EMERGENT TRACHEOSTOMY DISLODGEMENT EDUCATIONAL PROGRAM FOR INTENSIVE CARE NURSE TO IMPROVE SELF-COMPETENCE AND CLINICAL PERFORMANCE

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Contents

Abstract

Background: Tracheostomy tube dislodgment is a rare but life-threatening complication that can be avoided with proper management and intervention. There is limited literature strictly studying tracheostomy tube dislodgement, leaving gaps in the nursing knowledge regarding tracheostomies and their management. It is imperative nurses can understand prevention and rescue measures to improve outcomes of patients with tracheostomies.

Purpose: to test the effectiveness of an educational program involving simulation training and clinical scenarios focused on tracheostomy tube dislodgement for intensive care unit nurses.

Methods: A Pre/Post test design was used with a 13 question Likert scale questionnaire and an educational program consisting of tracheostomy tube dislodgement simulation and clinical scenarios conducted in the ICU.

Results: Positive trends for both self-competence and clinical performance. Significant positive correlation between self-competence and clinical performance.

Recommendations and Conclusions: Simulation training and clinical scenarios are effective educational tools to increase self-competence and clinical performance. Educational programs are beneficial for ICU nurses based on results. More studies are needed to evaluate the frequency in which educational programs should be offered.

Keywords: educational program, tracheostomy tube, dislodgement, intensive care unit, self-competence, clinical performance, knowledge, simulation training

Tracheostomy is a surgical procedure in which a hole or stoma is made through the anterior side of the neck and into the trachea (*Tracheostomy- Mayo Clinic*, 2019). A tracheostomy tube is then placed into the stoma to keep it open for breathing (*Tracheostomy- Mayo Clinic,* 2019). It is a frequent procedure performed on critically ill patients who require prolonged mechanical ventilation, frequent suctioning for pulmonary toileting, or have obstruction of the upper airway (Casserly et al., 2007). Tracheostomy can be performed in the operating room as well as at the bedside. According to Casserly et al. (2007), approximately two-thirds of tracheostomies are performed on patients in the intensive care unit (ICU). Due to the high acuity and the complexity of care for patients with tracheostomies, they are at a greater risk for serious, life-threatening complications. According to the study done by Spataro et al., (2017), 47% of the patients studied experienced a tracheostomy-related complication. Potential complications include but are not limited to, hemorrhage, mucous plugging, and tracheostomy tube dislodgement (Cramer, Graboyes, & Benner, 2018). The complication of focus for this project is tracheostomy tube dislodgement which is the inadvertent removal of tracheostomy tube out of the stoma (Omokanye et al., 2016).

Background and Significance

While there is literature discussing the overall complications associated with tracheostomies, there is limited literature strictly studying tracheostomy tube dislodgement. This could be due to it being a low incidence event, however it carries life-threatening risks when it does occur (Smith-Miller, 2006; Hurley et al., 2021; Yelverton et al., 2014). When a tracheostomy tube becomes dislodged, the patient's airway is compromised. If not corrected in a timely manner, patients could suffer an anoxic brain injury or death (McDonough et al., 2016).

Prompt nursing intervention is required in times of tracheostomy dislodgement to prevent serious complications (McDonough et al., 2016).

Nurses play a pivotal role in the care of patients with tracheostomies and, in many circumstances, are the first responders to tracheostomy related complications (McDonough et al., 2016). However, the literature shows gaps exist in the knowledge nurses have regarding tracheostomies and their management (Casserly et al., 2007; McDonough et al., 2016; Cramer et al., 2018; Smith-Miller, 2006). Not only do knowledge gaps exist, but nurses also feel incompetent to provide care due to their inexperience with tracheostomies (Serafin et al., 2021; Norris et al., 2019). Because nurses may lack the knowledge or competence to care for this patient population, if a complication such as dislodgement occurs, tracheostomy patients are at a higher risk for life-threatening events (Rassekh et al., 2015). Therefore, education programs have been studied to evaluate their effectiveness in increasing nurses' self-competence which in turn could increase clinical performance.

According to Casserly et al., (2007) tracheostomy tube dislodgment can occur at any time and can be life threatening, especially if it occurs prior to tracheostomy tract maturation. Tract maturation typically occurs 7-10 days post tracheostomy placement (Ng, 2022). If the tract has not matured and the tracheostomy tube needs to be re-inserted, the patient is at high risk for creation of a false passage where the tracheostomy is not positioned correctly in the trachea causing inadequate ventilation which can lead to respiratory arrest. The patient with a tracheostomy continues to be at high risk for complications even after tract maturation. In the study done by Spataro et al., (2017), the one tracheostomy death that occurred due to accidental tracheostomy tube dislodgement happened on postoperative day 96, resulting in an anoxic brain injury with subsequent death on postoperative day 102.

According to Cramer et al., (2018), most tracheostomy-related complications, such as tracheostomy dislodgment, are largely preventable and are due to a lack of knowledge or failure to rescue expeditiously. Because tracheostomy dislodgement is a rare occurrence but associated with a high risk for serious injury, it is imperative the healthcare team can detect this complication and know how to treat it. Nurses play a pivotal role in the management of these patients; therefore, it is essential they are competent in their assessments and clinical performance.

Due to high turnover and staff shortages, many intensive care units are employed by new graduate or novice nurses who have limited experience (Norris et al., 2019). The lack of knowledge and skill in new nurses, combined with the decreased availability of seasoned nurses to precept and teach the new nurses at the bedside, creates a care discrepancy (Smith-Miller, 2006). According to Norris et al. (2019), new graduate nurses question their ability to determine patient deterioration and feel a level of discomfort with their assessment skills, provider communication, prioritization, and time management. Because of this, novice nurses may not feel equipped to recognize complications and effectively manage them.

Smith-Miller (2006) implemented a tracheostomy care education program which showed experienced nurses' baseline knowledge was only slightly higher than the new graduate nurse. It also showed that nursing experience alone is not indicative of personal knowledge or comfort level (Smith-Miller, 2006). Therefore, there is no guarantee that experienced nurses will feel confident managing tracheostomy complications. Nurses need to be able to react quickly and correctly and feel competent in managing the airway to prevent further deterioration in times of crisis. If nurses do not feel competent or lack the ability to identify the correct interventions, patient care suffers and may lead to catastrophic outcomes (Han et al., 2017). Therefore, an

educational program needs to be developed to educate ICU nurses who care for patients with tracheostomies.

The purpose of this project is to create an educational program including simulation trainings and didactic education for ICU nurses to improve their self-competence and clinical performance when taking care of patients with tracheostomies, specifically tracheostomy tube dislodgement. While this complication is rare, it is highly life-threatening, lending credence to this project's intervention. By increasing the ICU nurses' self-competence and clinical performance in times of tracheostomy dislodgement, other potential catastrophic outcomes may be avoided leading to decreased mortality and morbidity. Research objectives for this study are to measure the nurses' perceptions of improved self-competence and clinical performance, and to determine potential frequency of the education program once implementation is complete.

Literature Review

The purpose of this review is to ascertain the current state of knowledge regarding the topic of complications associated with tracheostomy, with a focus on tube dislodgement or accidental decannulation, with the aim of improving patient outcomes. The review presents an analysis and synthesis of articles on existing educational programs for ICU nurses to determine the characteristics of such programs that improve nurse self-competence and clinical performance in tracheostomy care. Self-competence and clinical performance were chosen variables because nurses require a specific skill set to take care of these patients and need to have the capability to intervene quickly, skillfully, and autonomously (Han et al., 2017). The nurses feel they are competent in taking care of patients with tracheostomies, the nurses' clinical performance increases as well as the quality of patient care (McDonough et al, 2016).

Method: Data Sources and Research Strategies

Databases utilized were Cumulated Index to Nursing and Allied Health Literature (CINAHL), Elton B. Stephens CO (EBSCO), and Scopus. Key words included tracheostomy, complications, nursing, self-competence, intensive care unit, airway emergency, and educational program with Boolean phrase "AND". Inclusion criteria for selected works include peer reviewed articles published in the last 10 years with a focus on hospital nursing care. Articles discussing home health nursing were excluded due to the focus population of this project being on intensive care nurses in an acute setting.

Search of the database revealed only a small amount of literature in the focus area published in the last 10 years. As a result, the original search criteria were expanded and 2 articles that were published in 2006 and 2007 were included. A total of 15 articles were reviewed. The body of evidence consisted of various quantitative studies including 7 pre and post design studies, 1 prospective cohort study, 1 retrospective cohort study, and 2 retrospective reviews, as well as 3 qualitative studies utilizing in depth, semi-structured interviews. One article consisted of a literature review, providing clinical guidelines for current practice. Articles covered a wide range of international hospital settings, such as rural community hospitals to level 1 academic, teaching hospitals.

Research Themes

When investigating the best to approach to designing an effective educational program regarding tracheostomy management, 3 themes emerged: (a) the use of simulation training with traditional education is most effective (Han et al., 2017; Norris et al., 2019; McDonough et al., 2016; Abdulrahman et al., 2021); (b) development of multiple and varied clinical scenarios and the use of debriefings to allow for self-reflection in practice (Norris et al., 2019, Hurley et al., 2021; Han et al., 2017). Debriefings encourage participants to review areas of incompetence and

enable deeper understanding of interventions; and (c) the frequency to which education programs should be administered (Hurley et al., 2021; McDonough et al., 2016). It is recommended that educational programs be offered annually, if not more frequently.

Theme 1: Simulation. Regarding implementation of educational programs for nursing, simulation training mixed with traditional learning, such as lectures or modules, proved to be more effective when compared with traditional learning in improving self-competence and clinical performance (Han et al., 2017; Norris et al., 2019; McDonough et al., 2016; Abdulrahman et al., 2021). Simulation training allowed nurses to experience realistic clinical scenarios with hands on learning and real time feedback of their performance (Hurley et al, 2021). According to Smith-Miller (2006), nursing skills are better taught in a controlled environment. Simulation provides such an environment where nurses can practice without having the responsibility of actual patient care, providing the ideal environment to enhance their confidence levels, despite their level of experience (Smith-Miller, 2006). Simulation training allows nurses to be an active participant in their education, which leads to effective learning (Hans et al., 2017). It reduces barriers and improves skills, critical thinking, decision making, communication, and teamwork (Norris et al., 2019).

Theme 2: Clinical Scenarios and Debriefings. Not only should the education program include simulation training, but it should also utilize clinical scenarios and debriefings (Norris et al., 2019, Hurley et al., 2021; Han et al., 2017). Clinical scenarios need to be incorporated in an education program because they help expose nurses to potential complications and review the various steps that they may take. Clinical scenarios help nurses gain the clinical performance and problem-solving skills needed to provide care to patients (Han et al., 2017). After the clinical scenarios are reviewed, debriefing is recommended (Hurley et al., 2021; Han et al., 2017).

Debriefing allows nurses to review their actions, share ideas with others, and consolidate what they have learned (Han et al., 2017). Debriefing provides the opportunity to discuss potential concerns about difficult clinical situations and identify areas of improvement (Han et al., 2017). Hurley et al. (2021) states that debriefing should be done by the simulation observer, as this will close the gap between desired and actual performance. Clinical scenarios, debriefing, and simulation trainings have proved to be key elements in educational program, as well as the need for education programs to be done annually (Hurley et al., 2021; McDonough et al., 2016).

Theme 3: Frequency of Program. Tracheostomy tube dislodgment or accidental decannulation can be described as a low incidence, high risk event (Smith-Miller, 2006; Hurley et al., 2021; Yelverton et al., 2014) leading to infrequent use of this skill set. Because of this, it is recommended that education programs be implemented annually, if not more frequently (Hurley et al., 2021; McDonough et al., 2016). Hurley et al. (2021) called for newly hired nurses and those that have already participated in an emergent tracheostomy complication program to repeat in 6-9 months, as some sort of degradation of the material is to be expected. Continuing education helps nurses stay up to date on current practices (Abdulraham et al., 2021) which further supports the need for annual competencies.

To summarize, the current state of knowledge regarding educational programs for ICU nurses includes simulation training paired with didactic teachings, such as lecture and/or modules, realistic clinical scenarios, and debriefing sessions. These characteristics were found to increase self-competence and clinical performance in nurses (Han et al., 2017; Hurley et al., 2021; Norris et al., 2019; McDonough et al., 2016; Abdulrahman et al., 2021). In addition, the timing and frequency of such programs is also important. When skills are not frequently utilized, such as events like tracheostomy tube dislodgement, they can be lost leading to nurses feeling

incompetent (Hurley et al., 2021). Because of this, literature recommends annual, if not more frequent, implementation of such educational programs.

Gaps in Literature

Literature is limited in researching how to educate nurses in tracheostomy tube dislodgement as evidenced by the small number of recent articles uncovered in this literature search. The available literature is also spread over a wide range of hospital settings and geographic locations. While this can be viewed as a positive, it can also be viewed as a limitation in that in-depth work may not be present. There is also limited literature on knowledge retention with educational programs and if competency persists several months after an educational program. Another gap in the literature is limited concentration specifically on tracheostomy tube dislodgement. More research needs to be done for the nurses' role during a tracheostomy tube dislodgement.

Because of these gaps in the literature, the goal of this DNP project is to create an educational program for tracheostomy tube dislodgement management for ICU nurses to improve their self-competence and clinical performance. As stated before, nurses are on the frontlines and will be the first to respond to such an event (McDonough et al., 2016). They need to be well equipped in not only knowledge, but also skill to know how to intervene and minimize adverse outcomes. By increasing the nurses' self-competence and clinical performance, they will have more confidence with this patient population and will possess the skills necessary to provide quality care.

Conceptual Framework/Theoretical Model

Patricia Benner's nursing theory titled "From Novice to Expert" explains how nurses develop skills over time through meaningful education and personal experience (Benner, 1982).

In her theory, there are five levels of nursing experience, beginning with novice, moving towards advanced beginner, progressing to competent, then proficient, and finally expert (Benner, 1982). She describes the characteristics for each level and how they apply to different levels of nursing. For instance, she describes the novice nurse as a beginner with no experience. They need to be told what to do and how to do it. The advanced beginner is defined as a nurse with some experience in clinical situations and has the principles to help guide their decision making (Benner, 1982). The competent nurse has two to three years of experience, is more aware of long-term goals, and they gain perspective from planning their own actions (Benner, 1982). The proficient nurse understands the situation as a whole and has expectations for specific situations which improves decision making (Benner, 1982). Finally, the expert nurse has a deeper background of experience and can grasp the situation and intervene without relying on rules and guidelines (Benner, 1982). As nurses move between the different levels, they learn to be skilled nurses, able to view the situation as a whole and become an active member of the healthcare team rather than being an observer, detached from the situation (Petiprin, 2020).

This theory provides the basis for how the nurses evaluate themselves in the pre and post intervention questionnaire. A questionnaire was constructed, utilizing the five levels Dr. Benner created: novice, advanced beginner, competent, proficient, and expert (see Appendix A). Each level was described in the survey to ensure participants were able to accurately assess their self-competence and clinical performance.

The theory will also be utilized during the intervention implementation. Dr. Benner is quoted saying "…clinical practice is always more complex and presents many more realities than can be captured by theory alone" (Larrabee, 1999). Therefore, simulation activities must reflect

clinical practice to ensure the nurses will acquire and master the necessary skills, and then be able to perform in high stress situations.

The evidence-based model that will be used in conjunction with the Novice to Expert Theory for this project is the Iowa model. The Iowa model serves as a guide for nurses to use research findings to improve patient care (Titler et al., 2001). This model was chosen because it starts with a knowledge or problem focused trigger. The trigger specifically for this project was the lack of knowledge and skill related to tracheostomy dislodgement and the prevention of related complications.

After a discussion with the management of a local ICU, it was determined the need for such a program does exist. In emergent situations, nurses need to know what to do and how to do it in an efficient way. They need to feel confident in their assessment skills, interventions, and capabilities to improve patient care. The Iowa model provides an effective guide to gather and evaluate evidence to be used in practice and change clinical practice via a tracheostomy dislodgement educational program for ICU nurses, satisfying the aim of this DNP project.

Aim and Research Questions

The aim of this project was to test the effectiveness of an intervention designed to improve nurses' beliefs about their competence and clinical performance in relation to management of tracheostomy tube dislodgement. Specifically, three research questions were investigated during this project:

1. How did the educational program impact perceived self-competence?

2. How did the educational program impact perceptions of clinical performance?

3. What is the relationship between nursing experience and post-intervention self-competence and clinical performance?

Methods

Design

The aim of this project was to test the impact of a tracheostomy dislodgement educational program on nurses' competencies in dealing effectively with tracheostomy dislodgement. A pretest- posttest design was used to measure the impact of this educational intervention using a questionnaire designed and adapted from a survey. A pretest-posttest intervention questionnaire was given to the participants to obtain a baseline assessment of the nurses' knowledge and competence with tracheostomies. Once the pre-test was completed, a simulation training with clinical scenarios was implemented. Once the simulation training was completed, a posttest questionnaire was administered to the nurses to assess improvement in their self-competence and clinical performance.

Setting

This project took place at a local, community hospital in their ICU, which consists of 20 beds. The types of patients seen in this setting are stroke, sepsis, multiorgan failure, and respiratory failure, particularly related to COVID-19. This unit was chosen as many patients are ventilator-dependent and require placement of a tracheostomy.

Furthermore, this unit also has many new graduate nurses and seasoned nurses who do not have a great deal of experience providing care to this emerging, patient population. In the literature, it was found that to ensure safe, effective care, nurses need targeted training to maintain the knowledge and skillset required for tracheostomy care (McDonough et al., 2016). Therefore, all nurses, both men and women, who worked currently in the ICU were invited to participate.

Sample

Inclusion criteria included: all nurses who currently work in the ICU. All nurses were encouraged to participate no matter their age, sex, gender, or experience with tracheostomies. Any nurse who did not work in the ICU or those that did not complete the full educational program were excluded from the project. Recruitment of nurses occurred over two weeks, involving encouragement from management, emails sent to their work addresses, flyers, and reminders during their morning huddles.

After sending the recruitment email to 89 ICU nurses, a total of 20 nurses completed the pre-intervention survey (see Table 1 below for demographics). Of those 20 nurses, 17 completed the simulation training. After the simulation training, 13 nurses completed the post-intervention survey.

Table 1. Sample demographics (*N*=20)

Characteristics		N(%)
Gender		
	Female	19 (95)
	Male	1 (5)
Age		
	20-30 years	7 (35)
	31-40 years	7 (35)
	41-50 years	4 (20)
	51-60 years	2 (10)
Nursing Education		
	Associate degree	4 (20)
	Bachelor's Degree	16 (80)
Number of years practicing		
	0-2 years	3 (15)
	3-5 years	7 (35)
	6-10 years	7 (35)
	>10 years	3 (15)
Number of patients per month with tracheostomies		
	0	2 (10)
	1 to 2	9 (45)
	3 to 5	6 (30)
	>6	3 (15)

Intervention

The project intervention was an educational program that utilized a simulation session and clinical scenarios to help recreate situations in which nurses manage patients with tracheostomies. The educational program took place in an empty room in ICU lead by the project leader. Materials were obtained from the ICU which included different types of tracheostomy tubes such as Portex, Shiley, and Blue-Line Ultra, ambu-bag, suction, trach care kits, endotracheal tubes, glidescope, bougie, monitors, and mannequin. The program covered the types of tracheostomies used currently in the ICU, management of tracheostomies (Appendix B), and finally the steps necessary to take for when a tracheostomy becomes dislodged (Appendix B). It incorporated two clinical scenarios (Appendix C).

The simulation training began with an overview of a tracheostomy tube, discussing the parts of the tube and the functions of each (Appendix B). The different types of tracheostomy tubes, cuff versus cuffless, were also discussed, detailing the differences between each type of tracheostomy and why each type would be used. Once the anatomy of the tracheostomy tube was established, participants then learned the daily management of tracheostomies. Participants were asked to perform tracheostomy care which included cleaning around the stoma site and outer cannula, as well as replacing the inner cannula. The tracheostomy ties were also assessed and changed. Clean technique was reviewed (Appendix B).

From there, the participants were presented with two clinical scenarios, starting with clinical scenario 1 and moving to clinical scenario 2 (Appendix C). Using the algorithm and teaching steps in Appendix B, participants were taught the necessary interventions to complete based on patients' responses. Participants were given vital sign changes based on their interventions, leading to completion of the algorithm.

Finally, the participants reviewed difficult airway management techniques, such as jaw-thrust maneuvers, sniffing position, and proper hand placement and technique for bag mask ventilation. The participants were also presented with a review of the GlideScope, endotracheal tubes, and difficult airway tools like the bougie and endotracheal tube exchanger. After completion of the algorithm, the participants underwent a debriefing to examine their performance and discuss areas of tracheostomy tube dislodgement management. At the end of the educational program, the participants received badge buddies containing reminder steps for managing tracheostomy dislodgement (Appendix D).

Data Collection

At the start of the educational program, informed consent was obtained from each participant (Appendix E). The first question of the pre-intervention questionnaire presented the informed consent, detailing the project's purpose, confidentiality, and what was to be expected of the participants. Risks and benefits were explained. Participants were asked to accept or decline. If declined, they were no longer able to participate in the educational program.

To measure self-competence and clinical performance, a questionnaire was given pre and post intervention (Appendix A). The same survey was used for each event. The questionnaire items were created from a survey used in the literature, the Clinical Decision-Making Self-Confidence scale, to tailor the questionnaire to this project's goals (Norris et al., 2019). The Clinical Decision-Making Self-Confidence scale is a 12 item, 5-point Likert scale that evaluates the participants' self confidence in recognizing, assessing, intervening, and evaluating the effectiveness of interventions in decompensating patients (Norris et al, 2019). Permission was obtained from the author to be used and modified for this project. For this project's needs, the

confidence was changed to competence and clinical performance, and the interventions were specified to tracheostomy tube dislodgement.

The pre-test questionnaire was administered 2 weeks prior to the implementation of the educational program to allow as many nurses as possible to complete the questionnaire. The post-test questionnaire was then administered 2 weeks after the educational program to ensure the participants would complete the educational program. The training session was offered throughout one day from 6:30am to 7:30pm which allowed nurses from night shift and day shift to participate. Data collection was then kept on a password protected hard drive in the possession of the project lead.

Data Analysis

Due to the anonymous nature of the pre- and post-survey, direct comparisons/changes over time could not be statistically assessed for research questions 1 and 2. Instead, descriptive statistics in the form of frequencies (%) and means/standard deviations were used to describe the trends observed across the pre- and post-survey populations. For research question 3, Spearman rho correlations were utilized. Data met the assumptions for correlation in that it was ordinal and exhibited a monotonic relationship (Lund & Lund, 2018).

Results

How did the educational program impact perceived self-competence?

Overall means from the competency scale showed an increase in perceptions of competency from pre-survey ($M = 2.93$, $SD = 1.06$) to post-survey ($M = 3.80$, $SD = 1.03$). For individual items on the survey, frequency percentages and means also showed a positive trend in the data from pre-survey to post-survey (see Table 2 below).

Table 2. Competency

	Novice	Advanced Beginner	Competent	Proficient	Expert	M (SD)
Provide care to a patient with a tracheostomy						
Pre	0.0%	15.0%	35.0%	35.0%	15.0%	3.50 (.95)
Post	0.0%	7.7%	30.8%	30.8%	30.8%	3.85 (.99)
Provide care to a patient with an accidental tracheostomy dislodgement						
Pre	20.0%	30.0%	25.0%	20.0%	5.0%	2.60 (1.19)
Post	7.7%	0.0%	38.5%	23.1%	30.8%	3.69 (1.18)
Recognize a decompensating patient with a tracheostomy dislodgement						
Pre	10.0%	15.0%	35.0%	35.0%	5.0%	3.10 (1.07)
Post	0.0%	7.7%	23.1%	38.5%	30.8%	3.91 (.95)
Implement interventions to a patient with a tracheostomy dislodgement						
Pre	30.0%	20.0%	15.0%	35.0%	0.0%	2.55 (1.28)
Post	7.7%	0.0%	38.5%	30.8%	23.1%	3.62 (1.12)
Assess the effectiveness of an intervention should a tracheostomy become dislodged						
Pre	10.0%	30.0%	25.0%	30.0%	5.0%	2.90 (1.12)
Post	7.7%	0.0%	15.4%	46.2%	30.8%	3.92 (1.12)

How did the educational program impact perceptions of clinical performance?

Overall means from the clinical performance scale showed an increase in perceptions of competency from pre-survey (M = 2.88, SD = 1.16) to post-survey (M = 3.81, SD = 1.11). For individual items in the survey, frequency percentages and means also showed a positive trend in the data from pre-survey to post-survey (see Table 3 below).

Table 3. Clinical performance

	Novice	Advanced Beginner	Competent	Proficient	Expert	M (SD)
Providing tracheostomy care						
Pre	5.0%	15.0%	40.0%	25.0%	15.0%	3.30 (1.08)
Post	0.0%	15.4%	7.7%	46.2%	30.8%	3.92 (1.04)
Anticipate the next interventions when the tracheostomy becomes dislodged?						
Pre	25.0%	20.0%	25.0%	25.0%	5.0%	2.65 (1.27)
Post	7.7%	0.0%	23.1%	46.2%	23.1%	3.77 (1.24)
Implement the necessary interventions on a patient with a tracheostomy dislodgement?						
Pre	20.0%	25.0%	20.0%	30.0%	5.0%	2.75 (1.26)
Post	7.7%	7.7%	15.4%	38.5%	30.8%	3.77 (1.24)
Care for a decompensating patient with tracheostomy dislodgement						
Pre	15.0%	30.0%	20.0%	30.0%	5.0%	2.80 (1.20)
Post	7.7%	7.7%	15.4%	38.5%	30.8%	3.77 (1.24)

What is the relationship between nursing experience and post-intervention self-competence and clinical performance?

Spearman's rho correlations indicated significant positive correlations with competency in managing tracheostomy dislodgement ($r(12)=.66$, $p = .015$) and clinical performance ($r(12)=.63$, $p = .02$), suggesting that those with more experience had more positive perceptions of themselves. Self-competence and clinical performance were also found to be significantly positively related ($r(12)=.96$, $p < .001$).

Discussion

The aim of this project was to test the effectiveness of an educational intervention designed to improve ICU nurses' beliefs about their self-competence and clinical performance in managing patients with tracheostomy tube dislodgement. Literature is limited in researching how to educate ICU nurses, specifically in tracheostomy tube dislodgement. As stated previously,

tracheostomy tube dislodgment is a low incidence, high risk complication. Therefore, it is necessary for ICU nurses to know how to intervene and manage effectively.

Although statistical analyses were not able to be completed, trends in the data suggest a positive influence of the educational program for tracheostomy tube dislodgement on both competency and clinical performance. These findings support prior literature that has shown educational programs that incorporate clinical scenarios and simulations have a positive impact on nurses' self-competence (Han et al., 2017; Hurley et al., 2021; Norris et al., 2019; McDonough et al., 2016; Abdulrahman et al., 2021). By creating a controlled environment with simulation and clinical scenarios, nurses may feel less pressure, enriching their ability to learn (Smith-Miller, 2006). In this environment, nurses can ask questions along with making mistakes without causing lethal harm (Smith-Miller, 2006). By practicing and replicating realistic clinical scenarios, nurses could practice the necessary interventions, increasing their self-competence which led to improved clinical performance. However, due to the lack of statistical analyses, these findings should be considered preliminary, and replication of this intervention in this project's population should be conducted to understand if causal relationships do exist for ICU nurses.

Correlational analyses investigating the relationship between nursing experience, self-competency, and clinical performance revealed strong positive relationships between all variables. It could be said the more experienced the nurse is, the more competent they are in their abilities, which leads to increased clinical performance. This finding contradicts prior literature that has suggested that there is not a relationship between nursing experience and competency in managing patients with tracheostomies (Smith-Miller, 2006). According to Smith-Miller (2006), nursing experience alone is not indicative of personal knowledge or comfort level. The results of

this project could be due to most participants having 3-5 years (35%) to 5-10 years (35%) of nursing experience, with managing at least 1-2 tracheostomies a month. Some participants said they managed as many as 3-5 tracheostomies a month. By being exposed to tracheostomies and having to manage their care frequently, it increases the nurses' self-competence as it is becomes more familiar. As it becomes more familiar, they understand how to intervene which improves their clinical performance. Also, at the time of implementation of this project, the ICU was managing the care of two patients with tracheostomies. This may have enhanced the educational program as nurses could apply what they learned to real time patient care, solidifying concepts and interventions.

Based on the verbal feedback from the participants, the educational program was very helpful. It was a stress-free environment where participants were able to examine the varying types of tracheostomy tubes, practice rescue interventions through realistic clinical scenarios, ask questions, and debrief on their performance. By increasing exposure to high risk, low incident events like tracheostomy tube dislodgment, it builds nurses' competence. Nurses want to learn. They want to be proficient in knowledge and skill. Therefore, educational programs should be offered to them.

Limitations of this project include a small sample size, the lack of pairing of datasets, and the intervention design. A convenience sample was used. While 20 participants completed the pre-intervention survey, 17 completed the simulation training and 13 participants completed the post survey. Due to the small sample of nurses in this project, it may be beneficial to collect more statistical data on a larger ICU nurse population with more variation in experience and skill level. This could also allow for causal relationships to be explored through more complex statistical methods. Also, the participants were not given a PIN or identifier to pair the pre

survey to the post survey, leading to the inability to do statistical analyses on the data. The intervention design was limited to the equipment in the ICU. While clinical scenarios and hands on experience were utilized, the intervention design did not take place in a formal simulation laboratory.

For future projects focusing on this topic, simulation should take place in a simulation laboratory that has up to date technology. This would create a more controlled and realistic learning environment for ICU nurses. The sample size should also be increased to include ICU nurses from multiple sites varying in acuity, size, and specialties. To gain more information about ICU nurses' competence and clinical performance, qualitative research could be performed. Conducting focus groups could lead to more in-depth information in understanding ICU nurses and how they manage patients with tracheostomy tube dislodgment.

Conclusion

There are limited studies focused on the nurse management of tracheostomy tube dislodgement. Intensive care unit nurses need to be well equipped to manage this patient population as they are usually the first responders when this complication occurs. Based on the results of this project, the educational program was beneficial for ICU nurses' self-competence and clinical performance. This suggests educational programs should be offered and provided to ICU nurses. Simulation training and clinical scenarios are also effective educational tools and should be used in future projects. This project did not discover the frequency in which educational programs should be offered for tracheostomy tube dislodgement. Therefore, future studies are needed to evaluate retention of information and effective management of tracheostomy tube dislodgment by ICU nurses.

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Appendix A

DNP Survey Questions

A. Informed Consent
B. Demographic Questions:

1. Gender:
   a. Male
   b. Female
   c. Non-binary
   d. Prefer not to say
2. Age Range:
   a. 20-30 years
   b. 31-40 years
   c. 41-50 years
   d. 51-60 years
   e. >61 years
3. Nursing Education:
   a. Diploma
   b. Associates degree
   c. Bachelors
   d. Masters
   e. Doctorate
4. Number of years practicing:
   a. 0-2 years
   b. 3-5 years
   c. 6-10 years
   d. >10 years
5. Number of patients with tracheostomies per month:
   a. 0
   b. 1-2
   c. 3-5
   d. >6

C. Tracheostomy questions

When thinking about when you must provide care for a patient with a tracheostomy, answer the following questions based on your own perceived self-competence and clinical performance.

Likert-Scale: 1=Novice, 2=Advanced beginner, 3=Competent, 4=Proficient, 5=Expert

Novice: a nurse who is a beginner and needs to be told what to do and how to do it.

Advanced beginner: a nurse with some experience and has principles to guide clinical decisions.

Competent: a nurse with more clinical experience and has gained perspective from planning their own actions.

Proficient: a nurse who understands the whole situation and has expectations for specific situations.

Expert: a nurse who has a deeper background of experience and are highly proficient in their actions.

1. How competent do you feel in your ability to provide care to a patient with a tracheostomy?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

2. How competent are you in your ability to provide care to a patient with an accidental tracheostomy dislodgement?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

3. How competent are you in your ability to recognize a decompensating patient with a tracheostomy dislodgement?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

4. How competent are you in your skills in implementing interventions to a patient with a tracheostomy dislodgement?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

5. How competent do you feel you can assess the effectiveness of the interventions done should a tracheostomy become dislodged?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

6. Based on your clinical performance, how do you rate your clinical skills in providing tracheostomy care?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

7. Based on clinical performance, how do you rate your ability to anticipate the next interventions when the tracheostomy becomes dislodged?

1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

8. Based on clinical performance, how do you rate your ability to implement the necessary interventions on a patient with a tracheostomy dislodgement?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

9. Based on clinical performance, how do you rate your ability to care for a decompensating patient with tracheostomy dislodgement?
   1-Novice 2-Advanced Beginner 3-Competent 4-Proficient 5-Expert

Appendix B

DNP Teaching Steps for Tracheostomy Dislodgement

Clinical Scenario 1:

1. Call for help. This is a code blue since the airway has been compromised. —Respiratory, MD
2. Apply high flow oxygen to the patient's face and tracheostomy. Assess for adequate ventilation and oxygenation: Do you see chest rise and fall? Do you see condensation in the Non-rebreather or Bag Mask? Is there end-tidal CO2 tracings on the monitor? What are their sats?
    a. Review bag mask ventilation (lift face into the mask, EC with fingers) and necessary tips to help open the airway (jaw-thrust, use of oral/nasal airways, sniffing position)
3. Do not reinsert tracheostomy tube—wait for respiratory or MD. If the tracheostomy is less than 14 days old, there is a high risk for false track. However, have the obturator, new tracheostomy at bedside ready for them.
    a. Things to have at the bedside for this emergency: obturator in an easy position to be utilized, tracheostomy tubes one size bigger and one size smaller, a trach care kit with new neck ties, ambu-bag, and working suction.
    b. Review role of Obturator: this is used to guide the new tracheostomy tube into place. It is inserted inside the outer cannula and is the driver. Once the tracheostomy tube is in the correct position, the obturator is removed.
4. If the tracheostomy tube false tracks or it simply is not in the correct position after reinsertion by the MD, prepare for oral intubation or intubation through the stoma.
    a. This includes having oral endotracheal tube of various sizes (6-8mm, review reasons for sizing of tube: male/female, stoma size), a bougie, Glidescope in the room, RSI kit, ambu-bag, suction, intravenous fluids, IV access.

Clinical Scenario 2:

1. Call for help (Respiratory and MD) and assess the patient. Are they breathing? Are they ventilating? Do you see adequate chest rise and fall? Do you see condensation in the Non-rebreather/Bag Mask? Is there end-tidal CO2 on the monitor? What are the oxygenation saturations? If not, call Code Blue.
2. If they are breathing, apply high flow oxygen to their mouth and tracheostomy. This can be done with a non-rebreather, ambu-bag mask, and/or t-piece for the stoma.
3. Next, assess the trach for its patency-- Remove the inner cannula and try to pass the suction catheter down the outer cannula. If you cannot pass the suction catheter, the tracheostomy tube is occluded. Deflate the cuff, if it is present, then reassess. Is the

patient improving? If so, continue supportive measures (oxygen, more suction, Respiratory may consider lavage, reinsertion of a new inner cannula and try to ventilate. Consider a partial obstruction)

a. Review how to use the suction catheter. The catheter should be inserted until resistance is met. Do not apply suction during insertion. Once resistance is met, slowly retract the suction catheter while placing finger over suction port. Once the catheter is removed, place high flow oxygen back on the tracheostomy.

4. If the patient is not improving, the tracheostomy tube needs to be removed and high flow oxygen needs to be placed on the mouth and stoma (non-rebreather, ambu-bag)
5. If the patient continues to decompensate, cover the stoma with 4x4s or your hands, then bag mask ventilate. If still not improving, anticipate oral intubation or stoma intubation
    a. This includes having oral endotracheal tube of various sizes (6-8mm), a bougie, Glidescope in the room, RSI kit, ambu-bag, suction, intravenous fluids, IV access.
    b. Review bag mask ventilation and necessary tips to help open the airway (jaw-thrust, use of oral airways/nasal airways, sniffing position)

Tracheostomy Parts/Function—See Table 1 below

Tracheostomy care—Most dislodgements are preventable with frequent assessments and quality tracheostomy care.

a. Assessment
    1. Inspect the stoma and surrounding skin for redness, purple discoloration, skin breakdown, drainage, etc.
b. Site Care Procedure- due to be done every shift
    1. Explain the procedure to the patient
    2. Perform Hand Hygiene
    3. Apply clean gloves
    4. Remove dressing to allow for assessment and cleaning of the stoma
    5. For crusted areas, clean outside of tracheostomy tube with, or flange with diluted hydrogen peroxide-soaked cotton tipped applicator or 2X2 gauze and discard.
    6. Repeat with Normal Saline-soaked cotton tipped applicator or 2X2 gauze and discard
    7. Wipe outside of tracheostomy tube with dry gauze and discard
    8. Repeat steps 5-7 to stoma area.

9. Apply Barrier Film swab to the skin around the trach site for patients with secretions and allow to dry.
10. Apply the dressing—Absorbent silicone for newer tracheostomies, split gauze for well-established tracheostomies

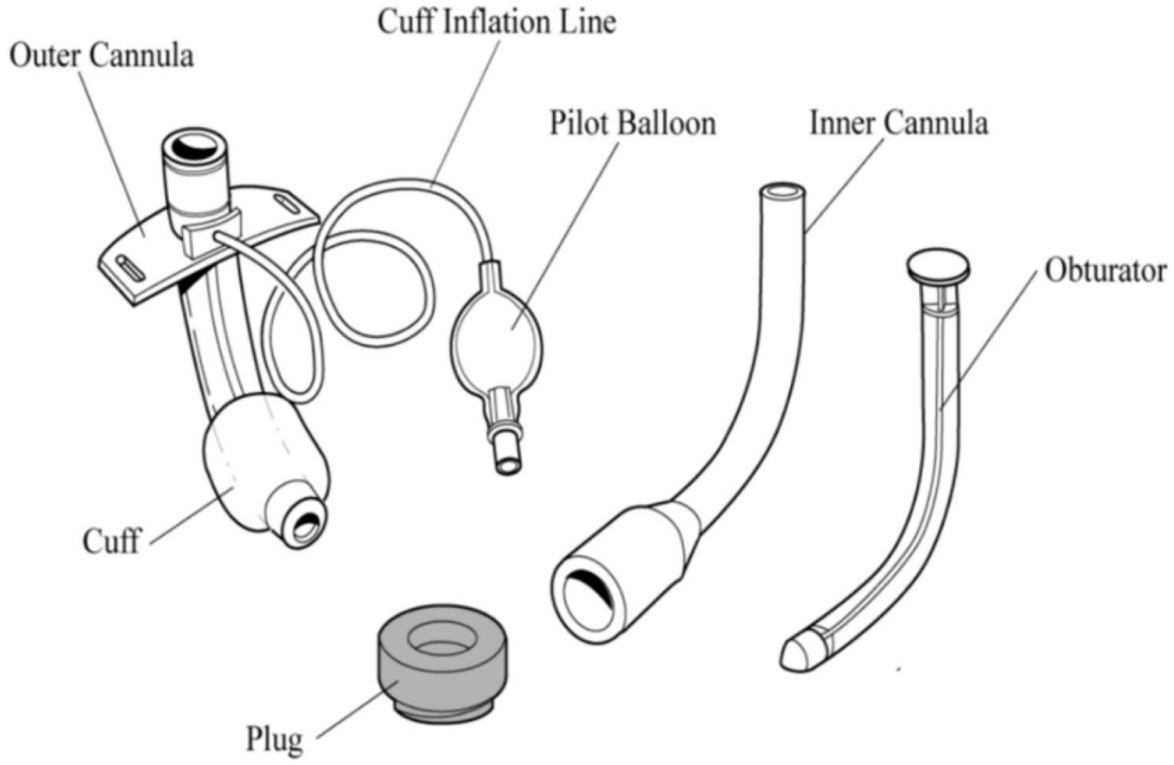
c. Changing the Disposable Inner Cannula

1. Perform hand hygiene
2. Open package of disposable inner cannula.
3. Apply clean gloves
4. Touching only the external portion, squeeze and unlock the inner cannula and remove from tracheostomy tube and discard
5. Place new sterile disposable inner cannula from the package; insert into the tracheostomy tube and lock into place.

d. Assess tracheostomy ties

Table 1

COMPONENT	FUNCTION
Cuff	Allows positive pressure ventilation, optimizes seal, and decreases aspiration risk. Deflation allows the patient to breathe through upper airway tract. Cuff decreases inner airway diameter and increases airway resistance.
Inner Cannula	This is often removable, which allows clearance of luminal secretions. Pediatric tracheostomies do not possess inner cannulas due to diameter limitations.
Outer Cannula	Remains in the tracheostomy site, keeping site open with inner cannula removal.
Obturator	Solid device used to insert the tracheostomy. The obturator must then be removed.



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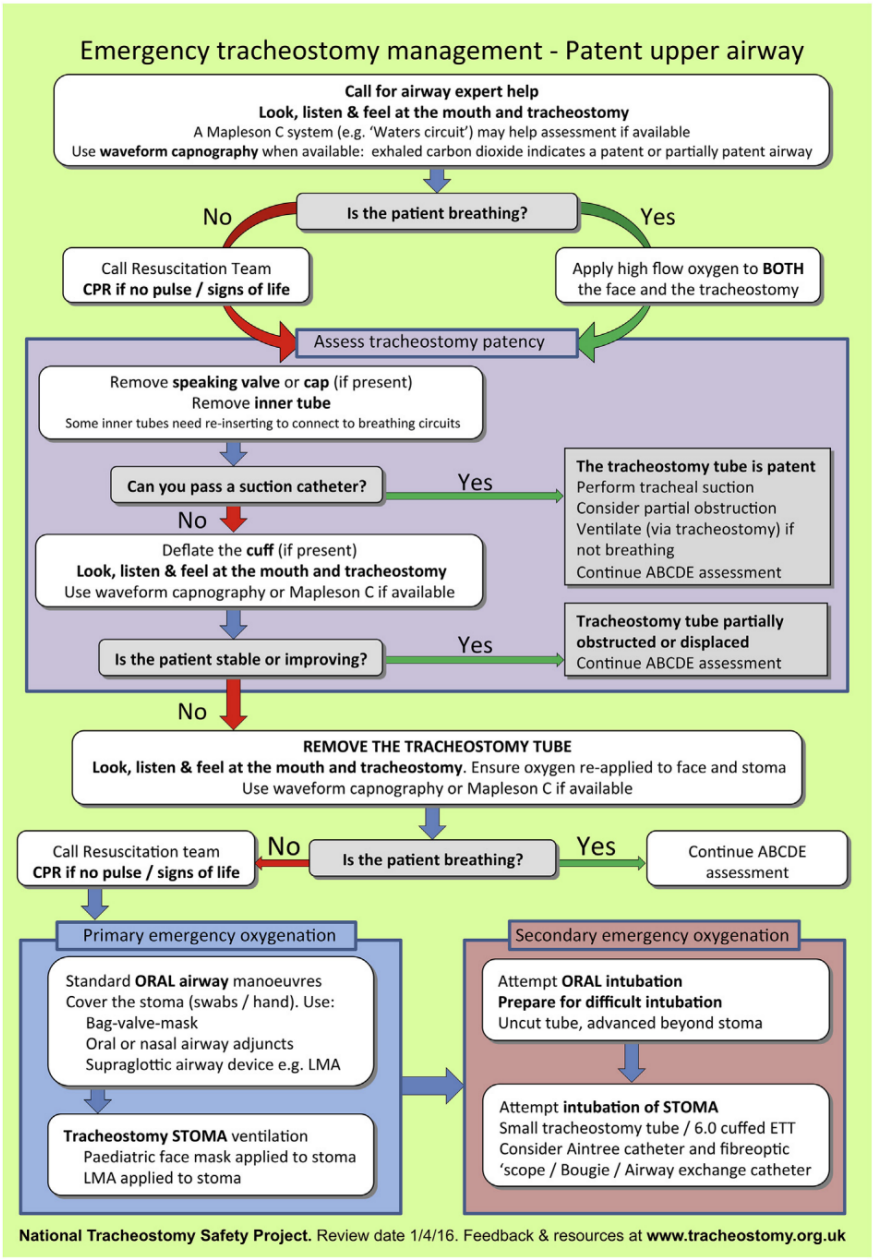

Fig 6 Emergency tracheostomy management—patent upper airway. Reproduced from McGrath BA, Bates L, Atkinson D, Moore JA. Multidisciplinary guidelines for the management of tracheostomy and laryngectomy airway emergencies. *Anaesthesia*. 2012; **67**: 1025–1041, Blackwell Publishing Ltd.

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Appendix C

DNP Clinical Scenarios

a. This patient had a tracheostomy placed around a week ago and is due for a total bed linen change. While turning this patient completely onto his side, the ventilator tubing got stuck in the rails of the bed, causing the tracheostomy to become dislodged. What are the neck steps?
b. This patient is 2 days post-op tracheostomy placement after being on the ventilator for longer than 14 days. The patient begins to have forceful, nonproductive coughing. The patient's saturations begin to drop. What are the next steps?

Appendix D

Badge Buddy/Information Reminder Card for Intensive Care Unit Nurses Post Education Program

Emergent Tracheostomy Tube Dislodgment Steps

1. Call for Help: Code Blue
2. Apply High Flow Oxygen to face and tracheostomy.
3. Assess patient for adequate oxygenation and ventilation.
4. If occluded, consider suctioning.
5. Prepare for new tracheostomy tube insertion by the MD.
6. Have back-up airway supplies readily available.
7. Remain calm.

Appendix E

IRB Information Sheet

Project Title: Emergent Tracheostomy Dislodgement Education Program for Intensive Care Unit Nurses to Improve Self-Competence and Clinical Performance

Principal Investigator: Laura Bueter

Faculty Advisor: Dr. Christine Kress

What is this all about?
I am asking you to participate in this research project to assess a tracheostomy dislodgement education program for intensive care unit nurses' self-competence and clinical performance. This research project will take 30 minutes collectively and will involve you completing a pre and post intervention survey and one clinical training. Your participation in this research project is voluntary.

How will this negatively affect me?
No, other than the time you spend on this project, there are no known or foreseeable risks involved with this project.

What do I get out of this research project?
You and/or society will or might improve their self-competence and clinical performance in managing patients with tracheostomies.

Will I get paid for participating?
You will not be paid for participating.

What about my confidentiality?
We will do everything possible to make sure that your information is kept confidential. All information obtained in this project is strictly confidential unless disclosure is required by law. We will not ask for any identifying information and all data will be stored on a password protected file on a private computer.

What if I do not want to be in this research study?
You do not have to be part of this project. This project is voluntary, and it is up to you to decide to participate in this research project. If you do agree to participate, at any time in this project, you may stop participating without penalty.

What if I have questions?
You can ask Laura Bueter at lrbueter@uncg.edu and Christine Kress at cmbazik@uncg.edu anything about the study. If you have concerns about how you have been treated in this study call the Office of Research Integrity Director at 1-855-251-2351.