant to nursing airway management, 84 articles were eliminated. After reading the abstracts for subject relevance, 12 were eliminated, and after removing duplicate articles, 13 were eliminated. A total of 15 studies met inclusion criteria. These inclusion criteria included airway management and nursing.

GRADE Criteria

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) criteria was used to evaluate the quality of literature. The literature included a wide range of study types, from randomized control trials to less stringent methodologies including quasi-experimental research, observational studies, a pilot study, and a mixed-method design with quantitative and qualitative aspects. This mix of research approaches rendered the rating of evidence as moderate with an initial GRADE level of 3. The literature was downgraded -2 due to limitations, such as imprecision due to small sample size, methodological flaws such as low participation rate, self-rated reporting instead of a more objective evaluation, and cultural bias. The overall GRADE level increased +1 to 2 because all possible confounders increase confidence in the estimated effect. The end score for the GRADE criteria of the literature is 2, indicating a low evidence quality. Although evidence quality is low, we recommend inclusion of additional airway management education within the nursing curriculum. This recommendation provides low risk to students with a high potential of improved clinical outcomes.

Literature Review and Synthesis of Evidence

Knowledge and performance of airway management skills are related to the survival outcomes of patients (Dermitas et al., 2021; Han et al., 2018) particularly because such emergency situations are associated with a high frequency of complications (Han et al., 2018; Musa et al., 2020, Roh et al., 2013). The intense demand of an emergency airway situation requires nurses to perform immediately and make critically sound decisions. The heightened stress levels may cause nurses to fail to manage situations appropriately and can lead to poor outcomes (Gok et al., 2014; Han et al., 2018; Kuszajewski et al., 2016; Musa et al., 2020; Roh et al., 2013). The ability to respond effectively to an emergency situation depends on the nurse

being competent and confident in life-saving measures (Madden, 2016; Roh et al., 2013). Thus, airway management is a vital life-saving skill that requires continuous knowledge reinforcement and simulation-based training to assure competency (Dermitas et al., 2021; Han et al., 2018, Luctkar-flude et al., 2015; Musa et al., 2020). Competency is defined as having knowledge and psychomotor skills to be able to perform in an emergency situation such as CPR (Gok et al., 2014; Madden, 2016; Roh et al., 2013).

The skills required for airway management are a critical component of patient resuscitation, with bag-valve-mask ventilation being an essential element in an emergency (Deakin et al., 2010; Luctkar-flude et al., 2015; Otten et al., 2014; Roh et al., 2013;). While bag-valve-mask ventilation is an important aspect of resuscitation, as many as 33% of nurses reported lacking the skill necessary to utilize a bag-valve-mask (Deakin et al., 2010; Luctkar-flude et al., 2015; Roh et al., 2013). Nursing students described feeling unprepared, verbalized fear of harming patients and making mistakes as their main nursing worries (Han et al., 2018; Luctkar-flude et al., 2015; Musa et al., 2020; Usher et al., 2015).

The use of simulation-based education contributes to learning with the use of repetition, feedback, and reflection (Luctkar-flude et al., 2015; Musa et al., 2020). The purpose of simulation-based education is to improve clinical competency without fear of inflicting patient harm (Cason et al., 2010; Luctkar-flude et al., 2015; Roh et al., 2013). Skills and knowledge of advanced cardiac life support decline as soon as 3 months after training, with skills declining faster than knowledge. The use of simulation-based education, however, results in increased skill retention to as much as one year beyond the training event (Han et al., 2018; Luctkar-flude et al., 2015). Simulation exposes students to a broader range of situations than they may experience in clinical practice and is the preferred training modality among nurses and nursing students

(Dermitas et al., 2021; Luctkar-flude et al., 2015; Roh et al., 2013). An intensive simulation acts as a reinforcement strategy and serves as a bridge between classroom instruction and clinical application (Musa et al., 2020; Usher et al., 2015). Active learning through simulation lab may also contribute to the development of critical thinking and leadership skills. Likewise, repeated practice paired with learning modules has been shown to increase accuracy and enhance the retention of clinical skills. Sufficient evidence exists that repeated simulation-based education can reinforce the strategies and skills to increase students' sense of security and confidence (Cason et al., 2010; Han et al., 2018; Luctkar-flude et al., 2015; Musa et al., 2020). Nurses should be trained in basic airway management strategies and should be familiar with various easy-to-use airway instruments to increase resuscitation success when assisting with advanced airway management (Gok et al., 2014; Usher et al., 2015).

Project Aims

The primary aim of this scholarly project was to determine baseline airway management knowledge, and skills of third-year BSN students attending AHU. A secondary aim was created to evaluate the effect of an SRNA lead educational intervention and low fidelity simulation experience designed to address common knowledge and skill gaps regarding basic airway management on student learning outcomes (knowledge, performance, self-confidence, and satisfaction). The objectives were delineated as follows:

- Objective 1: Determine if a difference exists between pre and post-test knowledge regarding basic airway management within the AdventHealth University Summer 2022 BSN nursing cohort by August 2022.

- Objective 2: Assess if a difference exists in the individual student's pre- and post-simulation ability to correctly perform effective airway management within the AdventHealth University Summer 2022 BSN nursing cohort by August 2022.
- Objective 3: Evaluate the effects of an SRNA led basic airway management educational intervention on the AdventHealth University Summer 2022 BSN nursing cohort's self-confidence and satisfaction by August 2022.
- Objective 4: Make recommendations regarding the integration of basic airway management skills within the nursing curriculum for future BSN nursing cohorts by February 2024.

Methods

Design

This scholarly project was designed as a quantitative, pretest-posttest, quasi-experimental quality improvement quality assurance (QI/QA) initiative. The purpose of a pretest/posttest design is to assess the planned educational intervention. A baseline assessment using the Virtual Airway Knowledge Pretest was performed. Once the education and simulation experiences have been completed, airway knowledge was reassessed using the same questionnaire.

An Airway Management Skill Testing Checklist was also used to provide a baseline of psychomotor skills. After the education and simulation experience was completed, the skills checklist was then readministered to assess for a difference in skillset. Following the simulation experience, a Student Satisfaction and Self-Confidence questionnaire was disseminated for completion to assess the effects of the simulation experience on self-satisfaction and self-confidence.

Setting

The setting used for this project was the nursing department at AdventHealth University, Orlando, Florida.

Sample

The population of interest were the 24 students enrolled in the Summer 2022 cohort of the Bachelor of Science degree program in nursing at AdventHealth University. The sample was obtained by using convenience sampling. Inclusion criteria included nursing students enrolled in the lab portion of the NRSG465 course during the Summer of 2022. Students also needed to be willing to participate in this scholarly project. An exclusion criterion was nursing students enrolled in their first, second, and third years of the BSN nursing program at AdventHealth University.

Recruitment Methods and Implementation Procedures

AHU's fourth-year nursing students were notified of this scholarly project via an emailed letter of invitation through AHU's Microsoft Outlook account on May 9, 2022 (Attachment #1). A classroom recruitment announcement was also made by the project sub-investigators three weeks prior to implementation on May 9, 2022 (Attachment #2). A follow-up reminder email was then sent out five days prior to the beginning of airway simulation lab on May 15, 2022 (Attachment #3). Upon completion of the 30- minute low fidelity airway management simulation lab, a follow-up email was sent to remind students to complete the Student Satisfaction and Self-Confidence in Learning Questionnaire (Attachment #4).

The emailed letter of invitation and announcement briefly described the project, what participants could expect, and contained a Canvas course invitation which allowed students access to the educational content. It was emphasized that while all students must complete the

education and participate in the simulation experience as part of the NRSG465 course requirements, only participants that agreed to volunteer would complete the questionnaires and have their skill performance assessed. Participants were also informed that questionnaire responses were obtained anonymously. Individual skill checklist results were not reviewed by nursing faculty and neither the questionnaire nor the checklist results affected a participant's course grade. The Canvas course remained open for six weeks from May 9, 2022- June 27, 2022.

Data Collection and Ethical Considerations

Canvas was used to create a custom learning environment. The course consisted of five educational modules. Module 1 contained a course introduction, course objectives, and course navigation. Module 2 contained an introduction to the Virtual Airway Knowledge Test and Cricoid Pressure pretest. These pretests consisted of 18 multiple choice questions and should have taken students approximately 20 minutes to complete. The knowledge pretest was embedded in Canvas as a Microsoft Form. Module 3 contained a 20-minute educational presentation on airway management and equipment. Module 4 contained the same Virtual Airway Knowledge Test and Cricoid Pressure test used in Module 2 as a posttest. These posttests should have taken approximately 20 minutes to complete. Module 5 contained the Student Satisfaction Self-Confidence in Learning questionnaire.

Microsoft Forms was used for the Airway Knowledge and Cricoid Pressure pretest and posttest as well as the Satisfaction and Self-Confidence in Learning questionnaire. This project did not collect personal identifiers for either the Airway Knowledge tests or the Self-Confidence in Learning questionnaire. Each student was to create a personalized pin as part of the first pretest question by using a combination of initials and mother's date of birth. The Airway Management Skills Testing Checklist was printed out and required the student's first and last

name to compare pre and post checklist results. Once complete, the skills checklists were compiled by the sub-investigators and maintained in a locked filing cabinet in the primary investigator's office. The personal information on The Airway Management Skills Testing Checklist were then paired, de-identified, and uploaded onto an Excel spreadsheet by sub-investigators. The physical copies of the checklist were then immediately shredded. All data was stored on a Microsoft Forms Excel Spreadsheet and kept for seven years and consequently deleted by AHU information technology (IT) department.

Instrumentation

The listed instruments have received author permission for use and are included in Appendix B.

Virtual Airway Knowledge Test

This 16-item tool was developed in the research study, "Teaching Airway Insertion Skills to Nursing Faculty and Students Using Virtual Reality: A Pilot Study". Experts in airway management from multiple disciplines (one military combat medic, one master's prepared registered nurse, two physicians, one certified registered nurse anesthetist, and one physician's assistant) reviewed the questionnaire and judged the instrument to have content validity.

National League for Nursing (NLN) Student Satisfaction and Self-Confidence in Learning Questionnaire

This 13-item tool was created to measure students' self-reported satisfaction with simulation activity (five items) and self-confidence in learning (eight items). It was created in 2003 by the NLN and was found to be reliable using Cronbach's alpha: satisfaction = 0.94; self-confidence = 0.87.

Airway Management Skills Testing Checklist

This is an eight-item checklist created by the sub-investigators of this project. This checklist went through a face validation process and was reviewed by two students, two faculty members, and one NRSG465 nursing course professor.

Cricoid Pressure Test

This is an additional two questions created by the sub-investigators of this project to address additional content the study above did not address. The two questions went through a face validation process and were reviewed by two students, two faculty members, and one NRSG465 nursing course professors.

Data Analysis

The NLN Student Satisfaction and Self-Confidence in Learning Questionnaire was scored on a 5- point Likert Scale. The Likert Scale is presented as follows: 1= STRONGLY DISAGREE with the statement 2= DISAGREE with the statement 3= UNDECIDED- you neither agree or disagree with the statement 4= AGREE with the statement 5= STRONGLY AGREE with the statement. Results from the questionnaire will be analyzed using descriptive statistics. Results from the questionnaire will be analyzed and performed using descriptive statistics

The analysis of the Airway Management Skills Testing Checklist was analyzed using descriptive statistics. Pre-simulation and post-simulation results were tallied to measure differences between pre and post-simulation results.

The statistical method that was used for analyzing the pre-test and post-test data was a paired t-test. The questions contained within the Virtual Airway Knowledge Test pretest and posttest required each question to be scored and tallied as correct or incorrect. The number of

correct answers were tallied, scored, and scaled per author guidelines. The scholarly project contains three independent surveys that were to be performed. The Bonferroni Correction method was applied to reduce the risk of Type 1 error. Therefore, the statistical significance probability was set at .017 level of confidence.

Data Storage

This scholarly project involved students; therefore, all platforms that were used including Canvas, Microsoft Outlook, Microsoft Forms, and Microsoft Teams are FERPA compliant and password protected (Instructure Inc., 2021; Microsoft, 2021).

Quality Improvement Framework

Witkins Needs Assessment Model describes a system with information, data input, internal processing stages, and potential solutions or interventions as output (Altschuld & Watkins, 2014). The Witkins Needs Assessment Model consists of three phases: pre-assessment, assessment, and post-assessment. The first phase of the model is pre-assessment. This phase is done to determine the feasibility of the needs assessment and the scope of the requirements (Watkins, Meiers, & Visser, 2012). Observations, informal interviews, and literature reviews were done by sub-investigators to initially find or confirm a gap in knowledge between education and airway management in clinical practice.

After the first phase is complete, the second phase, assessment, involves gathering and analyzing collected data. In this phase of planning, the data collection method is critical. Data from pre and post-test, skills checklist, and questionnaire will be collected and compared. The last and final phase of Witkins needs assessment model is post-assessment. This stage is about decision-making. After collecting and prioritizing data, finding the potential solutions to gaps or

problems will be made. The most potential, effective, and cost-beneficial solution is then recommended to be implemented into practice.

Planning and Procedures

Planning

Key stakeholders for this scholarly project were selected based on their roles at AHU. They were selected as follows: Dr. Janice Lowden-Stokely, Coordinator of Student Performance and Nursing Research; Dr. Chris Lorentz, Associate Professor; and Dr. Sarah Snell, faculty member of the Nurse Anesthesia program.

Implementation

The first step involved a discussion with nursing faculty to determine simulation lab dates and to obtain email addresses to contact students who were enrolled in NRSG465. An email was then sent including an explanation of the study and the requirements for completing the study. After this determination, a pre-test on airway management was disseminated. A 20- minute airway module was presented to students and a posttest will be administered. The cohort was broken up into groups on pre-determined lab times. Each group was provided a simulation education on airway management.

Barriers and Facilitators

Factors that facilitated the successful implementation of this scholarly project included support from nursing faculty. Barriers that occurred included the failure of students to complete learning material prior to simulation as well as failure of the students to complete the knowledge pre/posttests and confidence assessments.

Procedures to Sustain

To sustain proposed interventions an initial email was sent informing students to complete the pretest for learning modules. An additional email was sent as a reminder to complete the required posttest. A final email will be sent 24 hours prior to the simulation lab to facilitate the completion of pre/posttest and learning modules. To sustain student learning in the future, we recommend implementation of airway management into the nursing curriculum as the simulation lab in this project proved beneficial in improving the nursing students' skills when compared to pre simulation lab education. This education may serve as an enforcement of what they are minimally taught during the required BLS course students must take every two years.

Limitations

Limitations to this study included a small sample size, too narrow of a population, and setting limited to one study site. There was also a potential for confounding variables such as students completing surveys based on perceived expected responses. In addition, the administration of a pretest may have sensitized participants to the material assessed on the post-test.

Timeline/Dissemination plan

A proposal was submitted to the Institutional Review Board (IRB) in December of 2021. The implementation phase of the project occurred in the Summer of 2022. The collection of data began in May of 2022. The pre/posttest and learning modules were disseminated via email provided by the nursing faculty at AHU at the beginning of the Summer 2022 semester. The simulation lab took place at the AHU nursing classroom.

Budget

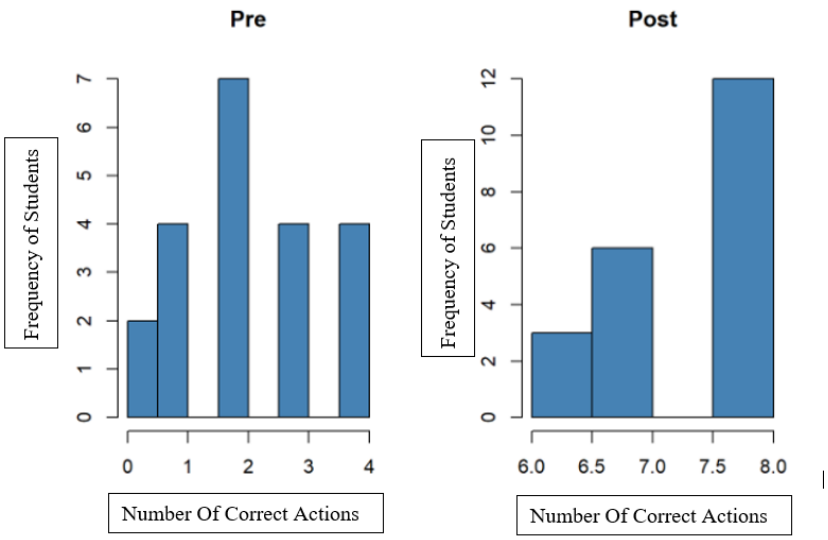
There is no budget required for the completion of this scholarly project.

Discussion & Implications

Results/Findings

There were a total of 21 participants; of the 21, only one student completed the Virtual Airway Knowledge retest, Virtual Airway Knowledge Test posttest, Airway Management Skills Testing Checklist and National League for Nursing (NLN) Student Satisfaction and Self-Confidence in Learning Questionnaire. However, all 21 expected participants attended the low fidelity airway management simulation lab and completed the Airway Management Skills Testing Checklist. The skills checklist was used to determine if there is a difference in scores between pre and post-tests after the low fidelity airway management simulation lab. Normality was evaluated on both pre and posttest by performing a Shapiro-Wilk Test. The Shapiro-Wilk Test of the pretest showed that the distribution of X did not depart from normality ($W = 0.91751$, p-value > 0.05) and followed normality assumption. The posttest showed that the distribution of X departed significantly from normality ($W = 0.72708$, p-value = 6.107e-05) and did not follow normality assumption. To evaluate the pre and post intervention mean score the Wilcoxon Signed Rank Test (paired) was utilized rendering a p-value of <0.05 (p-value=2.895269e-05). Results demonstrated that there is a significant difference in test scores pre- intervention as compared to post-intervention. The mean scores of the Airway Management Skills Testing Checklist are displayed in Figure 1 (below).

Figure 1: Difference in Pre & Post Test: Airway Skills Checklist



Discussion

Nurses are often first responders in airway emergencies; therefore, knowledge of airway management and the necessary skills needed to maintain oxygenation is essential. Currently, undergraduate nursing education does not provide sufficient exposure to basic airway management. While basic airway management is addressed during the required CPR course for nursing programs, it is not sufficient to fully address the gap in knowledge between education and clinical practice. The purpose of this scholarly project was to evaluate the effect of an airway management educational module and low fidelity simulation experience on the knowledge, skill, and confidence level of senior student nurses attending AdventHealth (AHU) University Orlando. Unfortunately, the limitations encountered during our study rendered our collected data as limited. Only one out of the 21 participants completed the required assessments for this project necessary to collect complete statistical data. Although we were unable to assess knowledge and confidence levels, we were able to collect data that confirmed a lack in skill among nursing students. The low fidelity airway simulation lab revealed that there is a need for

airway management education in senior nursing students. During the lab student stated that due to Coronavirus-19 (COVID-19), bag valve mask ventilation was taught in the BLS courses. Historically, during the BLS course, ventilation was performed using a barrier device. Although, students were educated on how to perform bag-mask ventilation, the students' performances in the pre-skills testing checklist demonstrated a lack of skill. Furthermore, a limited number of participants completed the airway management educational module which may have contributed to a lack in performance. Students may have not participated in the assessments of knowledge and confidence levels because it was not mandatory for their class. While the skills checklist was also not mandatory, the simulation lab that went along with the skills checklist was mandatory for them to attend. The simulation lab the investigator and sub investigators were present in person for the simulation which may have prompted students to participate. The other assessments were to be taken online and may have not been deemed as important. We recommend for education, and assessments to be taken in person to create a sense of importance. We also recommend that incentivization be used to ensure a larger sample size. Additionally, we recommend the addition of airway management into nursing curriculum to address the gap in skill that was found during this study.

Applicability to Practice/Contribution to Professional Growth

Airway management and proper ventilation are essential skillsets for nurses who are involved in saving the lives of patients during an emergency; therefore, preparing nursing students on how to use airway management skills is crucial. Nurse anesthetists as trained experts in airway management, may serve as great assets in addressing the gap in knowledge among nurses who deal with airway management (Deakin et al., 2010; Lynch & Crawley, 2018).

According to the American Association of Nurse Anesthetists' (AANA) Professional Attributes and Code of Ethics (2019), CRNAs have a responsibility to be leaders, teachers, and collaborators. As leaders, CRNAs are responsible for mentoring and empowering diverse individuals and teams. As teachers, CRNAs communicate knowledge and assess learners' understanding, and as collaborators, CRNAs work in collaboration with various healthcare providers to promote quality patient care. CRNAs are experts in airway management and are therefore equipped with the knowledge and skill to educate nursing colleagues on how to provide efficient airway management (Deakin et al., 2010; Lynch & Crawley., 2018).

Conclusion/Limitations

Due to the lack of participation, the results and findings of the project as a whole were inconclusive. Data limitations prevented the dissemination of project results as intended because data collection on knowledge and confidence levels were unable to be obtained. However, data collected on skills assessment demonstrated significant value as skills were shown to have significantly improved in the post- simulation lab assessment when compared to pre-simulation lab assessment (p-value= 2.895269e-05). This data showed a drastic gap in skill among nursing student who will be in charge of managing airways once in practice. A literature review regarding best practices and ethical options for project incentivization has been conducted with the intent of improving future project outcomes as part of dissemination (Appendix A). Replication of this scholarly project has generalizability and can be useful in providing meaningful results in other sample groups such as other nursing programs across the United States. Including multiple sites may improve participation rates and may yield significant findings for implementation into future nursing programs. Some instruments used for this scholarly project were validated in previous research studies, and author permission was

acquired. The other instruments used were face validated, and all instruments were tested in the sample population. Interrater reliability was preserved by incorporating multiple practice sessions between the investigator and sub-investigators.

Throughout the airway management skills lab, the investigator, and sub investigators maintained the same teaching positions for each group to account for interrater reliability. Although the results of this study were statistically significant, as expert airway management providers, there was a lack in knowledge and skill, amongst participants during the airway management skill lab. Some students stated, they had received additional airway management education during ACLS due to COVID-19, however, the sub-investigators witnessed a need for improvement in airway management skills. Therefore, we recommend further research should be conducted to address the gap in knowledge and skill of airway management in baccalaureate prepared nursing students. We also recommend the addition of airway management in nursing curriculum to bridge this gap in skill that was evident in this study.

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Purpose	**Variables**	**Setting/Subjects**	**Measurement and Instrument**	**Results**	**Evidence Quality**
Study One: To identify perceived competence and educational needs as well as to examine factors influencing perceived competence in resuscitation among staff nurses. **Study Two:** To evaluate the effects of peer-to-peer instruction vs standard instructor-led teaching on basic airway management skills, knowledge, and confidence attainment in undergraduate nursing students.	**Study One:** Primary outcome: Perceived competence and educational needs Secondary Outcome: Factors influencing perceived competence **Study Two:** Primary Outcome: Peer-to-peer instruction vs standard instructor-led teaching Secondary Outcome: Basic airway management skills, knowledge, and confidence levels.	**Study One:** Setting: 11 of 25 university-affiliated academic teaching hospitals in Seoul, Korea. Subjects: 502 hospital nurses from non-critical care areas. **Study Two:** Setting: WISER Institute at the University of Pittsburgh. Subjects: 48 undergraduate nursing students between ages 18-65.	**Study One:** 1.18-item Perceived Competence in Resuscitation Questionnaire 2. Four-item needs assessment tool **Study Two:** 1.pre-and post-learning surveys 2. Knowledge acquisition with an online 10-item multiple choice question assessment	**Study One:** Chest compression was the lowest-rated technical skill (M = 3.33, SD = 0.80), Bag mask ventilation was not far behind 3.41 (0.80). staying calm and focusing on required tasks was the lowest-rated non-technical skill (M = 3.30, SD = 0.80). Work duration, the usefulness of simulation, recent code experience, and recent simulation-based training were significant factors in perceived competence, F (4, 496) = 45.94, p < .001. Simulation-based resuscitation training was the most preferred training modality. **Study Two:** peer-to-peer skill scores were higher than those of the students in the standard teaching group with a large, calculated effect size for each skill. Cohen's d of 1.07 (p-value 0.002) for oropharyngeal airway, 1.14 (p-value <0.001) for nasopharyngeal airway and 0.81 (p-value 0.003) for bag mask ventilation. There was no significant difference between the pre-test and post-test scores and confidence levels. Peer to peer stress levels were significantly lower.	**Study One:** **Methodological flaws:** Low participation rate, self-rated reporting instead of an objective structured evaluation, cultural bias **Inconsistency:** None **Indirectness:** None **Imprecision** None **Publication bias** None **Study Two:** **Methodological flaws:** Low participation rates, long term knowledge retention and skills not measured. **Inconsistency:** Some students had previous experience with airway management although not on real people which may affect **Indirectness:** None **Imprecision** Small Sample Size **Publication bias** None
Design				**Implications**	
Study One: A cross-sectional descriptive survey **Study Two:** Single blinded randomized crossover trial.				**Study One:** Sim-based resuscitation training curriculum with cardiac arrest scenarios and a strong emphasis on high-quality CPR technical and non-technical skills to supplement real code experience and enhance optimal resuscitation performance among nurses. **Study Two:** peer-to-peer teaching method should be considered as a valid alternative to standard instruction.	

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Kuszajewski, M.L.,O'Donnell, J.M., Phrampus, P.E.,MD, Robey, W.C.,MD, & Tuite, P.K. (2016). Airway Management: A Structured Curriculum for Critical Care Transport Providers. *Air Medical Journal*, *35*(3), 138-142. https://10.1016/j.amj.2015.12.013

Purpose	**Variables**	**Setting/Subjects**	**Measurement/ instruments**	**Results**	**Evidence Quality**
Study One: To provide airway management simulation training to novice nursing students to improve their skills in performing the skill. **Study Two:** To determine if a blended learning curriculum using deliberate practice with simulation devices would improve knowledge and verify skill acquisition in airway assessment and management for CCT providers.	**Study One:** Primary outcome: Baseline Knowledge Secondary Outcome: Knowledge retention **Study Two:** Primary Outcome: Knowledge level pre-post simulation Secondary Outcome: Self-confidence level pre-post simulation Tertiary Outcome: Endotracheal checklist to assess correct steps	**Study One:** Setting: Hong Kong University Subjects: 20 third year undergraduate nursing students **Study Two:** Setting: All paramedics and nurses working in a hospital-based Commission on the Accreditation of Medical Transport Systems accredited CCT program in rural North Carolina Subjects: 9 critical care transporters: 5 paramedics (56%) and 4 nurses (44%) with years of experience in CCT consisting of 1 to 5 years (33%), 6 to 10 years (56%), and 11 to 15 years (11%).	**Study One:** 12- item knowledge test and 18 item skills checklists. **Study Two:** 21-item ETI checklist,20-item knowledge test, 8 item practice checklists, and 10-item self-confidence survey	**Study One:** Only 35% (n=7) were able to complete basic airway management in the first training and all of the students were able to complete it in the second training (n=20). None of the group were able to complete the airway management skills in the first trial. **Study Two:** Knowledge improvement was significant, with participants scoring above 85% on the post-test compared with the pretest (P ¼ .028). Mean scores in completion of the airway checklist pre- versus postintervention were significantly increased on all 3 evaluation points (P < .001 for all comparisons). Significant changes were noted in the response profile evaluating participants' confidence in their ability to verbalize indications for endotracheal intubation (P < .05).	**Study One** **Methodological flaws:** Very small sample size. **Inconsistency:** None **Indirectness:** None **Imprecision:** None **Publication bias:** None **Study Two** **Methodological flaws:** Small sample size. **Inconsistency:** None **Indirectness:** None **Imprecision:** None. **Publication bias:** None
Design **Study One**: Observational study **Study Two:** Pilot study with pre-test. post-test, repeated measures.				**Implications** **Study One:** Simulation training in airway management is effective in helping novice nursing students in gaining the experience, knowledge and performance of the skill. **Study Two:** Blended learning curriculum based on deliberate practice with simple to more complex simulation devices and patient care situations	

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Otten, D., Liao, M. M., Wolken, R., Douglas, I. S., Mishra, R., Kao, A., ... & Haukoos, J. S. (2014). Comparison of bag-valve-mask hand-sealing techniques in a simulated model. Annals of emergency medicine, 63(1), 6-12.

Purpose	**Variables**	**Setting/Subjects**	**Measurement and Instruments**	**Results**	**Evidence Quality**
Study One To evaluate the current level of knowledge of intensive care unit nurses on Basic Life Support (BLS) and airway management. **Study Two** To compare the efficacy of 1-handed, 2-handed, and modified 2-handed bag-valve-mask technique	**Study One** Primary outcome: Knowledge of BLA and airway management. **Study Two** Primary outcome: Comparison of 2-handed versus modified 2-handed and 2-handed versus 1-handed techniques with the use of a BVM. Secondary outcome: Expired tidal volume with each technique	**Study One** Setting: Intensive care units of the various hospitals Subjects: 52 nurses working in various ICUs. **Study Two** Setting: Denver Health Medical Center Subjects: 52 subjects including respiratory therapists, medical students, resident physicians, attending physicians, critical care or emergency department registered nurses, and paramedics	**Study One** 20- item knowledge questionnaire on BLS and 10 questions on airway management **Study Two** 1. Expired tidal volume continuously obtained and electronically recorded in real time with a Novametrix NICO. 2. Demographic data including provider type, health care experience level, previous bag-valve-mask ventilation experience, sex, hand size, and handedness. Hand size was measured with 2 methods; first, from the fifth finger to the thumb spread as far apart as possible, and second, from the distal volar wrist crease to the distal tip of the third finger. The dominant hand was used in both instances. Objective dominant hand grip strength was assessed with a Jamar hydraulic hand dynamometer.	**Study One** The mean number of correct answers in the pre-test was 8.9±1.9 and increased to 16.3±1.7 after BLS training; the mean success rates were 44.5% and 81.5%, respectively ($p<0.001$). 4 (7.7%) inserted a nasal airway, 6 (11.5%) inserted a laryngeal mask airway (LMA), and 22 (42.3%) performed endotracheal intubation. The mean number of correct answers in the pre-test was 4.3±1.3 and increase to 7.9±1.2 after training in airway management, and the mean success rates were 43 % and 79 %, respectively ($p< 0.001$). **Study Two** 2-handed mask-face sealing techniques resulted in higher ventilatory tidal volumes than 1-handed technique. Tidal volumes from 2-handed and modified 2-handed techniques did not differ.	**Study One** **Methodological flaws:** Unsure if tool was validated. Small sample size. No explanation of where study was done. **Inconsistency:** None **Indirectness:** None **Imprecision:** Heterogenicity, bias in pre-posttest due to same test administered. **Publication bias:** None **Study Two** **Methodological flaws:** Small sample size, convenience sampling, and non-blinding of investigators. **Inconsistency:** None **Indirectness:** None **Imprecision:** Small sample size. **Publication bias:** None
Design **Study One** Pilot study **Study Two** Prospective cross over study				**Implications** **Study One** Nurses in the intensive care units, have insufficient knowledge level on the adult airway management and BLS. Nurses should attend training on BLS with regular refreshments in order to keep their knowledge up to date. **Study Two** Rescuers should perform bag-valve-mask ventilation with 2-handed techniques.	

<table>
<tr><th colspan="6">References
Deakin, C. D., Murphy, D., Couzins, M., & Mason, S. (2010). Does an advanced life support course give non-anesthetists adequate skills to manage an airway?. Resuscitation, 81(5), 539-543.</th></tr>
<tr><th>Purpose</th><th>Variables</th><th>Setting/Subjects</th><th>Measurement and Instruments</th><th>Results</th><th>Evidence Quality</th></tr>
<tr><td>Study One:
To determine if an ALS course give non-anesthetists adequate skills to manage an airway during a cardiac arrest.</td><td rowspan="3">Study One:
Primary outcome:
Manual ventilation in anesthetist vs non-anesthetist
Secondary outcome:
LMA insertion in anesthetist vs non anesthetist
Tertiary Outcome:
Complications with patients assigned to anesthetist vs non anesthetist</td><td rowspan="3">Study One:
Setting:
South Hampton General Hospital, UK.
Subjects:
20 anesthetist and 16 non-anesthetist and 36 patients.</td><td rowspan="3">Study One:
The primary endpoint was the time to LMA insertion. Secondary endpoints were able to manually ventilate the patient using the self-inflating bag-mask, the ability to secure the airway with a LMA within 30 s (as defined by the ALS course) and the presence of any complications as listed above.</td><td>Study One:
Anesthetists:18 (90%) demonstrated adequate and 2 (10%) demonstrated partially adequate manual ventilation skills. Eighteen (90%) met ALS LMA insertion. Non-anesthetists: 5 (31.25%) demonstrated adequate, 5 (31.25%) demonstrated partially adequate, and 6 (37.5%) demonstrated inadequate manual ventilation skills ($p < 0.001$). 4 non-anesthetists (25%) met the ALS LMA insertion guideline ($p < 0.0001$). Six failed to insert the LMA (37.5%). There were four complications (25% of patients), compared with none in the anesthetic group ($p = 0.01$).</td><td rowspan="3">Study One
Methodological flaws:
Unknown sampling approach, small sample size.
Inconsistency:
None
Indirectness:
Does not explain what instruments were used and the people measuring adequacy of ventilations.
Imprecision:
None
Publication bias:
None</td></tr>
<tr><td>Design</td><td>Implications</td></tr>
<tr><td>Study One:
Randomized control study</td><td>Study One:
The airway component of an ALS course alone does not give adequate practical skills for non-anesthetists to manage an airway in an anesthetized patient.</td></tr>
</table>

Demirtas, A., Guvenc, G., Aslan, Ö., Unver, V., Basak, T., & Kaya, C. (2021). Effectiveness of simulation-based cardiopulmonary resuscitation training programs on fourth-year nursing students. Australasian Emergency Care, 24(1), 4-10. https://doi.org/10.1016/j.auec.2020.08.005

Han, M., Lee, J., Shin, Y., Son, J., Choi, E., Oh, Y., Lee, S., & Choi, H. (2018). Effects of a simulated emergency airway management education program on the self-efficacy and clinical performance of intensive care unit nurses. Japan Journal of Nursing Science: JJNS, 15(3), 258-266. https://doi.org/10.1111/jjns.12195

Purpose	**Variables**	**Setting/Subjects**	**Measurement and Instruments**	**Results**	**Evidence Quality**
Study One: To examine the effectiveness of a simulation-based CPR training program on the knowledge, practices, satisfaction, and self-confidence of nursing students. **Study Two:** To examine the effects of a simulated emergency airway management education program on the self-efficacy and clinical performance among nurses in intensive care units	**Study One:** Primary outcome: Simulation-based CPR training improved the level of knowledge and the skills of nursing students Secondary outcome: Simulation had a positive effect on students' satisfaction and self-confidence **Study Two:** Primary outcome: Simulation education program on emergency airway management significantly improved the self-efficacy and clinical performance of career nurses who work in ICUs	**Study One:** Settings**:** Nursing schools in February 2016 Subjects: 89, fourth year nursing students **Study Two:** Settings: A tertiary hospital in Seoul, South Korea Subjects: Thirty-five nurses who were working in adult intensive care units	**Study One:** Student demographic data form, CPR knowledge questionnaire, CPR skills observation checklist, Students' satisfaction, and self-confidence scale (SSSC), Semi-structured interview form **Study Two:** Self-efficacy based on a tool from Lee and Jung. Clinical performance questionnaire based on a tool from Kim and Jang.	**Study One:** Mean pretest CPR knowledge score before the simulation-based CPR training was 5.66 ± 1.97 out of 10.0. The mean posttest CPR knowledge score (8.38 ± 1.30) increased significantly after the simulation ($p < 0.001$). **Study Two:** The score for self-efficacy was 3.40 ± 0.33 before education and 3.98 ± 0.38 after education. The score for clinical performance was 3.90 ± 0.47 before education and 4.23 ± 0.45 after education. There were statistically significant differences ($t = 3.09$, 95% CI: 0.21–0.45, $P = 0.003$).	**Study one:** **Methodological flaws:** Small sample size study was conducted in only one nursing school **Inconsistency:** Study cannot be generalized to all nursing students **Indirectness:** none **Imprecision:** none **Publication bias:** None **Study Two:** **Methodological flaws:** Small Sample size Single-center study; therefore, the generalizability of the results to other hospital settings is unclear **Inconsistency:** Tools utilized were not directly named. **Indirectness:** selection bias due to this being a quasi-experimental study of one-group pre–post design **Imprecision** Post-education surveys were performed only 1 week after the simulation education classes **Publication bias** None
Design				**Implications**	
Study One: Mixed method design with quantitative and qualitative aspects **Study Two**: Quasi-experimental study of one-group pre–post design.				**Study One:** There is a link between knowledge of CPR, actual performance of CPR, and poor survival outcomes. Therefore, CPR training of nursing students who may encounter cardiac arrest is important. **Study Two:** A simulation education program on emergency airway management significantly improved the self-efficacy and clinical performance of career nurses who work in ICUs	

Cason, C. L., Cazzell, M. A., Nelson, K. A., Hartman, V., Roye, J., & Mancini, M. E. (2010). Improving learning of airway management with case-based computer microsimulations. *Clinical Simulation in Nursing*, *6*(1), e15-e23. https://doi.org/10.1016/j.ecns.2009.07.002

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Purpose	Variables	Setting/Subjects		Measurement	Results	Evidence Quality
Study One: Evaluate the usefulness of MicroSim in learning the principles and concepts of airway management by comparing learning outcomes achieved with MicroSim with those achieved with traditional lecture **Study Two:** Describe learner experience, knowledge, confidence, and performance of assessments and interventions for the unresponsive patient across 3 years of an undergraduate nursing program	**Study One:** Primary Outcome: Microsimulation as useful in helping students develop patient care skills and apply them in simulations of real-world situations. Secondary Outcome: Exam scores and learner receptivity to microsimulation were similar for both learning approaches, learning outcomes equivalent to those achieved with lecture. **Study Two:** Primary Outcome: Simulation training results in increased skill retention up to 1 year after training	**Study One:** Setting: Undisclosed University Subjects: 78 undergraduate first semester pediatric nursing students **Study Two:** Setting: A Canadian university. Subjects: 239 second-, third-, and fourth year Bachelor of Nursing Science students.	**Study One:** Michael Reynolds Severe Asthma MicroSim. Paper-and-pencil examination. **Study two:** Knowledge Quiz-three open-ended examinations. Self-Confidence Scale an eight-item, 5-point Likert scale. Critical Behavior Performance Checklists. Experience Survey	**Study One:** Students in the MicroSim group had higher percentage-correct scores on all exam questions than did the lecture group. Average first scores for students in the MicroSim group ($F(1, 75) = 2.9$, $p = .09$).Students in the lecture group had higher average times of engagement with the microsimulation than did students in the MicroSim group ($F(1, 75) = 3.4$, $p = .06$.) **Study Two:** Higher knowledge scores were obtained by fourth-year students on the presurvey than third-year participants ($p = 0.01$). No statistically significant difference in overall self-confidence was found among students; the least confidence with initiating ventilations with a bag-valve-mask, assessing the airway. Fourth year students reported lower confidence for assessment of breathing ($p = 0.004$) and circulation ($p = 0.003$). Performance checklist scores generally improved from the second through the fourth years. Second-year students were more likely to agree that the simulations enhanced knowledge (p 0.05).	**Study One:** **Methodological flaws:** small size of the sample **Inconsistency:** Lack of information on the students' status as neomillennial learners prior to the start of the study **Indirectness:** The receptivity survey was designed as an end-of-semester evaluation. It provided only a generic assessment of students' response to microsimulation rather than one specific to the learning benefits. **Imprecision:** None **Publication bias** None **Study Two:** **Methodological flaws:** Small sample size **Inconsistency:** Researchers could not control for all prior learning; it is possible that past clinical experience may have influenced student performance **Indirectness:** None **Imprecision:** None **Publication bias:** None
Design				**Implications**		
Study One: Comparison group design **Study Two:** Descriptive cross-sectional.				**Study One:** Microsimulation was just as effective as lecture in acquiring knowledge of concepts and principles of airway management **Study Two:** High-fidelity simulation addresses to identify gaps in their students' learning outcomes related to management of the unresponsive patient.		

Samosorn, A. B., Gilbert, G. E., Bauman, E. B., Khine, J., & McGonigle, D. (2020). Teaching airway insertion skills to nursing faculty and students using virtual reality: A pilot study. Clinical Simulation in Nursing, 39, 18-26. https://doi.org/10.1016/j.ecns.2019.10.004

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Purpose	**Variables**	**Setting/Subjects**	**Measurement**	**Results**	**Evidence Quality**
Study One: To examine whether an educational intervention with a pilot contemporary immersive virtual reality simulation (CIVRS) builds knowledge and is feasible to implement among nursing students and faculty. **Study Two:** To assess changes in perceptions of confidence and preparedness for practice of preregistration nursing students before and after the introduction of a capstone subject, and factors associated with perceptions of preparedness.	**Study One:** Primary Outcome: Virtual reality can be effective for knowledge transfer to learners from a digital educational platform as Bauman's layered-learning model. Secondary Outcome: Virtual reality can provide consistent learning experiences designed to simulate practice and provide a mechanism for students to learn and be evaluated through performance. **Study Two:** Primary Outcome: Improving graduate nurses' preparedness for practice.	**Study One:** Setting: Midwestern campus of a national nursing school Subjects: 21 students enrolled in the three-year Bachelor of Science in nursing program. 10 faculty members **Study Two:** Setting: A regional university in north Queensland, Australia Subjects: 167 third year nursing students enrolled in a 3-year Bachelor of Nursing Science	**Study One:** The presence questionnaire (PQ) Virtual reality sickness questionnaire (VRSQ) Immersive tendencies questionnaire. Virtual Airway Knowledge Test **Study Two** Casey-Fink Readiness for Practice Survey	**Study One:** Faculty and students rated the VR airway laboratory as having high presence, no cybersickness, and significantly improving knowledge of airway management ($p < .0001$) Median faculty and student PQ scores were 140 (IQR = 16.8) and 143 (IQR = 17) The minimum and maximum for the global VRSQ score were 0% and 8.3% Knowledge test: Average student mean post-test scores were significantly higher than mean pretest scores ($p < .0001$) Mean post-test scores were significantly higher than faculty pretest scores ($p < .0001$) Experience: Mean scores ranged from 3.43 to 3.76 **Study Two:** Top two episodes of care participants are most uncomfortable performing independently involve invasive procedures: venipuncture, assisting with intubation, insertion of Guedel airway. Inverse correlation was found between age and confidence in managing a three patient assignment ($rs(147) = -0{\cdot}19$, $p = 0{\cdot}022$)	**Study One:** **Methodological flaws:** Small Sample size. Administration of a pretest may have sensitized participants to the material assessed on the post-test **Inconsistency:** There were significant short-term gains in knowledge, long-term gains were not assessed, there is minimal internal validity in this design, and it has no external validity because it lacks a control group **Indirectness:** Number of years students were studying was not collected or whether students had exposure to airway management **Imprecision:** None **Publication bias** Recruitment bias. Faculty and students were compensated to participate in the study. **Study Two:** **Methodological flaws:** Small sample size The study was conducted at one university **Inconsistency:** None **Indirectness:** None **Imprecision** Limited by social desirability inherent in all self-report measures **Publication bias** None
Design **Study One:** A quasi-experimental one-group pretest-posttest design. A pilot study **Study Two:** A two-phase survey study.				**Implications** **Study One:** Virtual reality can be used as an intervention in nursing education. **Study Two:** There is a need for new graduate support initiatives including transition and intern programs in the first year of practice and pre-graduation strategies such as preceptor led final clinical placements	

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Purpose	**Variables**	**Setting/Subjects**	**Measurement**	**Results**	**Evidence Quality**
Study One: To investigate the extent to which Irish nursing students acquire and retain CPR cognitive knowledge and psychomotor skills following CPR training. **Study Two:** To determine the efficacy of simulation training in airway management among final year nursing students. **Design** **Study One:** A quasi-experimental time series design. **Study Two:** A quasi-experimental research design.	**Study One:** Primary outcome: A longitudinal follow-up of students' CPR knowledge and skills would enrich the study findings **Study Two:** Primary outcome: An intensive simulation training program on airway management serves as a bridge on the gap between classroom instruction and practical application Secondary outcome: Intensive simulation increases students' sense of security and confidence before they are exposed to real clinical areas.	**Study One:** Setting: Republic of Ireland, one Irish general teaching hospital Subjects: 18 general nursing students within the second-year cohort of a three-year undergraduate nursing Diploma program **Study two:** Setting: Health Training Institutions in Northern Borneo Subjects: 40 final year nursing students	**Study One:** 21 item structured multiple-choice assessment **Study Two:** Modified Pre-test Post-test Design Tool, Simulation Efficacy Tool Modified (SET-M).	**Study One:** The mean score of students' CPR knowledge in the pre-test was 15.2(6%(n=1), mean score of students' CPR knowledge in the post-test was 18.1, 72% (n = 13) Ten weeks after the CPR program, the mean score of students' CPR knowledge was 16.8, 44% (n = 8) The mean score for CPR performance in the post-test was 15; 94% of students achieved higher scores from the pre-test to the post-test. **Study Two:** Significant difference on confidence level, the mean score of the pre-test and the mean score of the post-test (CI95% (-0.53414, -0.09586), t= -3.009, df = 19, p<.05). **Implications** **Study One:** Nurses' CPR knowledge and skills have implications for patient survival from a cardiac arrest and is a critical health care issue as Ireland faces the huge burden of CVD mortality of its growing population **Study Two:** Intensive simulation acts as a reinforcement strategy on the technical and nontechnical skills to determine their competency	**Study One:** **Methodological flaws:** Small population and sample size Study conducted in one geographical location **Inconsistency:** None **Indirectness:** None **Imprecision:** The study design did not permit studying variables such as 'motivation' and 'perceived competence in CPR. **Publication bias:** None **Study Two:** **Methodological flaws:** Small population and sample size Study conducted in one geographical location **Inconsistency:** None **Indirectness:** None **Imprecision** None **Publication bias:** None

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Appendix A

Incentivization in Research: A Literature Review

Research assists in gathering and improving knowledge, answering questions, and filling existing gaps from previous research (Urick et al., 2021; Zarah, 2022). This aides in improving practices that enforces growth and development (Parker, 2018). Moreover, research helps distinguish between true or false phenomena through scientific investigation, testing, and support (Kapur, 2018). Participation in research provides information on the area of study, which informs decisions and knowledge on the context of the study (Michael & Carnochan, 2020). Participation and consent are vital to conducting research. Therefore, some researchers offer incentives for participation to boost recruitment, as compensation or as an appreciation to the participant for the time they participated in the research. Monetary incentives have been characterized as a potential solution to proper recruitment to increase the number of participants and improve the effectiveness of research participation (Abdelazeem et al., 2022).

Disadvantages of Incentivization

Incentives for participation in research may result in biasness in the study (University of Oxford, 2020). Incentives can attract people interested in the reward or the financial benefit instead of contributing to the study area. Incentives may also contribute to having the wrong groups of respondents, especially when a researcher needs help validating if the information the participants give themselves is true. These respondents might need to give more accurate information, which can corrupt the viability of the research (Abdelazeem et al., 2022). Different types of incentives may attract different groups of participants, influencing biased and unduly participation, particularly in the self-selecting population. Similarly, incentives in research may raise ethical concerns, and research enrollment may be biased toward what the researcher aims to

achieve (Afkinich & Blachman-Demner, 2019; Różyńska, 2022; Roaab & Biller- Andornoab, 2022). Incentive-caused bias coerces and directs people to the researcher's interest, influencing how people act.

Additionally, offering incentives may be unethical, especially when rewards are given. It may hinder participants from considering the risks the research may have (Abdelazeem et al., 2022). Incentives increase the chances of participants agreeing and offering consent to participate in research (Saleh et al., 2020). They might need to critically examine the consequences and the study's impact on them. Participants are at risk of being exploited and burdened with agreeing to unreasonable risks they would normally disagree with if not for the desire to attain the reward or the incentive.

Incentivization of participation can lead to coercion. If the number of incentives varies, depending on the type of research, the time, and the activities involved, participants may choose to participate in the high-paying study (Różyńska, 2022). By doing so, they may be at risk of persevering through uncomfortable conditions. Participants from financially disadvantaged settings and those with poor resources risk being victims of coercion to participate in research where participants are rewarded (University of Oxford, 2020). Incentives promote undue inducement, which influences the decision-making of participants, which is unethical (Roaab & Biller- Andornoab, 2022). Participation in research should be voluntary and conducted with informed consent, which is compromised when incentives are given to influence decision-making.

Advantages of Incentivization

Introducing incentives as a compensatory measure encourages participants' engagement and commitment to the research. Research studies can be time-consuming and may result in

participants incurring some expenses. There are different levels of participation in research depending on whether the research is qualitative or quantitative. Oftentimes, there is a lack of understanding on the importance of research projects and the need for participation. Informed consent is crucial for the significance of the research project, therefore employing different techniques to obtain a relevant participation for the study population could mean offering various rewards. (Gergely et al., 2022).

As a result, the specific targeted population may fail to participate to avoid incurring expenses (Saleh et al., 2020). Abdelazeem et al. (2022) and Mahmutovic (2022), identified a significant increase in the rate of consent and response when participants were given monetary incentives. Additionally, utilization of incentive to obtain participation helps to increase participant investment and retention in research studies (Saleh et al., 2020; Abdelazeem et al., 2022). The Self-determination theory describes the improvement to commitment to the task provided when workers are rewarded. Similarly, rewarding participants in research generates positive behaviors and promotes the desire to contribute significantly to research (Thibault Landry & Whillans, 2018; Faust, 2021).

Offering incentives for participation in research promotes the attainment of a statistically significant sample. Within a research study, the researcher may target specific subjects to form its study population. Recruitment of the population of the study is vital, trials can be terminated early and deemed unsuccessful due to failure to recruit appropriate subjects and the required number of participants. Offering incentives has been viewed as a way to reduce recruitment failure (Abdelazeem et al., 2022). The Central University Research Committee (CUREC) recommends these factors to take into consideration when offering incentives to prompt an individual's participation in research. These include, the welfare of the volunteer, the potential

threat to the common good, and the professional responsibilities of researchers (University of Oxford, 2020). Moreover, incentives promote goodwill and encourage responses to lengthy surveys. Micro surveys are lengthy, and this might deter participants commitment to the research. Providing compensation helps overcome objections due to time commitments and in instances where personal privacy is compromised (Abdelazeem et al., 2022).

Prevention of ethical misconduct must remain of primary importance, however without participation, the research study may not be viable. Therefore, incentivizing can increase participation, promote participation engagement and commitment to the research, improves task performance, and retains participation throughout the research study. Further research should be conducted on controlling incentives and avoiding researchers using them to entice participation, to control results.

Appendix B

VIRTUAL AIRWAY KNOWLEDGE TEST©

Directions: Read each sentence and indicate the best answer by filling in the circle ("O") corresponding to that answer.

ID: _____ Date: _____

Administration: Pretest: O Posttest: O

1. During placement of the endotracheal tube the laryngoscope is held...
- O a. by an assistant
- O b. in the left hand.
- O c. in the right hand.
- O d. with both hands.

2. The correct endotracheal tube size is determined by the patient's...
- O a. gender.
- O b. gender, height, and weight.
- O c. height.
- O d. height and weight.
- O e. weight.

3. The correct landmarks used to measure or size a nasopharyngeal airway are:
- O a. Corner of the patient's mouth and the tip of the ear.
- O b. Lateral aspect of the zygomatic arch to the tip of the nose.
- O c. The middle of the patient's chin and the corner of the patient's mouth.
- O d. The middle of the patient's chin and the tip of the ear.
- O e. Tip of the patient's ear and the patient's nostril.

4. The correct landmarks used to measure or size an oropharyngeal airway are:
- O a. Corner of the patient's mouth and the tip of the ear.
- O b. Lateral aspect of the zygomatic arch to the tip of the nose.
- O c. The middle of the patient's chin and the corner of the patient's mouth.
- O d. The middle of the patient's chin and the tip of the ear.
- O e. Tip of the patient's ear and patient's nostril.

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5. The endotracheal tube is:

- O a. less invasive than the King airway.
- O b. less invasive than the laryngeal mask airway
- O c. less invasive than the oropharyngeal or nasopharyngeal airway, King airway or laryngeal mask airway.
- O d. more invasive than the oropharyngeal airway, nasopharyngeal airway, King airway or laryngeal mask airway.
- O e. Both a. and b.

6. The endotracheal tube when placed correctly is...

- O a. blindly inserted into the patient's airway.
- O b. not passed through the patient's vocal cords.
- O c. passed through the patient's vocal cords into the trachea.
- O d. seated in the patient's esophagus.
- O e. None of the above

7. The head-tilt/chin-lift is:

- O a. a technique used to open a patient's airway
- O b. is often used in conjunction with airway adjuncts
- O c. not used for definitive airway management
- O d. both a. and b.
- O e. both a. and c.

8. The head-tilt/chin-lift is:

- O a. is only used if a patient is not breathing at all.
- O b. is used to provide positive pressure ventilation to patients who are not breathing or not breathing effectively.
- O c. should only be used if the patient is in cardiac arrest.
- O d. should only be used with a positive end-expiratory pressure (PEEP) valve attached.
- O e. None of the above

9. The King airway is sized according to the patient's...

- O a. gender.
- O b. gender, height, and weight.
- O c. height.
- O d. height and weight.
- O e. weight.

10. The laryngeal mask airway or LMA and King airway are...

- O a. both considered more invasive than an endotracheal tube.
- O b. both supraglottic airway devices.
- O c. cannot be used with a bag valve mask.
- O d. require a laryngoscope to place correctly.
- O e. None of the above

Suggested citation: Samosorn, A., Gilbert, G. E., Bauman, E. B., Khine, J., & McGonigle, D. (2020). Using VR to teach nursing faculty/students airway insertion skills. *Clinical Simulation in Nursing, 39*(2), 18–26. https://doi.org/10.1016/j.ecns.2019.10.004.

11. The laryngeal mask airway or LMA is sized according to the patient's...

- O a. gender.
- O b. gender, height, and weight.
- O c. height.
- O d. height and weight.
- O e. weight.

12. The oropharyngeal airway should only be used in patients...

- O a. as a precursor to the placement of a more advanced tube.
- O b. who are awake and talking.
- O c. who are unable to tolerate other airway adjuncts.
- O d. who do not have a gag reflex.
- O e. with agonal respirations.

13. The proper placement of the bag valve mask for artificial ventilation includes placing the mask...

- O a. only over the patient's mouth.
- O b. only over the patient's nose.
- O c. over both the patient's mouth and nose.
- O d. None of the above

14. What is the correct high flow oxygen setting when using a bag valve mask during emergency airway management to ventilate a patient?

- O a. 1-2 liters of oxygen/minutes
- O b. 2-4 liters of oxygen/minute
- O c. 10-15 liters of oxygen/minute
- O d. More than 15 liters of oxygen/minute
- O e. None of the above

15. When ventilating a patient who has a pulse but is not breathing with a bag valve mask with or without an advanced airway, you should deliver each breath about once every.

- O a. 3 seconds.
- O b. 5 seconds.
- O c. 10 seconds.
- O d. 15 seconds.
- O e. None of the above

16. When ventilating a patient with a bag valve mask, you should deliver each breath over the course of:

- O a. 1-1.5 seconds.
- O b. 2-2.5 seconds.
- O c. 3-3.5 seconds.
- O d. 4-4.5 seconds.
- O e. None of the above

Suggested citation: Samosorn, A., Gilbert, G. E., Bauman, E. B., Khine, J., & McGonigle, D. (2020). Using VR to teach nursing faculty/students airway insertion skills. *Clinical Simulation in Nursing, 39*(2), 18–26. https://doi.org/10.1016/j.ecns.2019.10.004.

CRICOID PRESSURE QUESTIONS

1. Which maneuver temporarily occludes the upper esophagus by posteriorly displacing the cricoid cartilage against the cervical vertebrae?
    a. Jaw-thrust
    b. Larson
    c. Sellick
    d. Valsalva
2. Contraindications to the application of cricoid pressure include: **(Select 2.)**
    a. active vomiting.
    b. a history of difficult airway.
    c. limited respiratory reserve.
    d. unstable cervical spine injury.

Student Satisfaction and Self-Confidence in Learning

Instructions: This questionnaire is a series of statements about your personal attitudes about the instruction you receive during your simulation activity. Each item represents a statement about your attitude toward your satisfaction with learning and self-confidence in obtaining the instruction you need. There are no right or wrong answers. You will probably agree with some of the statements and disagree with others. Please indicate your own personal feelings about each statement below by marking the numbers that best describe your attitude or beliefs. Please be truthful and describe your attitude as it really is, not what you would like for it to be. This is anonymous with the results being compiled as a group, not individually.

Mark:
1 = STRONGLY DISAGREE with the statement
2 = DISAGREE with the statement
3 = UNDECIDED - you neither agree or disagree with the statement
4 = AGREE with the statement
5 = STRONGLY AGREE with the statement

Satisfaction with Current Learning	**SD**	**D**	**UN**	**A**	**SA**
1. The teaching methods used in this simulation were helpful and effective.	○ 1	○ 2	○ 3	○ 4	○ 5
2. The simulation provided me with a variety of learning materials and activities to promote my learning the medical surgical curriculum.	○ 1	○ 2	○ 3	○ 4	○ 5
3. I enjoyed how my instructor taught the simulation.	○ 1	○ 2	○ 3	○ 4	○ 5
4. The teaching materials used in this simulation were motivating and helped me to learn.	○ 1	○ 2	○ 3	○ 4	○ 5
5. The way my instructor(s) taught the simulation was suitable to the way I learn.	○ 1	○ 2	○ 3	○ 4	○ 5
Self-confidence in Learning	**SD**	**D**	**UN**	**A**	**SA**
6. I am confident that I am mastering the content of the simulation activity that my instructors presented to me.	○ 1	○ 2	○ 3	○ 4	○ 5
7. I am confident that this simulation covered critical content necessary for the mastery of medical surgical curriculum.	○ 1	○ 2	○ 3	○ 4	○ 5
8. I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform necessary tasks in a clinical setting	○ 1	○ 2	○ 3	○ 4	○ 5
9. My instructors used helpful resources to teach the simulation.	○ 1	○ 2	○ 3	○ 4	○ 5
10. It is my responsibility as the student to learn what I need to know from this simulation activity.	○ 1	○ 2	○ 3	○ 4	○ 5
11. I know how to get help when I do not understand the concepts covered in the simulation.	○ 1	○ 2	○ 3	○ 4	○ 5
12. I know how to use simulation activities to learn critical aspects of these skills.	○ 1	○ 2	○ 3	○ 4	○ 5
13. It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time..	○ 1	○ 2	○ 3	○ 4	○ 5

Revised December 22, 2004

Airway Skills Checklist

Critical Performance Steps	Check if done correctly
Apply the mask by starting at the bridge of the nose and rotating it down to cover the mouth and chin.	
Assess for gaps between the static manikin's face and the mask at the eyes, cheeks, and chin.	
Forms a C with the first and second digits of the left hand over the face mask.	
Forms an E with the remaining three digits spaced along the bony prominence of the mandible and the fifth digit placed at the angle of the jaw.	
Opens the airway via the head tilt chin lift or jaw thrust maneuver.	
Ventilate with an airtight seal.	
Produce continuous static manikin lung inflation over one second.	
Ventilates at the correct rate (1 breath every 5-6 seconds) for 1 minute.	