THE IMPLEMENTATION OF A PREPARATION CHECKLIST AND SIMULATION FOR OUT OF OR INTUBATION: A QUALITY IMPROVEMENT PROJECT

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Table of Contents

Dedication and Acknowledgements

It is with heartfelt gratitude and appreciation that I dedicate this Doctor of Nursing Practice (DNP) project to my family. This project is a profound expression of gratitude, love, and admiration that I hold for each of you. My journey to attain a Doctor of Nursing Practice degree has been a monumental undertaking, and it is only fitting that I express my deepest appreciation to you, my family, whose unwavering support has made this all possible. Your patience, understanding, and sacrifices have allowed me to dedicate myself fully to this endeavor. Every late night, every moment spent studying, and every challenge I faced was eased by your presence and belief in me.

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Abstract

Background: Endotracheal intubation (ETI) in the intensive care unit (ICU) poses a significantly higher risk of life-threatening complications compared to procedures in the operating room (OR). Limited resources and the complex, critical condition of ICU patients make ETI more challenging. To bridge the gap in care, implementing standardized checklists and simulation training for ETI procedures in intensive care units will enhance patient outcomes by ensuring proper preparation, equipment, medications, and communication between healthcare providers. **Purpose**: This project aims to improve knowledge and ICU nurses' confidence in preparing for and managing endotracheal intubation procedures in critically ill patients, thereby enhancing patient safety during emergent intubations outside the operating room. **Methods**: The Lewin's Three-Step Model of Change and the Iowa model of evidence-based practice provided context for implementation. A PowerPoint presentation which reviewed the contents of a standardized preparedness checklist was followed by a simulation exercise led by the primary investigator. A mixed-methods design using a pre-and post-test survey was utilized for data collection. **Results:** Sixty-two ICU RNs participated in the intervention. A paired T-test was utilized to analyze the data from the pre-and post-test surveys. 70% of ICU RNs participating in this project reported increased confidence with the greatest improvement in self-reported confidence exemplified in the group of nurses with less than two years of experience working in the ICU. **Conclusion:** The results indicated that the intervention effectively increased confidence and knowledge of ETI, which improves patient safety and decreases morbidity and mortality. Additionally, results indicated that simulation training is beneficial to increase confidence levels while preparing for life-threatening emergencies in a safe, controlled environment.

Key Words: endotracheal intubation, checklist, education, Intensive care nurses' confidence

Background and Significance

Endotracheal intubation is understood to be a high-risk procedure for any patient requiring a secure airway both inside and outside of the operating room (OR). However, patients requiring emergent endotracheal intubation (ETI) in the intensive care unit are at nearly 40% increased risk of experiencing life-threatening complications associated with acquiring a secure airway (Jaber et al, 2010). Risks associated with endotracheal intubation include life-threatening hypoxia, hypotension, and cardiac arrest (Cabrini et.al, 2018; Conroy et.al, 2014; Janz et. al, 2018). While anesthesia providers are in the OR there is access to ample resources to mitigate these risks. For example, the gas machine is readily available and has been checked before each case, the room is adequately stocked including emergency materials, medication dispensing machines are in the room, and there are usually other skilled providers readily available to assist in the case of an emergency. However, when the provider leaves the OR to intubate a critically ill patient these resources may be severely restricted (Groombridge et al., 2020). Furthermore, due to the precarious nature of the intensive care unit patients' hemodynamic and respiratory status, endotracheal intubation becomes physiologically and situationally more challenging for the anesthesia provider (Brindley et. al, 2017).

In addition, the patients that arrive in the OR are generally considered elective intubations where the anesthetist has some knowledge of the patient they are receiving. During ETIs outside of the OR, the anesthetist typically has an abundance of knowledge on airway management and the intubation procedure, but he or she may have little knowledge of the patient and the materials available to them at the destination. Furthermore, the nurse caring for the patient in the destination unit may have little knowledge of the ETI procedure and the necessary equipment, but he or she has an in-depth understanding of the patient's medical history and current situation.

For these reasons, a gap in care for critically ill patients exists during ETI procedures completed in the ICU.

Standardized work in the form of checklists has been found to improve patient outcomes during medical procedures, like central line insertions, by ensuring providers do not miss critical steps or necessary equipment while performing these procedures (Whytock & Atkinson, 2021). There is reason to believe that a standardized checklist for ETI denoting necessary equipment, medications, and suggestions for a report of pertinent information from nurse to anesthesia provider will assist in bridging this gap in care.

Purpose Statement

The purpose of this project is to provide impactful education for intensive care nurses at a level one trauma center to improve patient safety during emergent intubation procedures occurring outside of the operating room. Through the use of simulation and a checklist, the goal is to provide the nurses with the knowledge and confidence to prepare for and participate in an emergent intubation procedure.

Literature Review

The process of ETI occurs in three stages. These are (1) preparing the patient and environment for intubation, (2) placing the endotracheal tube, and (3) verifying tube placement. Preparation is a key factor in the anesthesia provider's ability to safely complete endotracheal intubation. However, in instances where the ETI occurs outside of the OR, the patient may not be adequately prepared. The nurse or nurses caring for the critically ill patient are responsible for preparing the patient and environment for intubation. Intubations of critically ill patients occurring outside of the OR are reportedly more challenging and more dangerous when compared to intubations occurring inside the OR (Hubert et. al, 2014; Jaber et.al, 2010; Sherren

et. al, 2014). The goal of this project is to provide ICU nurses with impactful resources that enhance their knowledge of the intubation procedure and increase their confidence while participating in this precarious situation. Interventions that will assist in achieving this goal are the employment of a standardized checklist and intubation simulation. The purpose of this literature review is to examine the efficacy of a standardized checklist and simulation during out-of-OR (i.e., ED or ICU) ETIs in critically ill patients.

Literature Search Methods

For this synthesis PubMed, CINAHL, and SCOPUS were searched using the keywords and phrases: “endotracheal intubation or intubation”, “checklist* or tool”, “intensive care unit or ICU or critical care or critical care unit”, “simulation*”, and “simulation in healthcare education”. This search process yielded articles that were filtered using the following inclusion criteria: a publication date within the last ten years, the article must be written in English, and an adult patient population. Exclusion criteria included patient populations that related to COVID-positive status at the time of the investigation, and the setting for intubation could not be outside of the hospital. Systematic reviews of randomized control trials and meta-analyses were preferred for inclusion. The articles incorporated in this report included quantitative study designs, randomized control trials, systematic reviews of randomized control trials, and meta-analyses.

Efficacy of Checklists in Intubation Procedures

Standardized work in the form of checklists improves patient outcomes during medical procedures by ensuring providers do not miss critical steps or necessary equipment while performing these procedures (Whytock & Atkinson, 2021). Two categories of checklists emerged for ETI: procedural checklists and preparedness checklists.

Procedural Checklists

Procedural checklists refer to the step-by-step process providers conduct while completing a medical procedure such as central line insertion or endotracheal intubation. Numerous publications concluded that the use of a procedural checklist did not have a significant effect on the frequency of complications and/or adverse events during ETI procedures (Conroy et. al, 2014; Janz et. al, 2018; Zeuchner et. al, 2021). Furthermore, Forristal et. al (2021) found that using the procedural checklist increased the amount of time it took for providers to establish a secure airway. Minimizing time to intubation is one of the main priorities in endotracheal intubation because prolonged intubation increases the risk of adverse events. However, after repetitious use of the checklist providers may be able to achieve a calmer interdisciplinary approach to laryngoscopy (Groombridge et al., 2020). Due to the time-sensitive nature of endotracheal intubation, a procedural checklist would not be the most efficient form of a checklist for this program.

Preparedness Checklists

Intubations completed without the use of a preparedness checklist increased the risk for adverse events. Adverse events included cardiac arrests, esophageal intubations, and unsuccessful first-pass attempts at placing the endotracheal tube. Hypotension and hypoxia were the most commonly measured physiologic complications with the intubation procedure. Preparedness checklists include equipment and other environmental factors that should be readily available before the procedure begins (i.e., appropriate patient positioning, preoxygenation in progress, and working suctioning equipment). Preparedness checklists for intubation procedures improve patient outcomes and reduce the risk of adverse events (Cabrini et.al, 2018; Smith et al., 2015; Turner et al., 2020).

During intubation, before the endotracheal tube is placed the patient undergoes a period of apnea. Minimizing this apneic period by appropriately preparing for intubation and promptly placing the endotracheal tube is crucial. Absent appropriate planning and availability of necessary equipment, the patient may suffer a preventable hypoxic event. A systematic review authored by Turner et al. (2020) suggested that 11 different studies including more than 3000 patients reported significant results for decreased hypoxic events following the use of a preparedness checklist during ETI. In addition, a systematic review authored by Cabrini et al. (2018) found that checklists including preoxygenation with a high-flow nasal cannula or other noninvasive oxygen supplementation showed a significant decrease in severe and non-severe complications. The implementation of a preparedness checklist during intubation was associated with a reduction in oxygen desaturation, emesis, esophageal intubation, hypotension, and cardiac arrest (Smith et al., 2015). Incorporating a preparedness checklist will decrease morbidity and mortality for critically ill patients undergoing endotracheal intubation.

Efficacy of Simulations in Difficult Airway Management

Simulation exercises have reportedly been a valuable tool in various disciplines of healthcare education in the last decade. These simulation opportunities serve as a way for clinicians to accrue beneficial experiences without the risk of harm to patients. The exercises are considered a bridge between classroom learning and real-life clinical experience (Society for Simulation in Healthcare, 2023). While conducting this literature review numerous advantageous themes of simulation education emerged. These included improved technical skills, improved non-technical skills, and increased learner confidence.

Improved Technical and Non-technical Skills

The goal of simulation learning is to provide the learner with experience to apply didactic knowledge of a topic or skill in a low-stress environment. Learners who participate in these experiential learning opportunities have been shown to better perform the technical skills associated with the activity in the clinical setting (Forbis, 2018; Hammontree & Kinderknecht, 2022). This directly correlates to the technical skills of preparing a patient for intubation and maintaining patient safety while waiting for the arrival of the anesthesia provider.

In addition to improving the technical skills, there are several other non-technical skills participants acquire. Non-technical skills typically include, but are not limited to, interdisciplinary teamwork and communication. After the simulation exercise, the learners have an opportunity to debrief about areas of opportunity if they were to participate in a similar exercise in the future. Learners benefitted from these debriefings equally as much as they benefitted from the application of the technical skills (Coyle et al., 2020; Hubert et al., 2014). Researchers also reported that the debriefing activity resulted in increased retention of situational knowledge at the core of the learning outcomes for the simulations (Hammontree & Kinderknecht, 2022; Hubert et al., 2014).

Increased Learner Confidence

Individuals engaging in simulation experiences frequently gained heightened confidence in their capacity to successfully complete or actively engage in the subject matter simulated. Hammontree & Kinderknecht (2022) identified 67 nurses who indicated they experienced a feeling of increased competence and confidence after participating in a mock code simulation experience. Similarly, Forbis (2018) discovered that student-registered anesthetists also experienced higher levels of confidence in their ability to handle a difficult airway after simulation as compared to only classroom discussions.

Inconsistencies and Gaps

Among current literature, few publications compare interdisciplinary education with anesthesia providers and ICU nurses. Almost all of the studies solely focused on the anesthesia provider as the population of interest. The goal of this project was to prepare a checklist for ICU nurses that would allow them to prepare the patient and environment for the arrival of the anesthesia provider before intubation. In this scenario, the ICU nurse has a more active and empowered role in the intubation of a critically ill patient. Through interdisciplinary training individuals from various disciplines will benefit from knowledge sharing, and the anesthesia provider may find some barriers to adequate preparation of the patient in an emergent situation unique to specific hospital systems. In addition, interdisciplinary education will help foster a positive working relationship between anesthesia providers and ICU nurses.

Summary

Intubations occurring outside of the operating room pose a significant risk to the safety of critically ill patients. Preparedness checklists and simulation experiences have proven to be useful interventions to enhance ICU nurses' knowledge of the intubation procedure and how to prepare the patient and environment for the anesthesia providers' arrival. This intervention will also serve as an opportunity for knowledge sharing across professional disciplines and bridging the gap between anesthesia providers and ICU nurses.

Methods

Project Design

In this project, the principal investigator (PI) was a student registered nurse anesthetist (SRNA). This project design utilized a mixed-method approach for implementing a checklist and simulation for endotracheal intubation. A pre-test and post-test survey (Appendix A and B) was

created by the DNP student to evaluate critical care nurses' self-perceived confidence in clinical skills associated with endotracheal intubation procedures in critically ill patients. The objective of this project was to evaluate the effects of a checklist and simulation on the critical care nurse's confidence in preparing for and participating in endotracheal intubation procedures. Data was collected using paper pre-test and post-test surveys (Appendix A and B) to address the following question: Does a simulation and standardized checklist for intubation increase confidence in ICU nurses' ability to assist in and prepare for emergent out-of-OR intubations? The evidence-based checklist included equipment, medications, positioning suggestions, and an abbreviated handoff tool for information most pertinent to the anesthesia provider (Appendix C). The checklist was presented to the critical care nurses via an educational PowerPoint. The simulation exercise followed the presentation of the PowerPoint, and the ICU nurses were able to practice their knowledge and skills related to preparing a critically ill patient for intubation. The project participants included intensive care unit Registered Nurses at an urban tertiary care center. This was not a controlled study. Each participant had an equal opportunity to participate in the exercise and learn about endotracheal intubation. Before the implementation of the simulation and checklist, the PI met with the education supervisor of the surgical trauma intensive care unit to ensure the investigators were meeting the needs of the critical care unit staff.

Theoretical Framework

The theoretical framework for this DNP project is Lewin's Three-Step Model of Change. Lewin's theory of change has been noted as one of the most influential approaches to organizational change (Burnes, 2020). This model involves three consecutive steps that must take place for the application of new practices to be successful: Unfreezing, Moving, and Refreezing. First, in the unfreezing process, the investigator creates an awareness of an issue that

allows others an influential opportunity to relinquish old habits. Second, in the moving process, the investigator attempts to demonstrate the benefits of changing the previously identified problem. This step typically involves training and reeducation (Burnes, 2020). Finally, in the refreezing process, the acquired knowledge and training will become a new habit.

The behavior evaluated in this DNP project was critical care nurses' ability to prepare for and participate in endotracheal intubation. Based on Lewin's change theory, the unfreezing process involved the identification of endotracheal intubations outside of the OR as a major risk factor for morbidity and mortality in critically ill patients. In addition, critical care nurses were assessed for their current understanding and self-perceived confidence in their role during endotracheal intubation. Next, the moving process involved the implementation of a checklist and simulation to assist critical care nurses in establishing a habit of preparedness for intubation. Finally, the refreezing process included reassessing the critical care nurses for changes in their understanding and self-perceived confidence in their role during endotracheal intubation. Utilizing Lewin's Three-Step Model of Change the PI was able to assist critical care nurses in establishing a new equilibrium for when a critically ill patient requires intubation in their unit.

Evidence-Based Practice Model

The evidence-based framework best suited for the implementation of a preparation checklist and simulation for out-of-operating-room intubation was the Iowa model of evidence-based practice. The Iowa model was created in the early 1990s and revised in 2017 by a team of nurses from the University of Iowa Hospitals and Clinics and the College of Nursing (Cabarrus College of Health Sciences, 2022). Since its inception, this model has been adopted to guide a wide array of clinical practice changes. According to the authors of the Iowa Model

Collaborative (2017), this model has been requested for permission to be used by clinicians, educators, administrators, and researchers from all 50 states and 130 countries.

This model was developed as a systematic method to assist healthcare providers in developing and implementing evidence-based practice changes. The step-by-step process includes identifying areas of opportunity for improvement, gathering credible literature to support an evidence-based intervention, designing a pilot study for testing the proposed intervention, and sustaining the practice change (Iowa Model Collaborative, 2017).

The objective of this DNP project, similar to the Iowa model, was to identify an area of opportunity for improvement in the clinical setting and employ the use of evidence-based practice to prompt a clinical practice change. The key steps in the model and their correlation to this project are listed below:

1. Identify Triggering Issues/ Opportunities: There was an appreciable gap in care related to a lack of patient and provider preparation before emergent intubations in the intensive care unit.

2. State the Question or Purpose: A formal problem statement and research question were presented to the DNP faculty before the literature review process began.

3. Determine if the topic is a priority: Leadership members in the intended intensive care unit were approached and asked about their opinion on the need for this particular educational exercise for their nurses. They agreed that there was a gap in care and that a formal checklist and simulation for intubation would be beneficial for ICU nurses.

5. Assemble, Appraise, and Synthesize the Body of Evidence: A systematic review of the literature was conducted to assess current research related to this topic. This evidence was then synthesized into the literature review section of this paper.

6. Determine if there is sufficient evidence: Sufficient evidence was found to support the use of a checklist and simulation during intubations conducted outside of the operating room. The evidence was appraised, compiled, and presented as a literature review.

7. Design and Pilot the practice change: A checklist was composed based on the literature search mentioned above, and a simulation was conducted with intensive care unit nurses.

9. Integrate and Sustain the Practice change: After the simulation activity the checklist was left with the intensive care unit in the unit's charge nurse book for clinicians to refer back to this education as often as they need. The unit was also interested in incorporating this checklist in the orientation modules for newly hired nurses.

10. Disseminate Results: The DNP project was composed and submitted for final review by the DNP faculty, and the checklist was available for use among other nursing units that often experience emergent intubations. The DNP project was made publicly available via a university repository.

Permissions

A sponsorship letter to conduct this DNP project at an urban tertiary care hospital was obtained from the nurse manager and education supervisor of the surgical trauma intensive care unit. The unit's leadership team served as the advisors and clinical points of contact for implementing this project. Institutional Review Board (IRB) approval was obtained by the University of North Carolina at Greensboro and the tertiary care hospital's Student Research Committee before implementing the intubation checklist (Appendix C) and simulation training.

Sample and Setting

The implementation of an endotracheal intubation checklist and simulation was conducted at an urban tertiary care center. The target population for this project was critical care

nurses employed in the Surgical Trauma and Neuro ICUs. Intubation procedures in these ICUs often require the assistance of an anesthesia provider whereas other ICUs utilize other advanced practice providers.

Critical care nurses working in these ICUs voluntarily participated in this project as part of an annual event known as "Skills Blitz". During this event, critical care nurses come to exercise vital skills directly related to their everyday practice and emergency management. This event has been a part of the units' practice for many years. The Skills Blitz occurred on the hospital's campus in a large ballroom with multiple stations for clinical competencies. The checklist and simulation were presented as one of the skills stations in which the nurses were encouraged to participate. Voluntary participation was emphasized by the PI during a recruitment speech, and prospective participants were made aware that there was no penalty for opting out of participation in this project. Convenience sampling was used. Inclusion criteria for participants involved nurses who spent more than fifty percent of the time working in the intensive care units, nurses who attended the Skills Blitz, and staff nurses. Exclusion criteria for participants involved nurses who spent less than fifty percent of the time working in the intensive care units, nurses who did not attend the Skills Blitz, and travel nurses.

Implementation Plan

This project had four stages of implementation: (1) creation of the pre-and post-test paper surveys (Appendix A and B) and intubation preparation checklist (Appendix C), (2) pre-test evaluation (Appendix A) of current nursing knowledge and confidence, (3) collaboration with intensive care unit staff and presentation of educational materials, (4) post-test survey (Appendix B) of self-perceived confidence.

The training was conducted in multiple small sessions over two days. Nurses were able to select which session they preferred to attend. Dates and times for the sessions were scheduled by an education committee dedicated to the arrangement of the Skills Blitz. The presentation of the checklist and simulation exercise was completed at a station assigned to the PI by the education committee. Materials needed for the simulation exercise were donated by the tertiary care hospital's anesthesia department.

Participants were made aware of the objectives of this project and were given ample time to consider their participation in this exercise. Participants were allowed to ask questions before the PI began training. The participants were given a paper pre-test survey (Appendix A) to evaluate baseline confidence. The paper survey was returned to the PI face down. Next, the checklist (Appendix C) was disseminated to the participants, and the PI presented an educational PowerPoint on the use of the checklist in preparation for endotracheal intubation. Then the PI conducted the simulation experience and observed the participant's abilities. Small groups of nurses rotated from station to station at each session, and thus this process was repeated until all nurses had rotated to the PI's station. Finally, after two weeks, the PI returned to the site of implementation and the participants were administered a post-test survey (Appendix B).

Data Collection

Procedures

The participants were read a recruitment speech which described the expected process for project implementation, the objectives of the DNP project, and the voluntary nature of the nurses' participation. Pre-test surveys were distributed to potential participants at the beginning of each group rotation throughout each session. Implied consent was obtained before the participants' submission of the pre-test survey (Appendix A). Critical care nurses' participation

was strictly voluntary. Nurses who chose not to participate returned blank surveys to the PI, protecting the anonymity of the nonparticipants. All surveys included demographic data and one question to link pre-test surveys and post-test surveys. The completed pre-test surveys (Appendix A) were returned to the PI face-down and were placed in a folder marked pre-test. The results from this survey were used to establish the participants' baseline level of confidence. Two weeks after the implementation of the intubation checklist (Appendix C) and simulation the PI returned to the intensive care units and distributed the post-test survey (Appendix B). The PI left a folder marked post-test on each unit and left the respective unit. After three hours the PI returned to the intensive care units and retrieved the completed post-test surveys.

Instruments

The pre-test survey (Appendix A) developed by the PI was administered before the presentation of the checklist (Appendix C) and simulation exercise. The pre-test survey (Appendix A) included Likert-scale questions to assess the participants' perceived level of confidence in their knowledge and role in intubation. The initial portion of the survey included demographic information of each participant and one question to link the pre-test surveys to the post-test surveys to maintain anonymity. The second portion of the survey included questions directed at specific categories of the participants' self-perceived level of confidence. These questions focused on the nurses' confidence in clinical skills, nursing roles, the ability to prepare a patient for endotracheal intubation, and understanding of medications needed for intubation. The final question assessed the participants' perception of utilizing a checklist (Appendix C) to prepare for and participate in intubation.

The post-test survey (Appendix B) developed by the PI was administered two weeks after the checklist presentation and simulation exercise occurred. The post-test survey (Appendix

B) assessed the critical care nurses' self-perceived confidence in their knowledge and role in intubation utilizing questions identical to the pre-test survey. Additional questions addressed the participants' perception of the use of checklists and simulation in clinical education. A final question evaluated the presence of potential barriers to consistently safe intubations in critically ill patients at the facility.

Both the pre-test and post-test surveys (Appendix A and B) include Likert scales. The Likert items included: Strongly disagree (SD), Disagree (D), Undecided (UN), Agree (A), and Strongly agree (SA). Likert scales have been used in numerous healthcare studies including populations similar to those assessed in this project. The PI developed the pre-and post-test surveys (Appendix A and B); therefore, there is no reliability or validity score associated with this tool.

Data Analysis

Sixty-two ICU RNs completed both the pre-test survey (Appendix A) and the post-test survey (Appendix B). Data from the completed sixty-two linked pre-and post-test surveys (Appendix A and B) were entered into Microsoft Excel software version 16 and analyzed using descriptive statistics. Each Likert item was assigned a score from one to five with one indicating "strongly disagree" and five indicating "strongly agree". Likert totals for each participant were summated in both the pre-test survey and the post-test survey. Using a Q-Q plot and box plot, the normality of data distribution was evaluated. Using a paired T-test, the pre-and post-test survey (Appendix A and B) results were compared to evaluate whether ICU RNs exhibited increased confidence in their ability to prepare for and participate in endotracheal intubation after the simulation training and presentation of the checklist (Appendix C). A paired T-test compares two paired groups to determine if the pairs are different in a statistically significant manner. The

paired T-test assumes that the data is normally distributed. A paired T-test was selected as the method of data analysis after the normality of this data set was established. An alpha value of 0.05 was used for a one-tailed test and a two-tailed test. The effect size was evaluated using Cohen's d test. Effect size indicates the practical significance of a research outcome by evaluating the difference between groups. Cohen's d is designed for comparing two groups, and it takes the difference between two means and expresses it in standard deviation units. In this project, Cohen's d indicates the standard deviation from the pretest data. A large effect size indicates that a finding has practical significance while a small effect size indicates limited practical applications.

Demographic data was also obtained from each participant during the pre-test survey. Demographic data included race, gender, and years of experience as an ICU nurse. After post-test surveys were completed, surveys were linked using the participant's mother's birthday as an identifier. Demographic data was entered into Microsoft Excel version 16, and data was sorted by years of experience as an ICU nurse. Participants could choose from three experience categories as an ICU nurse: less than 2 years, 2-5 years, and over 5 years. For each category, average scores for pre-and post-tests were calculated, and differences between pre-and post-tests in each category were evaluated.

Budget, Time, and Resources

No financial resources were required to implement this DNP project. This quality improvement project was conducted on September 11th and 12th, 2023. The PI spent twelve and ten hours implementing the DNP project each day respectively. Each day the PI interacted with multiple small groups of intensive care nurses. Approximately twenty minutes were spent with each small group. A three-minute recruitment speech was given to the participants. Five minutes

were spent completing the pre-intervention survey (Appendix A). The educational presentation of the checklist (Appendix C) and its application required twelve minutes.

Material resources were donated from the anesthesia department and the educational committee. Materials included airway instrumentation tools (i.e., Macintosh and Miller blades, laryngoscope handles, oral airways, tongue depressors, various sizes of endotracheal tubes, Ambu bag, laryngeal mask airway, nasogastric tube, etc.). All unused materials were returned to the respective departments upon the conclusion of the project implementation or disposed of per the institution's policy.

Human resources included the education committee, project team leader, and statistician. Communication was maintained before, during, and after the implementation period with each party listed.

Results

Before the presentation of the endotracheal intubation checklist (Appendix C) and simulation, ICU RNs were asked to complete the pre-test survey. Each question was evaluated utilizing a five-point Likert scale that ranged from 'strongly disagree' to 'strongly agree'. Two weeks after the presentation of the checklist (Appendix C) and simulation the clinicians were asked to rate their confidence level using the same rated scale (Appendix B) to evaluate for any changes in clinician confidence.

Eight questions on both the pre-test survey and the post-test survey focused on the ICU RN's self-perceived confidence and competence in various aspects of airway management, such as direct patient care, intubation, preparation, equipment identification, medication administration, and knowledge of necessary medications. Two questions on the pre-test and post-test (questions nine and ten) evaluated the ICU RN's perception of the use of checklists and

simulations as effective tools in airway management, and two questions on the post-test (questions eleven and twelve) evaluated for institutionally specific barriers related to consistently safe intubations in critically ill patients. The contents of the surveys (Appendix A and B) were organized using two themes: confidence and competence in airway management knowledge and confidence in roles and responsibilities in airway emergencies. Questions one through five evaluated the ICU RN's confidence and competence in airway management knowledge. Questions six and seven pertained to the ICU RN's understanding of his or her roles and responsibilities during an airway emergency, including knowing which personnel to contact and overall preparedness.

Once all data had been collected, a Q-Q plot and a box plot were constructed to determine the normality of the data set. The Q-Q plot showed a linear trend, and there were no outliers on the box plot indicating normality for the difference between the pre-test and post-test.

Next, the results of the paired T-test showed an alpha level less than 0.001. In addition, both the two-sided and one-sided alpha level were less than 0.05. Since the two-sided alpha was less than 0.05, the PI concluded that there is significant evidence that there is a significant difference between pre- and post-test results. In addition, since the one-sided alpha value was less than 0.05 this indicated that, on average, the ICU RNs' confidence significantly increased at the post-test compared to the pre-test.

Furthermore, Cohen's d-test revealed an effect size of 0.927. This suggests a substantial effect size, implying that the shift in mean confidence from pre-test to post-test is both statistically significant and holds clincal significance.

After statistical and practical significance were established, the data was further evaluated for each participant's change in self-reported level of confidence. First, Likert scores were

assigned to each of the categories from strongly disagree to strongly agree. Strongly disagree was represented by a 1 and strongly agree was represented by a 5. Likert scores across eight identical questions on the pre-test and post-test survey were summated for each participant. Total scores indicated each participant's self-perceived confidence and competence across numerous categories of airway management during endotracheal intubation for critically ill patients. A higher total Likert score indicated a high level of confidence, and a lower total Likert score indicated a lower level of confidence. When comparing pre-test Likert scores to post-test Likert scores for each individual, forty-four participants had an increase in their Likert score, seventeen participants had the same Likert score, and one participant had a decrease in total Likert score.

The surveys (Appendix A and B) also included a demographic data section indicating the participant's self-reported race, gender, and years of ICU experience. 'Years of ICU experience' was used to stratify the data and identify differences in average increase in confidence in each category. The participants were able to select from three categories: < 2 years, 2-5 years, or >5 years of experience as an ICU nurse. Analyzing the mean of pre-and post-test Likert scores within each category revealed a noticeable enhancement of self-reported confidence across all categories. However, the greatest improvement in self-reported confidence from pre- to post-test was evident in the group of nurses with less than two years of experience working in the ICU.

Discussion

The primary objective of this doctoral project was to enhance patient safety during emergent endotracheal intubation (ETI) procedures outside the operating room (OR) by providing impactful education to intensive care nurses. The key findings highlighted the effectiveness of utilizing a preparedness checklist and simulation training in improving the confidence and competence of ICU nurses. Overall, the results of the post-test survey indicated

that 70% of ICU RNs participating in this project reported increased confidence in direct patient care, intubation, preparation, equipment identification, medication administration, and knowledge of necessary medications which leads to improved patient outcomes.

These findings directly address the purpose of this project, which aimed to equip ICU nurses with the knowledge and confidence to prepare for and participate in emergent ETI procedures occurring outside the OR. The project successfully fulfilled its purpose by demonstrating a clear improvement in nurse confidence and competence, aligning with the project's goals.

The review of evidence highlighted the significance of preparedness checklists and simulation exercises in improving patient outcomes during ETI procedures, particularly in reducing adverse events and enhancing healthcare providers' skills and confidence (Cabrini et.al, 2018; Smith et al., 2015; Turner et al., 2020). The project's findings aligned with the existing evidence, reaffirming the potential benefits of these interventions in the context of critically ill patients.

This project was guided by Lewin's Three-Step Model of Change and the Iowa model of evidence-based practice. By using Lewin's Three-Step Model of Change, the DNP project successfully unfroze existing practices, introduced beneficial changes, and refroze these changes into new habits among critical care nurses. This model proved to be a valuable framework for managing the process of introducing and sustaining clinical practice improvements. Next, the Iowa Model of Evidence-Based Practice provided a robust and systematic framework for conducting this DNP project. It offered a clear and methodical approach to identifying, evaluating, and implementing evidence-based interventions to enhance clinical practice in the critical care setting. This model's structured steps were pivotal in guiding the project's

progression, from the identification of issues to the integration and sustainability of practice changes.

The implications of this project are substantial. It suggests that the implementation of preparedness checklists and simulation training in ICU settings can efficiently bridge the gap in care for critically ill patients during ETI procedures outside the OR. This not only improves patient safety but also fosters interdisciplinary collaboration between nurses and anesthesia providers (Whytock & Atkinson, 2021; Cabrini et.al, 2018; Smith et al., 2015; Turner et al., 2020). The PI recommended the incorporation of these interventions into routine clinical practice and future skills blitz events to enhance patient outcomes.

One significant outcome of this project was recognizing the importance of tailoring interventions to specific healthcare settings and target populations. In this case, ICU nurses with less than two years of experience benefitted most from these interventions. Therefore, in the future, it may be beneficial to separate nurses based on years of experience as an ICU nurse and tailor the simulation to more challenging airway scenarios with increasing years of experience. Next, the interaction with airway management equipment significantly contributed to knowledge retention and confidence building. This aligned well with current literature that a simulation exercise assists learners in retaining pertinent information (Society for Simulation in Healthcare, 2023; Forbis, 2018; Hammontree & Kinderknecht, 2022).

In conclusion, this doctoral project has demonstrated that the use of preparedness checklists and simulation training significantly improves the confidence and competence of ICU nurses in managing emergent ETI procedures outside the OR. This enhancement in nurse readiness contributes to improved patient safety and a reduction in adverse events during ETI in critically ill patients. Implementation of a simulation and preparedness checklist for endotracheal

intubation in clinical practice can help bridge the gap in care for critically ill patients and improve outcomes, underscoring the importance of standardized tools and interdisciplinary collaboration in healthcare settings.

Limitations

The project was implemented within a single healthcare facility. While this allowed for a detailed examination of the initiative in this context, it may limit the generalizability of the findings to other institutions. Variations in institutional culture, resources, and patient populations can significantly impact the effectiveness and feasibility of replicating this program elsewhere. Therefore, the implementation of this project at other facilities may yield additional useful data concerning the efficacy of an endotracheal intubation checklist and simulation.

The sample size of ICU nurses involved in the project, although representative of the chosen facility, may not fully capture the diversity of healthcare professionals and patient cases encountered in broader clinical practice. A larger and more diverse sample would provide a more robust assessment of the program's impact, considering the potential variations in skill levels and experiences among different practitioners.

Furthermore, the project's timeline and duration did not allow for a comprehensive assessment of long-term outcomes and sustainability. An extended follow-up period would be necessary to evaluate the program's lasting effects on patient outcomes and interprofessional collaboration over time.

Lastly, the availability of resources, including simulation equipment, dedicated training time, and personnel, may vary between healthcare facilities. These resource constraints could pose challenges to the successful implementation and ongoing sustainability of the checklist and

simulation program in settings with limited resources. Addressing these limitations is essential when considering the broader adaptation of this initiative to diverse healthcare contexts.

Recommendations for Future Practice

Based on the comprehensive analysis of this DNP project, several recommendations for future practice emerged. First and foremost, a commitment to continuous education and training is essential (Stanley, 2016). Regular training sessions should be established, engaging both anesthesia providers and ICU nurses in ongoing education and simulation exercises. Furthermore, the development of an online repository of resources can facilitate self-directed learning, enabling healthcare professionals to refresh their knowledge and skills as needed.

The integration of this program into clinical practice is equally critical (Stanley, 2016). It should be integrated into the orientation process for new staff members to ensure that all individuals are formally introduced to the principles of endotracheal intubation in critically ill patients. Additionally, routine use of the checklist as part of standard operating procedures in ICU settings should be encouraged.

Feedback mechanisms must be established to ensure the program's effectiveness over time (Stanley, 2016). Continuous feedback from anesthesia providers and ICU nurses can inform improvements and modifications to the checklist and training. Data collection on key performance metrics, such as intubation success rates and adverse events, should be ongoing to monitor the program's impact over time. Furthermore, the project focused on the perspective of ICU nurses but did not directly assess patient outcomes, which could have provided more comprehensive insights.

Interdisciplinary communication is another vital component. Regular interdisciplinary meetings should be promoted to discuss challenging cases, share experiences, and reinforce

collaborative communication. Crisis resource management training, including effective communication strategies, can enhance teamwork during critical airway situations (Forbis, 2018; Hammontree & Kinderknecht, 2022).

Adaptation to changing practices is key to keeping the program relevant (Stanley, 2016). Staying current with advances in airway management and regularly updating the checklist and training program to reflect updated guidelines and best practices is crucial. Finally, promoting a culture of safety, engaging hospital leadership, and encouraging open communication within the organization is vital for institutional buy-in and the continued success of this patient-centered initiative.

Overall, these recommendations collectively reinforce the commitment to improving patient care and safety in critical airway management situations while fostering a culture of collaboration and continuous improvement within healthcare organizations.

Conclusion

The goal of this project was to evaluate the impact of a checklist and simulation on ICU RNs' knowledge and confidence while preparing a critically ill patient for endotracheal intubation at an urban tertiary care hospital. This DNP project also evaluated the benefits of incorporating the checklist into the unit’s resources for the nurses’ future reference.

The project achieved these goals by conducting a quality improvement project focused on increasing the ICU RNs' confidence in their role, skills, and knowledge during endotracheal intubation through the presentation of a checklist and simulation experience. Each participant completed pre- and post-test surveys and received reeducation through the use of a checklist and simulation exercise.

The results of this project demonstrated that the checklist and simulation positively impacted the ICU RNs' confidence. More specifically, seventy percent of the participants reported increased confidence in their ability to prepare for and participate in endotracheal intubation. Throughout the project implementation and after the dissemination of this project's results and recommendations, ICU RN participants expressed a desire to make the endotracheal intubation checklist readily available in each ICU. In addition, members of the leadership team indicated a desire to incorporate the checklist and simulation experience into new employee orientation as well as yearly competency training for all employees. This project also identified gaps in the facility's current relationship between ICU nurses and anesthesia providers. The PI offered recommendations to ensure endotracheal intubations followed current practice guidelines and the facility's procedure protocol.

Continuous education through the use of a preparedness checklist and simulation is a crucial part of ensuring patient safety during endotracheal intubation in critically ill patients. The use of a checklist and simulation exercise helped augment traditional approaches to clinical education methods. Consistent application of the checklist and opportunities to simulate ETIs will create better patient outcomes and increase patient safety in out-of-OR intubations for critically ill patients. The results of this project were consistent with previous literature demonstrating the positive effects of preparedness checklists and simulations in medical procedures on clinician confidence. Therefore, this project recommends incorporating this checklist and simulation-based training into education related to out-of-OR endotracheal intubation in critically ill patients to increase ICU RNs' confidence and knowledge in preparing patients for endotracheal intubation and participating in the procedure during an airway emergency.

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Appendices

Appendix A
Endotracheal Intubation Pre-Test Survey

Part I: Demographics

1. How do you describe your gender?
   Male Female Other:_____ Prefer not to answer
2. How many years have you been a nurse in the ICU?
   <2 years 2-5 years >5 years
3. What is your ethnic Background?
   White/ Caucasian Asian- Eastern Asian- Indian Hispanic
   African-American Hispanic Mixed Race Other:_____
   I prefer not to say
4. What is your MOTHER's birthday? _____

(This is to link your pre- and post-test surveys while maintaining anonymity)

Part II

SD: (strongly disagree); D: (disagree); UN: (undecided): A: (agree); SA: (strongly agree)

Questions	SD	D	UN	A	SA
1. I feel confident in my skills during an airway emergency involving direct patient care.					
2. I feel confident in my role during an intubation.					
3. I feel confident in my role in preparing for intubation.					
4. I am confident in my ability to identify various equipment needed by the anesthesia provider for intubation.					
5. I feel confident in my ability to identify and draw up medications needed for intubation.					
6. If my patient requires intubation, I know which personnel to contact.					
7. I know my role and responsibilities during an airway emergency.					
8. I am confident in my knowledge of what medications are necessary for an induction sequence.					
9. Checklists are an effective tool in the management of standard medical procedures like intubation.					

Appendix B

Endotracheal Intubation Post-Test Survey

Part I: Demographics

1. How do you describe your gender?
   Male Female Other:_____ Prefer not to answer
2. How many years have you been a nurse in the ICU?
   <2 years 2-5 years >5 years
3. What is your ethnic Background?
   White/ Caucasian Asian- Eastern Asian- Indian Hispanic
   African-American Hispanic Mixed Race Other:_____
   I prefer not to say
4. What is your MOTHER's birthday? _____

(This is to link your pre- and post-test surveys while maintaining anonymity)

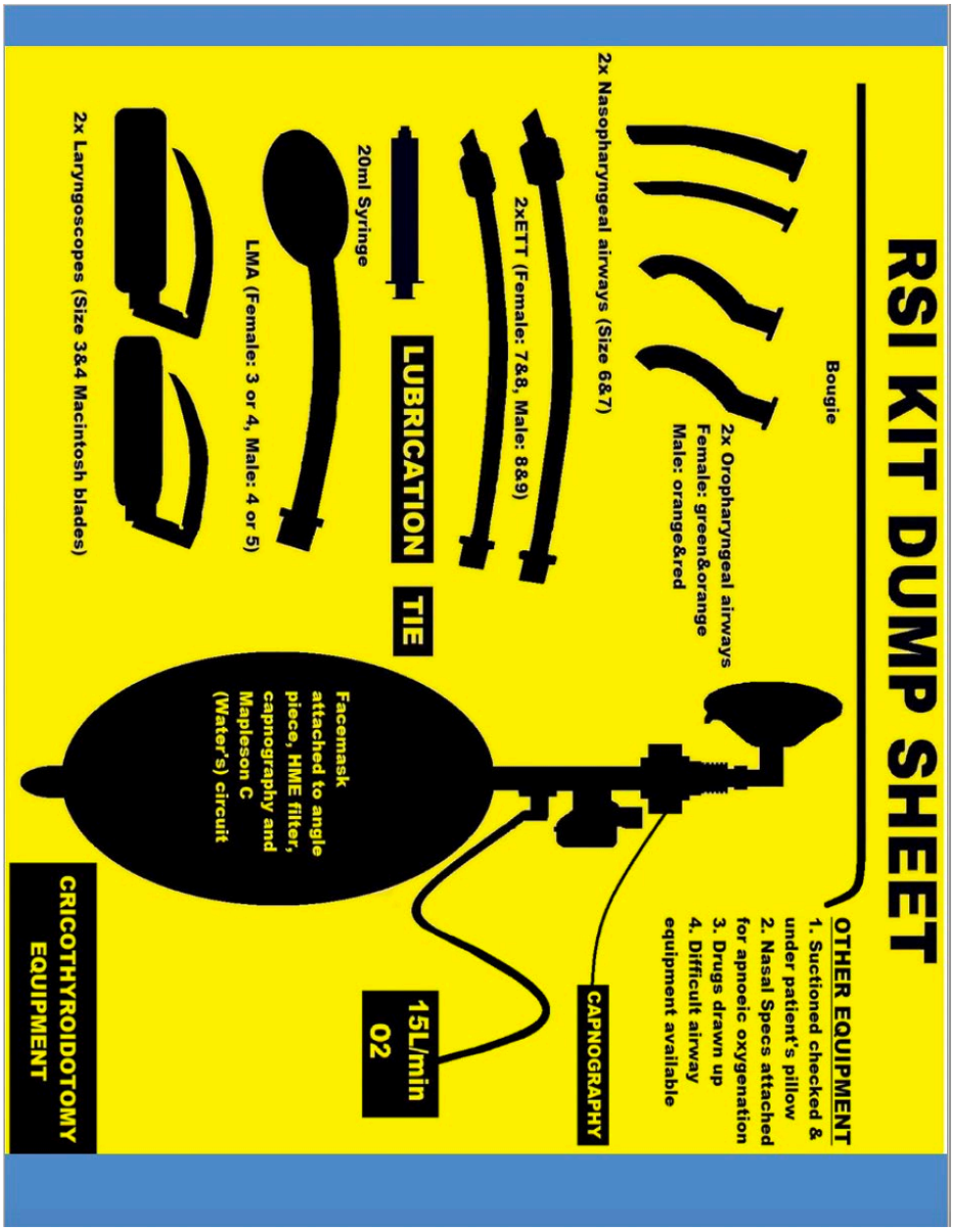
Part II

SD: (strongly disagree); D: (disagree); UN: (undecided): A: (agree); SA: (strongly agree)

Questions	**SD**	**D**	**UN**	**A**	**SA**
1. I feel confident in my skills during an airway emergency involving direct patient care.					
2. I feel confident in my role during an intubation.					
3. I feel confident in my role in preparing for intubation.					
4. I am confident in my ability to identify various equipment needed by the anesthesia provider for intubation.					
5. I feel confident in my ability to identify and draw up medications needed for intubation.					
6. If my patient requires intubation, I know which personnel to contact.					
7. I know my role and responsibilities during an airway emergency.					
8. I am confident in my knowledge of what medications are necessary for an induction sequence.					
9. The intubation checklist and simulation from Skills Blitz increased my confidence and competence in the management of an emergent intubation.					
10. Should this exercise be repeated in the future? 11. If yes: How often?					

Appendix C


ENDOTRACHEAL INTUBATION CHECKLIST
Equipment
Continuous suction with yankauer on and working
Ambu bag and mask
Glidescope (RT should be able to grab this)
Ventilator
Anesthesia team will bring a box with all other airway equipment
IV readily available for use with free flowing fluid
Things To Do/ People to Call
Call RT and let them know you're calling a provider for intubation. They'll bring a ventilator, a tube holder, and the glidescope
Ensure the patient is pulled up to the top of the bed and pillows are removed.
Ensure clear area behind head of bed
Begin preoxygenating patient with mask and O2 at 100%
Medications
RSI Kit is available in pyxis which should include most induction medications.
Sedative: Propofol (200 mg) or Etomidate (50 mg)
Paralytic: Succinylcholine (200 mg) or Rocuronium (50 mg)
Analgesia: Fentanyl (100 mcg)
+/- Local anesthetic: 2% Lidocaine (100 mg)
Propofol and Fentanyl drip for after intubation
Fluid bolus line primed and hung with pressure bag (if appropriate)
Report for Anestheia Provider
Provide a brief summary of patient history, status, and events leading to intubation
Notify provider of any allergies
Most recent Potassium Level
Notify the provider if patient is on vasoactive drips
Report any other significant past medical history or injuries
If patient has a c-collar let the provider know when you call initially, and ensure Glidescope is readily available


RSI KIT DUMP SHEET
Bougie
2x Oropharyngeal airways
Female: green&orange
Male: orange&red
2x Nasopharyngeal airways (Size 6&7)
2xETT (Female: 7&8, Male: 8&9)
LUBRICATION
TIE
20ml Syringe
LMA (Female: 3 or 4, Male: 4 or 5)
2x Laryngoscopes (Size 3&4 Macintosh blades)
OTHER EQUIPMENT
1. Suctioned checked & under patient's pillow
2. Nasal Specs attached for apnoeic oxygenation
3. Drugs drawn up
4. Difficult airway equipment available
CAPNOGRAPHY
15L/min O2
Facemask attached to angle piece, HME filter, capnography and Mapleson C (Water's) circuit
CRICOTHYROIDOTOMY EQUIPMENT